

IS
20
19

Zbornik 22. mednarodne multikonference

INFORMACIJSKA DRUŽBA

Zvezek E

Proceedings of the 22nd International Multiconference

INFORMATION SOCIETY

Volume E

Kognitonika

International Conference on Cognitronics

Uredila / Edited by
Vladimir A. Fomichov, Olga S. Fomichova

<http://is.ijs.si>

7.–8. oktober 2019 / 7–8 October 2019
Ljubljana, Slovenia

Zbornik 22. mednarodne multikonference
INFORMACIJSKA DRUŽBA – IS 2019
Zvezek E

Proceedings of the 22nd International Multiconference
INFORMATION SOCIETY – IS 2019
Volume E

Kognitonika
International Conference on Cognitronics

Uredila / Edited by

Vladimir A. Fomichov, Olga S. Fomichova

<http://is.ijs.si>

**7.-8. oktober 2019 / 7-8 October 2019
Ljubljana, Slovenia**

Urednika:

Vladimir A. Fomichov
Department of Intelligent Monitoring Systems,
Institute No. 3 Control Systems,
Informatics and Electric Power Industry,
Moscow Aviation Institute (National Research University),
Orshanskaya street 3, 121552 Moscow, Russia

Olga S. Fomichova
Centre of Social Competences "Dialogue of Sciences",
State Budget Professional Educational Institution “Sparrow Hills”,
Universitetsky prospect 5, 119296 Moscow, Russia

Založnik: Institut »Jožef Stefan«, Ljubljana
Priprava zbornika: Mitja Lasič, Vesna Lasič, Lana Zemljak
Oblikovanje naslovnice: Vesna Lasič

Na naslovnici je uporabljena slika robota podjetja 

Dostop do e-publikacije:
<http://library.ijs.si/Stacks/Proceedings/InformationSociety>

Ljubljana, oktober 2019

Informacijska družba
ISSN 2630-371X

Kataložni zapis o publikaciji (CIP) pripravili v Narodni in univerzitetni knjižnici v Ljubljani
COBISS.SI-ID=302466048
ISBN 978-961-264-163-4 (epub)
ISBN 978-961-264-164-1 (pdf)

PREDGOVOR MULTIKONFERENCI INFORMACIJSKA DRUŽBA 2019

Multikonferenca Informacijska družba (<http://is.ijs.si>) je z dvaindvajseto zaporedno prireditvijo tradicionalni osrednji srednjeevropski dogodek na področju informacijske družbe, računalništva in informatike. Informacijska družba, znanje in umetna inteligenco so - in to čedalje bolj – nosilci razvoja človeške civilizacije. Se bo neverjetna rast nadaljevala in nas ponesla v novo civilizacijsko obdobje? Bosta IKT in zlasti umetna inteligenco omogočila nadaljnji razcvet civilizacije ali pa bodo demografske, družbene, medčloveške in okoljske težave povzročile zadušitev rasti? Čedalje več pokazateljev kaže v oba ekstrema – da prehajamo v naslednje civilizacijsko obdobje, hkrati pa so notranji in zunanji konflikti sodobne družbe čedalje težje obvladljivi.

Letos smo v multikonferenco povezali 12 odličnih neodvisnih konferenc. Zajema okoli 300 predstavitev, povzetkov in referatov v okviru samostojnih konferenc in delavnic in 500 obiskovalcev. Prireditev bodo spremljale okrogle mize in razprave ter posebni dogodki, kot je svečana podelitev nagrad. Izbrani prispevki bodo izšli tudi v posebni številki revije Informatica (<http://www.informatica.si/>), ki se ponaša z 42-letno tradicijo odlične znanstvene revije.

Multikonferenco Informacijska družba 2019 sestavljajo naslednje samostojne konference:

- 6. študentska računalniška konferenca
- Etika in stroka
- Interakcija človek računalnik v informacijski družbi
- Izkopavanje znanja in podatkovna skladišča
- Kognitivna znanost
- Kognitonika
- Ljudje in okolje
- Mednarodna konferenca o prenosu tehnologij
- Robotika
- Slovenska konferenca o umetni inteligenci
- Srednje-evropska konferenca o uporabnih in teoretičnih računalniških znanostih
- Vzgoja in izobraževanje v informacijski družbi

Soorganizatorji in podporniki konference so različne raziskovalne institucije in združenja, med njimi tudi ACM Slovenija, SLAIS, DKZ in druga slovenska nacionalna akademija, Inženirska akademija Slovenije (IAS). V imenu organizatorjev konference se zahvaljujemo združenjem in institucijam, še posebej pa udeležencem za njihove dragocene prispevke in priložnost, da z nami delijo svoje izkušnje o informacijski družbi. Zahvaljujemo se tudi recenzentom za njihovo pomoč pri recenzirjanju.

V 2019 bomo sedmič podelili nagrado za življenjske dosežke v čast Donalda Michieja in Alana Turinga. Nagrada Michie-Turing za izjemen življenjski prispevek k razvoju in promociji informacijske družbe je prejel prof. dr. Marjan Mernik. Priznanje za dosežek leta pripada sodelavcem Odseka za inteligentne sisteme Instituta »Jožef Stefan«. Podeljujemo tudi nagradi »informacijska limona« in »informacijska jagoda« za najbolj (ne)uspešne poteze v zvezi z informacijsko družbo. Limono je dobil sistem »E-zdravje«, jagodo pa mobilna aplikacija »Veš, kaj ješ?!«. Čestitke nagrajencem!

Mojca Ciglarič, predsednica programskega odbora
Matjaž Gams, predsednik organizacijskega odbora

FOREWORD - INFORMATION SOCIETY 2019

The Information Society Multiconference (<http://is.ijs.si>) is the traditional Central European event in the field of information society, computer science and informatics for the twenty-second consecutive year. Information society, knowledge and artificial intelligence are - and increasingly so - the central pillars of human civilization. Will the incredible growth continue and take us into a new civilization period? Will ICT, and in particular artificial intelligence, allow civilization to flourish or will demographic, social, and environmental problems stifle growth? More and more indicators point to both extremes - that we are moving into the next civilization period, and at the same time the internal and external conflicts of modern society are becoming increasingly difficult to manage.

The Multiconference is running parallel sessions with 300 presentations of scientific papers at twelve conferences, many round tables, workshops and award ceremonies, and 500 attendees. Selected papers will be published in the Informatica journal with its 42-years tradition of excellent research publishing.

The Information Society 2019 Multiconference consists of the following conferences:

- 6. Student Computer Science Research Conference
- Professional Ethics
- Human – Computer Interaction in Information Society
- Data Mining and Data Warehouses
- Cognitive Science
- International Conference on Cognitronics
- People and Environment
- International Conference of Transfer of Technologies – ITTC
- Robotics
- Slovenian Conference on Artificial Intelligence
- Middle-European Conference on Applied Theoretical Computer Science
- Education in Information Society

The Multiconference is co-organized and supported by several major research institutions and societies, among them ACM Slovenia, i.e. the Slovenian chapter of the ACM, SLAIS, DKZ and the second national engineering academy, the Slovenian Engineering Academy. In the name of the conference organizers, we thank all the societies and institutions, and particularly all the participants for their valuable contribution and their interest in this event, and the reviewers for their thorough reviews.

For the fifteenth year, the award for life-long outstanding contributions will be presented in memory of Donald Michie and Alan Turing. The Michie-Turing award was given to Prof. Marjan Mernik for his life-long outstanding contribution to the development and promotion of information society in our country. In addition, a recognition for current achievements was awarded to members of Department of Intelligent Systems of Jožef Stefan Institute. The information lemon goes to the “E-Health” system, and the information strawberry to the mobile application “Veš, kaj ješ?!” (Do you know what you eat?!). Congratulations!

Mojca Ciglarič, Programme Committee Chair
Matjaž Gams, Organizing Committee Chair

KONFERENČNI ODBORI CONFERENCE COMMITTEES

International Programme Committee

Vladimir Bajic, Južna Afrika
Heiner Benking, Nemčija
Se Woo Cheon, Južna Koreja
Howie Firth, Škotska
Olga Fomichova, Rusija
Vladimir Fomichov, Rusija
Vesna Hljuz Dobric, Hrvatska
Alfred Inselberg, Izrael
Jay Liebowitz, ZDA
Huan Liu, Singapur
Henz Martin, Nemčija
Marcin Paprzycki, ZDA
Claude Sammut, Avstralija
Jiri Wiedermann, Češka
Xindong Wu, ZDA
Yiming Ye, ZDA
Ning Zhong, ZDA
Wray Buntine, Avstralija
Bezalel Gavish, ZDA
Gal A. Kaminka, Izrael
Mike Bain, Avstralija
Michela Milano, Italija
Derong Liu, Chicago, ZDA
Toby Walsh, Avstralija

Organizing Committee

Matjaž Gams, chair
Mitja Luštrek
Lana Zemljak
Vesna Koricki
Marjetka Šprah
Mitja Lasič
Blaž Mahnič
Jani Bizjak
Tine Kolenik

Programme Committee

Mojca Ciglaric, chair	Andrej Gams	Dunja Mladenic
Bojan Orel, co-chair	Matjaž Gams	Franc Novak
Franc Solina	Mitja Luštrek	Ivan Rozman
Viljan Mahnič	Marko Grobelnik	Niko Schlamberger
Cene Bavec	Vladislav Rajkovič	Stanko Strmčnik
Tomaž Kalin	Grega Repovš	Jurij Šilc
Jozsef Györköss	Nikola Guid	Jurij Tasič
Tadej Bajd	Marjan Heričko	Denis Trček
Jaroslav Berce	Borka Jerman Blažič Džonova	Andrej Ule
Mojca Bernik	Gorazd Kandus	Tanja Urbančič
Marko Bohanec	Urban Kordeš	Boštjan Vilfan
Ivan Bratko	Marjan Krisper	Baldomir Zajc
Andrej Brodnik	Andrej Kuščer	Blaž Zupan
Dušan Caf	Jadran Lenarčič	Boris Žemva
Saša Divjak	Borut Likar	Leon Žlajpah
Tomaž Erjavec	Janez Malačič	
Bogdan Filipič	Olga Markič	

KAZALO / TABLE OF CONTENTS

Kognitonika / International Conference on Cognitonics	1
PREDGOVOR / FOREWORD	3
PROGRAMSKI ODBORI / PROGRAMME COMMITTEES	5
Teaching / Learning and Experiential Procedures in the Ternary Ecosystem School/Environment/ Society / Catalfamo Elide	7
Cognitonics in Plato's Cave / Christofidou Angela	11
The Pillars of Higher Personality Development of Net Generation in Smart Society / Fomichova Olga S., Fomichov Vladimir A.....	15
Towards Harmonic Existence of Green Computing in Knowledge Society / Fakhereldine Amin, Dhaini Mahdi, Jaber Mohammad, Hamdan Sleiman, Haraty Ramzi A	19
Art and Culture as a Mirror, Testimony and Testament of Their Times / Jadzińska Monika	26
Technology and the Socio-Human Transformation in the World Structure / Kim Joonho.....	29
Simultaneous Teaching Through Video Call and Providing Mentorship Remotely – Challenges for Laboratory Classes in Higher Education / Liverić Dijana, Brusić Teo, Šupica Žaklina	33
The Approach of Human Ecology in Digital Society / Micarelli Rita, Pizziolo Giorgio.....	37
The Conceptual Architecture of Intentional Human Action / Oksala Tarkko	41
The Effects of Yoga on Quality of Life Perception / Karolina Ovijač, Krivec Jana	45
Creating Multimedia Systems According to Principles of Cognitonics / Panev Ida.....	50
Application of Robotics in High Schools / Sertić Martina.....	54
Transforming Teaching History in a Smart Learning Environment with Open Educational Resources / Vakaloudi Anastasia D	58
Indeks avtorjev / Author index	63

Zbornik 22. mednarodne multikonference
INFORMACIJSKA DRUŽBA – IS 2019
Zvezek E

Proceedings of the 22nd International Multiconference
INFORMATION SOCIETY – IS 2019
Volume E

Kognitonika
International Conference on Cognitronics

Uredila / Edited by

Vladimir A. Fomichov, Olga S. Fomichova

<http://is.ijs.si>

**7.-8. oktober 2019 / 7-8 October 2019
Ljubljana, Slovenia**

Preface/Predgovor

Sixth International Conference on Cognitonics (Cognit 2019)

Since October 2009, the biannual international scientific conference on Cognitonics (“Kognitonika” in Slovenian) is a part of the international scientific multiconferences “Information Society” (Slovenia, Ljubljana, Jozef Stefan Institute).

Cognitonics may be very shortly characterized as the science about the human being in the digital world. More exactly, Cognitonics is the science about the trajectories of raising the human being to such level of intellectual and spiritual height, where the scale of his/her personality becomes proportional to the scale of the digital world.

The first aim of Cognitonics is to explicate the distortions in the perception of the world, in the development of the personality caused by the peculiarities of knowledge society (or smart society) and globalization processes. The second, principal aim is to join the efforts of the scholars and educators from various fields for coping with these distortions by means of elaborating systemic solutions for compensating the negative implications of the kind for the personality and society, in particular, for creating cognitive-cultural preconditions of the harmonic development of the personality in the information society (transforming into knowledge society) and for ensuring the successful development of national cultures and national languages.

The birth of Cognitonics was stimulated by the ideas of Philosophy, Cognitive Linguistics, Artificial Intelligence theory, Web Science, Applied Linguistics, Art theory, Cognitive Psychology, and Cognitive Biology.

Two factors seem to be especially important from the standpoint of achieving the goals of Cognitonics:

- information and communication technologies (ICT) have been developing extremely quickly and have been expanding unusually broadly, they penetrate not only into every office and laboratory but also into every school class and every family;
- it is necessary and promising to use the power of modern ICT in order to very quickly and broadly disseminate the found effective methods of compensating the negative distortions in the development of the personality and of national cultures in information society and knowledge society.

The goal of the conference is to combine the efforts of the scholars from numerous scientific fields and educators in order to establish a new synergy aimed at ensuring the harmonic, well-balanced development of the personality, national cultures, and national languages in the modern information society and knowledge society and, as a consequence, to compensate a number of broadly observed negative distortions.

From the standpoint of educational practice, Cognitonics proposes an answer to the following question: what precious ideas and images accumulated by the mankind, at what age, and in what a way are to be inscribed into the conceptual picture of the world of a person in order to harmonize his/her intellectual and spiritually-coloured emotional development and to contribute to the successful development of national cultures and national languages?

Cognitronics formulates a new, large-scale goal for the software industry and Web science: to develop a new generation of culture-oriented computer programs and online courses (in the collaboration with educators, linguists, art historians, psychologists) - the computer programs and online courses intended for supporting and developing positively-oriented creativity, emotional intelligence (cognitive-emotional sphere), mindfulness, the appreciation of the roots of the national cultures, the awareness of the integrity of the cultural space in the information society and knowledge society, and for supporting and developing symbolic information processing and linguistic skills, associative and reasoning abilities, social responsibility of young children, adolescents, and university students.

The Program Committee has accepted for the conference the papers of 22 researchers from 10 countries of two parts of the world: Asia (Japan, Lebanon) and Europe (Croatia, Cyprus, Finland, Greece, Italy, Poland, Russia, Slovenia).

The editors would like to thank the authors of the papers for their contributions and the members of the Program Committee for their precious comments ensuring the high quality of the accepted papers and making the reading as well the editing of this volume a rewarding activity.

Editors and Program Chairs / Urednika

- Vladimir A. Fomichov
- Olga S. Fomichova

PROGRAMSKI ODBOR/PROGRAMME COMMITTEE

Dr. Mario Allegra (Italy)

Dr. Rosa Maria Bottino (Italy)

Dr. Dumitru Dan Burdescu (Romania)

Dr. Angela Christofidou (Cyprus)

Dr. Paul Craig (PR China)

Dr. Vasileios Dagdilelis (Greece)

Dr. Vladimir A. Fomichov, President (Russia)

Dr. Olga S. Fomichova, President (Russia)

Dr. Monika Jadzinska (Poland)

Dr. Joonho Kim (Japan)

Dr. Jana Krivec (Slovenia)

Dr. Felipe Lara-Rosano (Mexico)

Dr. Rita Micarelli (Italy)

Dr. Marian Cristian Mihaescu (Romania)

Dr. Ida Panev (Croatia)

Dr. Giorgio Pizziolo (Italy)

Dr. Ivan Pogarcic (Croatia)

Dr. Jens Pohl (USA)

Dr. Anastasia D. Vakaloudi (Greece)

Teaching / Learning and Experiential Procedures in the Ternary Ecosystem School/Environment/ Society

prof. Elide Catalfamo
GRASPthefuture
Regional President of A.N.I.S.N. Italian
association Teachers of Natural
Sciences
Via San Giovanni 14/c, 34015 Muggia
Trieste Italy
anisnfv3@gmail.com

ABSTRACT

A brief excursus analyses the process of the education to an environmental and human culture in the last fifty years, through reflections on personal experiences and the thoughts expressed by different Authors. The little awareness of the **gift of nature** for human life hasn't helped prevent previously speculated scenarios, throughout three generations. Will the school be able, within the next twenty years, to stop the fast realization of the scientific forecasts? Time is up, concrete and immediate actions can be done only by governments, will the power be able to act "wise"?

Keywords

Human Ecology, interactive education, dualism, individualism, , bio and cultural diversities.

1. INTRODUCTION

Will school change the wisdom of the world or will the world change the school?

Facing the problems linked to the present time and to the forecasts for the future starting from data might help (or can discourage), it will most definitely help those who are already discouraged because they will verify that almost nothing has changed since the seventies through the XX century. We hope to choose a path that won't lead to resignation, but will encourage everyone towards a prospective of possible changes. Why have we mentioned school as the maker of change? For many reasons it is the best place for relations and communications in almost all the world, at least between the ages of three and fourteen and more, secondly because it is the place where many ecosystems connect. We are keeping our simplified but global definition of ecosystem as the *PLACE OF INTERACTIONS* childhood ↔ adulthood, social world ↔ familiar world, the world of imaginative freedom ↔ the world of rules, the world of cognitive development ↔ the world of social dimension, world of reality ↔ world of artificiality.

Where, in all of this, stands the knowledge of the world and the reflections on it? Each ↔ represents the two ways flow of elements between one side and the other and which, ultimately, stands for the Ecotone between Man and Environment (natural, social, political, economic). Let's try, then, to analyze and reflect, following a time line.

2 "TIME IS OFF-AXIS"

In 1978, Gregory Bateson [1] in the appendix to Mind and Nature, addressed to the Regents of the University of California, wrote that "time is off-axis". This is because the two components that rule the evolutionary process don't go to the same pace. If one part of the cultural system is late it means that the other one has developed too fast. The inner evolution hasn't kept the pace with the outer one, imagination has overtaken strictness. This analysis was really referred to the obsolescence of the contents and of the teaching methods of the universities that proposed dualisms and cultural itineraries of deterministic type, that were already out of the reality of the time. In 1993 Professor Sandro Pignatti¹ said, in a conference for Natural Sciences teachers, that "many of the unsolved problems of our time actually depend on the deterministic vision that has accompanied the western scientific research since Galileo". He continued by reminding that the linearity of processes to which we have been accustomed is not applicable to living systems because these are not systems that we can isolate in order to study them, but they are complex systems the organization of which is self-organizing and the processes that rule their existence have a cyclical trend [7].

If we stop and think about the situation today in the western world, we find out that dualisms are far from being overcome, they persist in the vision of the world, or we might better say that they persist in that specific part of society, of economy, of finance that have no interest to leave old cultural paradigms, uncertain because the outcomes are unpredictable. Professor Giaccone writes: "Ecologists have gathered, in this century, experimental scientific evidences that assert that for specie's population the goal of using resources in nature is to reach the fitness; this is to be able to persist with the future generations in the biosphere, developed in ecological niches" [3].

Some modern economists, heirs of the marginalist revolution (that one century ago reduced the economic paradigm to an individualistic, static and a short time matter) have transformed

¹ Ecologist at the University La Sapienza in Rome

economy from a science that studies development, richness of the populations, growth, happiness of populations, in a science that concentrates on the distribution of the scarce resources on an individual level.

3 METHODOLOGICAL INDIVIDUALISM

The methodological individualism of the modern economy and the liberalistic capitalism that apply its principles have promoted in the last two centuries a socio-economic development process that has contributed to transforming humans from an included species, even though rationally, in the biosphere, to a species that, though it appeared in the evolutionary process more than one hundred thousand years ago, in a short period of time it is destroying a biodiversity that is the outcome of an evolution about four billion years old.

4. ECOLOGICAL ALTERNATIVES

If the political, social and economic world has refused to take awareness of what was going on in the ecological environment of men in the past fifty years, what can we deduce from it? For example we can understand that all that was functional to the gain of an ever growing “power” (political and economic) has stopped human social evolution. Giaccone [3] also writes: “Each generation, in fact, needs to know how to invent or at least redefine its niche; this is its lifestyle, in order to use new resources or at least to exploit in a new way the existing ones. If this does not happen or if the previous generation don’t allow the new ones to have a cultural evolution, the only way to have a generational change or a change in the socio-political regime is through a revolution [...] that in ecological terms means an extreme competition of a generation that kicks out the previous one from a niche that was conquered before by the elder generation: without evolution there is revolution!

The change in lifestyle, in the vision of the world, if we don’t want it to be revolutionary and fierce, it has to take place with the solidarity between generations and populations. At the base of economy, from the ecological point of view, what is really important is the interests of the species and not of the single individual, therefore of the whole mankind. The differences in the polis cannot become a rigid distinction between social classes, ethnicities, otherwise exclusive competition takes place (riots, civil wars like in the Balkan’s or in Africa). It is necessary to break the barriers and make information and resources flow in order for the different lifestyles to undergo a process of reciprocal cultural influences, so to allow the evolution in the cultural niche of mankind.

Promote inter-generational responsibilities, accept the new and promote it, include the needs of the environment in the socio-economical process, obtain reciprocity in the relationships, these are all parameters of niche that will allow evolution in the third millennium”.

5 WHERE DOES SCHOOL STAND IN ALL OF THIS?

We think that remarkable initiatives done based on these analysis throughout the 70’s, 80’s and 90’s in the world of cultural agencies, ONG, school, that had as a goal the ecological training of teachers in order to reach the students and the public opinion, have essentially failed. The term Environmental Education itself postulated the transmission of knowledge that are not easily digested by those that are not insiders. Talking to who didn’t have the necessary bases in ecology and in the functioning of complex systems has reduced the safeguard of the niche to pure dexterity. Today we assist to the protraction of this misunderstanding when we approach the different groups that use the web through the social networks. We are sorry to say that in education nobody understood that the term implied a continuous process between family, school, socio-economical context and the elected trainers in the school already existed and they were those teachers of Natural Science that had already introduced the study of economy through innovative methods. We’ll talk about these later on. Now we need to reflect on how easy it is to kill in the school also those initiatives that are useful to the social development if who manages the *Res Public* doesn’t have the necessary competences (or the necessary interest).

But the purpose was antinomical compared to the primary goal of the school that is to form the citizens of the future; it was, in fact, calibrated on the needs of the industry and the economy of the time. In fact, in those segments of the Italian school where more than elsewhere it appeared to be essential a transversal and complex teaching of the ecological sciences, the Industrial and Professional Institutes, we have assisted to a reduction or an exclusion of this cultural field. What are the consequences? That exactly where it would have been necessary to form citizens that often do not go on with their studies a path that served to form citizens at least partially aware of the choices that they would have had to do in their life was eliminated. Therefore, now it is useful to propose again a reflection by Bateson that was made forty years ago for the American socio-economical world, that now perfectly fits also the Italian one. Today, we, too, can recognize the considerations that Bateson does on the thought sphere where he writes that we are “teared between the denial of feelings and the strong current of anti-intellectual fanaticism”. Was it predictable? Yes, if we share the thought that social and ecological evolution has been “...off axis”.

The learning environments have widened, new scenarios have been opened by the new technologies, we hope these will be *ruled* in order to avoid passing from a partially unknowable reality to the impossibility to understand the world ahead of us. During a lecture at the University of Trieste, Giuseppe O. Longo [5] said that already technology has overcome scientific knowledge and through these changes also the mind is modified. “Today, through informatics and computers, we are witnessing the overcoming of technology on science. While science is trying to show the complexity of the world, technology simply ignores it, showing only the friendly and endearing aspects of the functionalities that it is able to produce. From an original blissful unawareness, man has passed, through science, to a phase of consciousness of problems. Today, though, through technology, man tends to go back to unawareness, and all that it comes with it. At a cognitive level, what will the effects of this change be? We don’t know, nobody today is able to give an answer. Maybe those who will

live in this new artificial environment won't care about the answer.

The analysis continues through an intervention in 2014 at the Convention Frascati Scienza [6], where he said:

"It (...technology) not only modifies the quantity but also the quality of information. Man, relying on technological systems, delegates a lot when it comes to choices. But the technological systems are very fragile, because they are organized following a very low level of redundancy. A small problem can block the system, sending high wire, as chain reaction, a huge number of other activities that are indirectly connected to it. Therefore, relying totally on technological systems is a hazard. This brings to inevitable negative psychological consequences for man, such as uncontrolled emotional reactions, continuous anxiety, permanent insecurity, fear and panic. This consequence appears to be inevitable, because man rely often on irrational projects that go on the sole choice of immediate opportunism and arbitrariness".

6. HUMAN ECOLOGY, A NEW WAY FOR LEARNING AND TEACHING

We certainly do not want this to happen and even then it should be the school that should have the task of conjugating the separations that are part of the time culture fragmentation in order to create new areas of learning such as the ecological and informatics ones that aim to make the modern man better.

We have postponed the reflections on the new learning paths on which the Italian school was experiencing since the years 2000 at least in the scientific disciplines.

A new method to introduce ecology as a study was the one to propose and start a European Project that would train teachers (Socrates, Comenius), exactly in the program of the year 2000.

The active participation of many European countries had raised hopes, as well as the sharing of new methods. The exceptional thing was that a project had been accepted that swiveled on the teaching of ecological disciplines. The produced materials had been asked to many, but apparently the timing wasn't right.

The starting point was that the modern school had to change methods and had to analyze the scientific contexts in the social/cultural meta contexts of the time. It was important to give students a new learning method, the self-learning one, through skills structured with multimedia products which allowed them, as a group, to be included in a context of research-study directly or virtually *in situation*. The term indicates three modalities to use and make other use daily:

- ✓ The study-research in a natural and man-made environment,
- ✓ The production of original multimedia products,
- ✓ The use of lab both in class and in field.

This experience, transferred to the local realities has given tangible results, students and their teachers trained to train students have excellent results in national and international

evaluative contexts, but this obviously isn't enough if the involvement is fragmented in the local realities. It is not time anymore to "think globally and act locally".

For the methodological approach that had been used, a new definition had been introduced, the **ecological-evolutive approach** in which the concept of historicity of the living being in the environment was introduced and following the appearance of mankind.

The didactic instruments and the innovative methods had some priority goals:

- help to overcome the limits imposed to knowledge by the compartmentation of the disciplines, since the ecological-evolutional path emphasizes the interconnection between the different areas of knowledge;
- introduce the student to a new concept, often not considered, such as the historicity inherent in phenomena and the natural processes;
- Create the presupposition for a reflection on the relation between science and ethical values;
- Value the new area of knowledge and of production and comparison offered by the web. A correct use of the new technological instruments allows, thanks to the multimedia reworking, to highlight the system characteristics of ecology and society.

The typology of "reticular" reasoning today is considered to be essential in order to face a new way of "producing", in research, but also in the medium-high profile work activities. It is the student himself that gets used to reorder "his own way" in the whole of the old and new knowledge, as the new concepts are always an autonomous product of the one who is learning and therefore he himself has to build them relying on his own cognitive needs.

It is known to teachers that what is learned as a consequence of a strong motivation is most likely to become "significative learning" to the student, who in such way feels capable of building his own "new knowledge". It is also to be highlighted that from the activity done in natural environment it is easier to reach another goal: nature's biodiversity shows us that the interactions that produces different organisms also acts in the social systems. The ecosystem "orientates" and can make one understand that the relations that are at the base of adaptations and of the differentiations in nature, also act in each one's culture and life.

At this point we know that the time we have for the changes is almost up. It took three generations for the world of the scientific culture and of the most innovative school to spread new knowledge and awareness of the importance of the actions to be taken for ecology to be transformed in Human Ecology, that is for man. The target has been centered, but only for the more acculturated and open to the change part of the population, will scientists and school be able in twenty years, last deadline at the moment to stop irreversible processes of environmental destruction, to make the entire human society aware?



Figure 1: the Green Schooner, Mediterranean Environmental Sentinel

6. CONCLUSIONS

For those who still today keep denying the evidence of human responsibility, we remind them that we have knowledge that since at least one hundred years man has been acting on the environment by simplifying natural biodiversity and by accelerating natural processes. We already have preoccupying signs of climate changes and their inevitable consequences: extreme wheter events, disappearance of entire ecosystems that involve also the man-made world in which migrations are forecasted that involve forty million persons searching for water and food. Maybe the cultural transformation of lifestyles operated by the school, that involves at least one generation is not enough, it is time to strongly ask for quick interventions at a global level. Can we hope that those who rule the world, governments and political powers, rethink the socio-economic models and take action?

Let's conclude again with Bateson when, highlighting the danger of the myth of power more than power itself, he says “are we wise?”

7. ACKNOWLEDGMENTS

Many thanks to Vladimir Fomichov and Olga Fomichova for the creation, promotion and development of *Cognitonics* and for their kind invitation to the 2019 Conference on Cognitonics.

8. REFERENCES

Italian Editions

- [1] Bateson, G. 1984. *Mente e Natura (Mind and Nature)* It. Ed, Adelphi Milano
- [2] Confindustria – MIUR. 2004. Progetto Lauree Scientifiche, 17 giugno, 2004.
- [3] Giaccone G, 1998 ECOLOGIA, ECONOMIA DI COMUNIONE E SVILUPPO SOSTENIBILE: RIFLESSIONI DI UN ECOLOGO in *Nuova Umanità*, 1998.
- [4] Longo, G.O. 2001. TECNOLOGIA E CULTURA, CONFERENZA, UNIVERSITÀ DEGLI STUDI DI TRIESTE, transcribed by C. Genzo
- [5] Longo, G.O. 1997. Le tecnologie multimediali come strumento di formazione: riflessione epistemologica, in CD FARE, Ipermedia 1, M.P.I. - ANISN
- [6] Longo, G.O. 2014. QUALE ETICA PER IL POST.UMANO, Atti Convegno Orvieto Scienza
- [7] Longo, G.O. 2012. *Homo Technologicus*.
- [8] Pignatti, S. 1994. LO STUDIO DELLA NATURA COME IMPEGNO PER LO SVILUPPO CULTURALE, in *Atti del IX Convegno Nazionale , Le scienze naturali nella scuola* , Napoli 1994
- [9] Catalfamo, E. 1977. PROJET "MIRAMARE 80" - RAPPORTS ET PROCES VERBAUX DES REUNIONS. *Comm. Int. Mer Medit.* Monaco, Vol. ,XXXXV, fasc. 6 pp. 137-140.
- [10] Blezza, F., Catalfamo, E. 1991. DIDATTICA DELLE SCIENZE NATURALI - *Atlante della Pedagogia* - Vol. III, Ed. Tecnodid – Napoli, (editor M. Laeng).
- [11] Manelli, H . Catalfamo, E Todaro, C. 2001. PER UN CURRICULUM SPERIMENTALE DELLE SCIENZE DELLA NATURA, in *Annali della Pubblica istruzione* (Italian Edition)
- [12] Catalfamo, E. 2005. EDUCAZIONE ALL'AMBIENTE E ALL'USO DELLE RISORSE , “*Le scienze naturali nella scuola*”, 2005 Loffredo editore-Napoli
- [13] Catalfamo, E. 2017. PAS Scientifici - L'esperienza dell'Associazione Nazionale Insegnanti di Scienze Naturali, *Quaderni CIRD*, parte sec- n.14, 2017, Università di Trieste

Cognitonics in Plato's Cave.

The responsibility of the creative writer

Angela Christofidou

Writer, Journalist

11 Verenikis Street, 2002,

Nicosia, Cyprus

Tel: +357 99286185

email:

Angela.Christofidou.ean@outlook.com

ABSTRACT

In Plato's cave modern creative writers type the words that refer to the shadows of ideas on the screen of the computer. The eye grasps the words in links and research tools, but the mind does not grasp the birth of the idea. As the writer types, hyperlinks change the route of thought, while grammar checkers guide the mind via syntax suggestions. The subject is being revised by collective interactive media and word processing is altering the sense of the text, that is displaying the story on the screen while its reflection is not the inner narration in the cognitive sphere of the intellect. Outside the cave Marcel Proust and Dostoevsky and Victor Hugo decrypt the depths of the human soul. The missing bright sunlight does not only reflect the light of knowledge and insight but also the lack of the light of the joy of genuine creation and beyond that, outside the cave, shedding its irreplaceable light, lies democracy.

Keywords

Plato's Cave, creative writer, cybernetics, literature, education, serendipity

1. INTRODUCTION

The path that led humanity into a contemporary Plato's Cave was full of technological innovation and accomplishments. Citizens from all countries and origins followed the path without any hesitation and without any planning made by the social structures. They were not ready for the vertiginous speed of the technological changes that is leading to the fourth industrial revolution and Globalization 4.0 but they follow the path that has no guiding instructions. Inside Plato's Cave, they find themselves facing a screen. In the screen their face can be instantly located, each instant at any location in the world. The location applications have no way of spotting the individual's identity, though. Existential anxiety, irrationality and aesthetic poverty is the constant echo of the inexhaustible flow of information that fills the screen. The words on the screen touch the senses but make no contact with the intellect, the modern cave inhabitants do not grasp the birth of the ideas and words. Education systems do not provide the cave's citizens with the ability to critically view what

is projected in front of them, for the goal of modern education is to prepare the student for his/her admission in the cave, forgetting the goal of creating the ideal man, able to criticize what is outside the self. The democratization of information replaces the democratization of knowledge and does not seek good, justice and beauty. Socrates had warned about this development at Plato's Allegory of the Cave, when he argues that "the instrument of knowledge can only by the movement of the whole soul be turned from the world of becoming into that of being, and learn by degrees to endure the sight of being, and of the brightest and best of being, or in other words, of the good.".

Constant information flow is the ground on which the modern citizen is called to stand and participate in the democratic process. The ruled citizens passively absorb the flow that appears to create a reality and have no defences against manipulation and propaganda. The rulers of the state are no others than some of the cave's inhabitants that have managed to use the flow of images and information and the advertising communication channels in order to reach the ruling state, by satisfying the needs and preferences of the average consumer. But do they rule? They follow the rules of the market, they use the same communication and advertising tricks, even after their election, while the giants of this mighty cyber market find their ruling work an easy task.

Of this global population blossom the modern creative writers, many of which find themselves spending their talent in order to please, who else, the average consumer, deprived from the joy of creation.

The creative writer has an obligation to escape the cave, find the light of true knowledge and then go back and tell his/her story to the prisoners.

2. THE ALLEGORY OF PLATO'S CAVE. A SCREEN ON THE WALL OF THE CAVE

In the Allegory of the Cave, a dialogue between Socrates and his disciple Glaucon, humans are prisoners in a cave, facing its wall, unable to turn to see the opening of the cave. They can see only the shadows of objects, projected on the wall. One must get free and find the light of knowledge outside the cave and return in order to free the intellect of the other prisoners [1]. In Plato's contemporary cave, a flow of data and information is projected on

a screen placed on the wall of the cave. The flow is fast and is often interrupted by other streams of flow. The words pass rapidly before the modern human's eyes. The modern human once too often interrupts the flow and casts a warm look on a familiar face, his/her own, projected in several locations. Checked in. The face is found. The identity is still lost in the inexplicable flow of data, shaping a stream of thoughts that were never born in the human's soul.

In a contemporary cave, a contemporary Narcissus, the son of the Nymph and the River – a river that is fluid, in a constant flow - is trying to reassure his lost ego that he/she exists by seeking him/her self not in the waters of the river but in the media [2] in the constant flow of data on the screen he/she faces.

2.1 Cybernetics in the Ocean

Plato first used the expression cybernetics to describe the steering of a ship and Aristotle later to describe the steering of a community. Norbert Wiener, the creator of modern cybernetics has described the world as a ship in the ocean destined to wreck. Wiener reflected deeply on the consequences of the by then second industrial revolution, "Long before Nagasaki and the public awareness of the atomic bomb, it had occurred to me that we were here in the presence of another social potentiality of unheard-of importance for good and for evil" [3]. The accelerating rhythm of the speed by which humanity has reached the fourth industrial revolution left no space for any harmonious adjustment. For political and economic reasons, the rulers responsible for the development of social structures and the planning of the societies designed no strategy to guide humanity in the one way that led from revolution to revolution. The boundaries between the biological, the physical and the digital realities are no longer distinct [4]. Beauty and joy are not part of the algorithm's game. However, the aesthetical poverty is proving its most powerful need for existence by the ethical and aesthetical flattening that have brought the ontological flattening in the new landscape [5], for the need to exist is the fate for existing and fate, as ancient Greek tragedies narrate, is not to be ignored.

2.2 Thoughts, Words, Meanings and Means

Reversing the question *Is thought without language possible* we may ask *what kind of language without the esoteric vibrations of thought is possible*. Language is born in the depths of one's secret places, an inner private movement in the path where it connects and synthesizes, it thrives and is becoming [6], while thought moves in the path of words – for Velimir Klebnikov “the living eyes of secrecy” - formed in codes that store and transmit collected memories and reflections of a person, his/her family, the community, to enter the big avenues of the world sharing its adventures in the course of time [7]. Words follow the thought while at the same time they push it towards the goal. Descartes four hundred years ago added thought in the equation that positioned language beyond the boundaries of mechanism [8], while the screen on the wall of the cave is adding a new component in the equation. A mediator, a facilitator, an inexhaustible source of information and memories. The text is not solid on a paper now, the text is fluid, it is copy pasted, it is

grammatically corrected, word processing is guiding the thought in a constant flow of interaction.

Nietzsche points out that “Our writing instruments are also working on our thoughts”. A contemporary literary critic, Hugh Kenner, in the context of his book *The Mechanic Muse*, develops the view that T.S. Eliot, James Joyce, Ezra Pound and Samuel Beckett evolved their creating writing, not in the choosing of the thematic but the actual writing itself - directly and indirectly influenced by the technological changes of their time [9]. Word processing allows the text to be flexible, open to changes, ready to expand [10]. In the context of her research Christina Haas argues that word processing and computers actually change the cognitive processes of writing, by altering the ways language is produced, distributed and consumed [11]. Word processing had developed for the organizing and restructuring of the office by automating the composition, transcription, reproduction and distribution of the printed word, highlights Matthew Kirschenbaum [12].

Words, syntax, grammar, connotations and connections appear ready and interconnected on the screen. The actions on the screen influence the train of thought and guide creation. A stream of interactive input and output that is constantly on the move via the social media, runs into the paths of syllogism and its impact sheds its collective shadow. Of this equation is missing a component that is essential for the genuine creation: the moments of solitude in the context of which the creator strives for the discovery of the truth, in the depths of the soul.

2.3 Cybernetics and Literature. Serendipity

Cybernetics as “the unit of measuring organization”, delivers a predetermined result, saving energy, keeping what is necessary to avoid driftlessness. Literature in its best form lavishly offers the unexpected, while in its consistency it unfolds the myth to its inevitable conclusion [13]. Artistic creation is the proud proof that what is necessary is not enough. The restless artistic spirit will keep exploring fantasy and the sphere of beauty and good.

Quite unexpectedly the difference between finding and exploring has created a space for serendipity in the modern online search process. One cannot avoid reflecting on the word serendipity, invented by Horace Walpole, inspired by “The Three Princes of Serendip”, in fact an early detective story and we do know that in detective stories the capable writer leaves traces of the unexpected end along the path of narration proving that the unexpected end was inevitable.

The thirst for exploration has driven humans to seek the great truths of knowledge in the external environment as much as in the internal landscape of their inner self, in the cognitive sphere of the intellect.

The development of the skill of exploration, the sense of devotion for the discovery of the truth, free spirit, discipline, critical thinking, are just some of the essential components that progress is made of. The same components are essential for a successful educational system, the foundation stone of democracy.

2.4 Education and Democracy

Any educational system ought to have as its primary goal to nurture the citizen who will combine the characteristics that will

bring him/her to a state of being where in addition to knowledge and critical thinking, he/she will acquire the love for the Form, the passion for free expression, “the awareness that beyond what is necessary there is something that is not biologically useful but is humanly essential” [14].

“No political theory is adequate unless it is applicable to children as well as to men and women.”, argues Russel, adding that the educator ought to give the child the tools and the inner strength to find the path not to an external goal that a social structure may propose, but the goals that are at the end of the child’s inner paths in the depths of the soul [15]. And there, private and personal, carrying the truths of one’s collective history in the course of time, the light of knowledge lies, in a soil that waits to be fertilized by the truths of the rest of the world.

In full contrast, a student that has been admitted to the cave, will passively accept what is being projected on the screen, unable to consult the inner foundations of critical thinking in order to stand in a distant from information and judge it. The student will grow up to become the citizen that is being manipulated by economic and political rulers. And the rulers who will emerge from such a crowd will be manipulated by the faceless giants that rule the world.

Creative writers live in the same era, facing the same challenges as the rest of the citizens.

3. CREATIVE WRITING, A TRADE ORDER RUNNING IN A VICIOUS CIRCLE OR A FRAGRANCE OF A MYTH BLOSSOMING IN THE LANDSCAPE OF OUR POETRY?

3.1 Creative Writing a la Cart

The bad news is that writers will no longer be able to survive financially as professional writers. The worse news is that if they do, it will be because they will offer their talent in order to please the needs of our good old average consumer, namely they will write a la cart without any satisfaction or joy. To make bad things even worse, as any other industry that enters the digital market, creative writing industry ends up free production and consumption. Content, talent, creation, free of charge. What the cyber giants truly sell is the consumer. The consumer is the product [16] and the consumer has developed a “textual attention deficit disorder”, skimming text [17] in the course of his/her constant reading the constant flow of nothings on the screen. Creative writers had always had to face difficulties in financially surviving on their talent as a profession. The challenge now is that it is extremely difficult for creators to find the political support and will to design protective statutes, in an increasingly hostile and complicated environment.

3.2 In the Cave They Like and They Write

All the inhabitants in the cave are consumers. And they are not the victims of the ones that manipulate the stream of symbols projected on the screen. In fact, they are the victimizers, for their preferences dictate the choices of the ones that serve them back to them [18] - in the same manner that voters get the rulers they deserve - and they are no longer able to distinguish between a

symbol that reflects an archetypal myth of the soul and a symbol that is created in order to provoke a reaction. Even some creative writers cannot make this distinction, the cave writers that lack the esoteric reflection of the meanings they are narrating, for the roots in the landscape of their cultural and earthly identity, their comprehension of their social structure and the historical sequence of events that gave birth to their individuality are floating together with the flow of data, the impressions and the messages that are constantly being poured in their minds.

The democratic base of creative writing also is missing, since the consumers passively absorb the servings of their own preferences, they accept what is offered to them without actively criticize and possibly reject it. This is evident not only in the thematic of their writings but also in the writing itself. “Language is the main tool of a human being, in his/her denial to accept the world as it is”, wrote George Steiner [19]. Resistance is the responsibility of the writer.

Some creative writers do resist, and they explore the depths of the human soul. They have a powerful idea that is complete. Under the idea lies reflection that has the weight of conceptualisation and it is not an occasional game of the mind. They have something new to say to the world [20]. They find the poetry of their myths and spare no effort in their strive to narrate it to the world, in language that speaks to the soul directly, leaving the lucky reader thunder struck and joyful and a better human being ready to change skin and heart and mind.

“I think of mythology as the homeland of the muses, the inspirers of art, the inspirers of poetry”, said Campbell to Moyers [21]. For without Myth rooted in the poetry of our being, we have nothing to tell the world.

The obligation belongs to the creative writer who escapes the cave, where he must return to share his story.

3.3 Roots

“Through the endless steppes in Russia, the vast fertile land of millions of people and the fierce social contradictions, the deeply rooted passions and the abyssal souls, in the context of great opportunities and the radical changes, the long endless winter nights that never saw the light of the dawn, the need for story telling, the need of the conscience to relive and narrate its experiences to itself, deep in the solitude of its being”[22], gave birth to the masterpieces of Fyodor Mikhailovich Dostoevsky and Leo Tolstoy and so many others that offered to the world some of the best novels in human history. The spirit of the French revolution and the deeply rooted demand for Liberty and Human Rights gave birth to Victor Hugo’s masterpiece *Les Misérables*. Deeply rooted in the soil of their land, absorbing the fertile climate or the bad weather, the vibrations of the struggles for progress and justice, the dark dreams and the desperate thoughts, the hopes and the future plans, the greatest writers of all times were deeply rooted in the myths of their land and had offered universal truths in their novels that are read in all lands.

“Homer, ancient Greek drama, Don Quixote, Shakespeare, Faust, Dostoevsky, Proust, with strongly national features, gave the universal measure, and engraved the myths of the soul that constitute our civilisation” [23].

4. A SCREEN AND A PASSION. A NEW COMPANION

The writer escapes the cave. He/she walks out of the opening and follows the path to his/her land. Like Raskolnikov, he/she bends down and touch with his/her lips the purified soil. Like Anastassya Filippovna, he/she throws Rogozin's packet of money in the blazing fire. Like Prince Myshkin, he strokes the murderer's hair, while sitting next to the victim and like Jean Valjean, he walks in the dark forest and lifts the heavy bucket from the little hand of Cosette, replacing it with his hand and then he carries Mario through the trenches of the French revolution. Like Antigone, he/she buries the beloved brother. Like Prometheus, he steals the fire from the Gods and goes back to the cave and offers it to humanity.

The writer returns and sits among the cave inhabitants and starts the narration. He/she is using a computer devise. The screen projects his/her passion. Decoding the depths of the human soul, he/she narrates the archetypal myths of human race, offering drop by drop the distillation of a human being's hypostasis, a wonderful blossom in the colours of his/her landscape, full of symbols and memories.

Next to him/her, listening with great interest sits Al.

5. ACKNOWLEDGMENTS

Zeno of Citium, founder of the Stoic school of Philosophy was born in Kition, Cyprus. Stoicism taught goodness and peace of mind that one can gain by living in harmony with Nature and Virtue. He survived a shipwreck near Pereus and he went to Athens where he went to a bookseller and started reading Xenophon's *Memorabilia*. "I had a good trip with my shipwreck" he said, for the shipwreck gave him the chance to start a dialectic journey, conversing with the dead, reading their writings. His cybernetics in steering his ship into wrecking in order to find the writings of the dead was successful.

My journey and the steering of this ship in my endeavour of writing this paper, would never be possible without my conversing with my dead father, reading his own writings, the ones used dated in 1965 – 1970, where in the small land of Cyprus, he wrote about cybernetics, and the Modern Narcissus, and the Space communication, art, education and more. I wish to thank him for cooperating with me with such a generous and rich manner. I also thank him for coming at home one summer when I was fourteen years old with a huge box, where he offered me as a gift all that Freud and Dostoevsky had ever written, actuating me in a journey with no end.

It doesn't matter if the ship has reached its destination. As in Ithaca, the journey is wonderful.

6. REFERENCES

- [1] Plato, *Republic* (514a–520a)
- [2] Christofides, A. 1966. *The contemporary Narcissus*, Fedros, Nicosia.
- [3] Wiener, N. 1948. *Cybernetics: or Control and Communication in the Animal and the Machine*. John Wiley and Sons, New York.
- [4] Plutschinski, T, 2017. *The Fourth Industrial Revolution from an Ethical Perspective*, ISPSW Strategy Series: Focus on Defense and International Security.
- [5] Barret, W, 1958. *Irrational Man: A study in Existential Philosophy*. Doubleday, US.
- [6] Vygotsky, Lev. *Thought and Language*. Cambridge, MA: MIT Press, 1986, pp. 9, 146, 149-150, 179-180, 185, 218. || [Amazon](#) || [WorldCat](#).
- [7] Christofides, A. 1995. *Reasons and Paradoxes*. Essays, Centre of Studies, Kykkos Monastery Research Centre.
- [8] Chomsky,N. 1995, *Language and Nature*. Mind, New Series, Vol. 104, No 413, pp. 1-61. Oxford University Press on behalf of the Mind Association.
- [9] Kenner,H. 1987. *The Mechanic Muse*. Oxford University Press. NY
- [10] McWilliams, P.A. 1982, *The Word Processing Book: A Short Course in Computer Literacy*. Random House Publishing Group.
- [11] Haas,C. 1995, *Writing Technology: Studies on the Materiality of Literacy*. Routledge.
- [12] Kirschenbaum, M. 2016, *Track Changes: A Literary History of Word Processing*. Belknap Press.
- [13] Christofides.A. 1965, *The Cybernetics Theory and Some of Its Extensions*. Fedros, Nicosia.
- [14] Christofides.A. 1954-1965, *The Ideal Man and the Role of the Studies*, Fedros, Nicosia
- [15] Russel.B. 1916, *Education as a Political Institution*. The Atlantic Magazine.
- [16] Morrison.E. 2011, *Are books dead, and can authors survive?* Edinburgh International Book Festival
- [17] Bliss.J. 2016, *How Internet changed the way we read*. The Daily Dot.
- [18] Christofides.A. 1968, *Masks and Faces, a Continuation on The Contemporary Narcissus*. Centre of Studies, Kykkos Monastery Research Centre.
- [19] Steiner.G. 1975, *After Babel. Aspects of Language and Translation*. Oxford University Press. Us and London.
- [20] Apostolides.R.I.S., *Prologue to the Anthology of Modern Greek Literature*, New Edition 2000, Nea Ellinika, Athens.
- [21] Campbell.J. 1988 *Joseph Campbell and the Power of Myth*. PBS Series.
- [22] Apostolides.R.I.S., *Introduction to the Anthology of Modern Greek Literature ***/****, Nea Ellinika, Athens.
- [23] Christofides.A.1970, *Space Communication and the Global Village*. Centre of Studies, Kykkos Monastery Research Centre.

The Pillars of Higher Personality Development of Net Generation in Smart Society

Olga S. Fomichova

Centre of Social Competences "Dialogue of Sciences",
State Budget Professional Educational Institution "Sparrow Hills", Universitetsky prospect 5, 119296 Moscow, Russia
olga.s.fomichova@gmail.com

Vladimir A. Fomichov

Department of Intelligent Monitoring Systems, Institute No. 3 Control Systems, Informatics and Electric Power Industry, Moscow Aviation Institute (National Research University), Orshanskaya street 3, 121552 Moscow, Russia

vfomichov@gmail.com

ABSTRACT

Firstly, the paper suggests a new look at little "C" and big "C" creativity (LCC and BCC) under the framework of cognitronics, its essence is the challenge of LCC and BCC convergence in knowledge society. Secondly, the paper proclaims a new focus of education in smart society, characterized by rapid technological changes and predictable shift in the list of professions - the focus on higher personality development. The maps of cognitive transformations of conceptual world's picture and the spectrum of cognitive skills into a new configuration ordered by smart society are proposed. As a whole, the paper suggests a strategic way to achieving a new stage of smart society corresponding to the expectations of the technologies users with higher personality development.

Keywords

Higher personality development, emotional intelligence, creativity development, little "C" and big "C" creativity convergence, development of figurative reasoning, art cognitronics, thought producing self, value of thought, early socialization of children, system of emotional-imaginative teaching, cognitive engagement, serendipity.

1. INTRODUCTION

The notion "net generation" (the generation which is born with a finger on the button) which is called "multitaskers" (ready to perform simultaneously various activities: to do home work, to listen to music, to talk on phone, to consult social networks, which can hardly distinguish private talk, private space from social networks and public life as a result they are given the new characteristic. They easily give away everything they know, trespassing onto private space of another person.

Net generation roams in the cyberspace, picking up information and exchanging it with a second thought. They are digitally enlightened and can't do without smart devices (we can't do without them either). The question is how to teach if they are sure that they can find everything in cyberspace and can be encouraged by their smart devices in all cases? Which way is it possible to achieve cognitive engagement, to increase their curiosity, to make them believe that getting information is not enough for being intellectually and spiritually mature?

2. THE RETURN OF THE NOTION "VALUE OF THOUGHT" TO THE

WORLD'S CONCEPTUAL PICTURE AND COMMUNICATIVE PRACTICE

Thought-Producing Self (TPS) is the awareness of the preciousness of the thought, its social significance, appreciation of the thought on the part of the authorities of different levels. Let's consider the main steps of our original complex method of realizing the TPS of the child, it is a part of our System of Emotional-Imaginative Teaching [3-5]. At the first stage five-six year old children are taught to understand what a thought is. They are asked to give an example of a thought. They start to speak about their wishes but no one mentions the wishes of mother, father, grandparents. Then they are given the examples of a thought which reveals another way of viewing something. For instance,

"The year is to midwinter moving ,

The roofs are dripping, roads are soak,

And on the ice the sun is brooding (Boris Pasternak).

Children give their own examples.

Example 1. "In early spring, when the snow is melting, there are puddles under every tree and bush. They look like the mirrors scattered by spring to help nature with a morning toilet after the long winter hibernation".

Then children are asked to remember the moments of happiness in their life experience. One of the most touching examples was given by a six year old girl who said that near her country house there lived a dog. The girl and her friends were sure that the dog was an orphan. But then her mother told her that in her childhood she knew the mother of that dog. And it made the girl really happy.

Example 2. "I woke up earlier as usual and saw the morning sun raising up above the deep forest. The sun was cristal clear and in good humour. I guessed that the water in the forest lake had already become warm, because the sun had already bathed in it, and I was happy".

Example 3. "Once upon at Christmastime I looked out of the window. It was a heavy snowfall. Suddenly, I saw a Santa Clause, he didn't walk to my house, he was carrying to somebody else. But I became happy, because I had seen a miracle. It was much more precious than a present".

Then we asked children to share their thoughts. Once of the boys asked: "If he shared his thought, whose thought it would be?". We explained to the children that it was happiness when one had an

opportunity to share one's thought, that there were people who were interested in your thoughts.

The first experience of sharing thoughts showed that children wanted to share their troubles and their pain. As a result, children came to understanding that the thought is a value, it is precious. It is the starting point of their strong interest towards the cognitive processes and of deep respect towards the thought of another person. It evokes the ability to admire the thought.

Then we start considering on the notion "shyness of thought", when people are shy to ask the questions, because they are not ready to listen to the answer.

Then we speak about the "shyness of soul", when we are shy to start up something being sure that can't cope with the task. This state of mind can be overcome with the help of consideration and clear understanding that it has nothing to do with some one's ability to cope with but it is just shyness of soul. Be brave and confident, trust yourself.

The last step but not the least is the idea that a thought is a deed. If you don't agree with something, you should oppose another thought but not power, because thought is powerful itself and can work wonders. People should take responsibility for their thoughts, and that is why they can dare (in this case, your responsibility is increasing).

The strongest enchantment is the enchantment of thought, because the thought can transfigure the world and it reveals revelation.

3. PUTTING TOGETHER BIG "C" AND LITTLE "C" CREATIVITY AS A NEW APPROACH TO IMPROVING OUT OF BOX THINKING AND THE ABILITY OF MULTIFACET WORLD'S VIEWING

One of the principal aims of this paper is to represent a new look at little "C" and big "C" creativity. Big "C" creativity (BCC) [7] is regarded in connection with the creative ability of outstanding scientists, musicians, painters, writers, poets [6]. Smart society demands little "C" creativity (LCC). It reveals the smart society's necessity of creative thinking [1] and creative approach to solving the every-day tasks. LCC improves problem solving skill, which is one of most important skills.

BCC is defined by two main characteristics. It is regarded as original and highly significant creative activity for big groups of people. Creativity of children (LCC) usually is subjective and is defined by their previous knowledge. The main characteristics of LCC is their imagination [2]. Smart society demands the necessity of supporting and improving LCC in order to create the preconditions for increasing the proportion of the specialists in significant application domains who possess BCC.

In order to solve that problem and achieve the significant results in increasing LCC in order to have BCC in future, we have found the way how to combine as early as possible LCC and BCC in the process of realizing the Thought-Producing Self of the child.

The first step suggests the understanding by the children of the significance of thought. It helps to return the notion "value of thought" to the world's conceptual picture of the school children.

The second step suggests the awareness of the school children of the fact that their ideas, metaphors, way of viewing nature ,

communicative situations, the pictures, etc. may be highly significant for relatively big groups of people in case of sharing their ideas with the others. The reason is that they have given a sophisticated look at something and have revealed an example of serendipity (the ability to make pleasant and unexpected discoveries entirely by chance). It happens due to their natural ability to see out of the way things in usual things and usual things in out of the way things. It might be thought provoking for grown-up people.

Example (one of the examples of nature inspired behaviour).

The crown is sitting on the twig. The crown is heavy and big, the twig is thin. But the crown is no nervous. It is not afraid of the fact that the twig may break, because the bird doesn't think about the twig, it trusts its swings (Anne, a seven year girl).

Example. Nine year old children are taught the language of painting. Then they are asked to paint with the help of the words natural language) the portrait of their mother and describe what they have depicted. One of the nine year old boys described his mother s, sitting in an arm chair in the garden in spring. He said that she was blond and she had a long plaid. In fact, his mother had short black hair. To the question why he had said that his mother was blond he answered that he had depicted her inner world, the essence of her personality in order to create the right image of hers, because all kind princesses in Russian fairy-tales are fair-haired.

The third step is to make children aware of the beauty and wisdom they have discovered, because in most cases they do it without a second thought, intuitively. It just donned upon them. They need encouragement to continue mental and spiritual work on that level. Their efforts and their inspiration should be discussed and appreciated by the community.

Example. "To dig out of the ground all its treasures, whether it is the goal of life?" (Angelina, 14 years old).

Example. "Do we love the Volga river only because it provides us with fish?" (Marina, 15 years old).

Example. "All good deeds are reflected on the palm of the Time" (Mary, 15 years old).

Example. "We are not planting the flowers, we are introducing beauty into the world" (Anton, 15 years old).

The fourth step is to show te examples of BCC revealing the same idea to make children believe that the value of thought doesn't depend on age and experience, but age and experience help us to penetrate the very essence of the thought, to comprehend it.

Example (a fragment from a poem by the world known poet Boris Pasternak).

"In everything I seek to grasp

the fundamental:

The daily choice, the daily task,

The sentimental

... And puzzling out the wave of fate,

Events observer,

To live, feel, love, and meditate

And to discover".

The awareness of the value of thought, the ability to see many aspects of reality, creativity as a thought provoking process being able to transfigure the world lead to improving out of box thinking, problem solving skills and reveal nature inspired behavior.

4. HIGHER PERSONALITY DEVELOPMENT

Knowledge society and digital space in general cause the endless processes of challenges and answers. The digital space is created by the most gifted people, who dare to create another world with much more opportunities for humans. On the other hand, that intellectual challenge and application of information and communication technologies in all spheres of human activity and even, in some cases, substitution by robots or androids reveal new demands to the Personality. In order to correspond to the created digital reality, we need to make the focus of education (face-to-face and e-learning) on the higher personality development in order to be successful in smart society. It means that the personality is able to regard thought as a value, understand (not only know which is equal to having information) and be thrilled by the processes of thinking, being able to dare and to take responsibility for it. It suggests that he/she is a socially and intellectually mature person and has improved emotional intelligence and is a spiritually mature person.

Higher personality development includes the ability to put unpredictable questions (out of box thinking), to be ready to make a breakthrough on any level, strong interest in cognition (self-cognition, meta-cognition), nature inspired behaviour, sociability, sense of belonging, awareness of the necessity to be grateful to other people [4, 5].

Modern reality teaches us that modern technological solutions which underpin the creation of new products are hidden. The companies don't want us to get the students acquainted with those technical solutions. They just teach us how to use their products (Google Educational Platform, for example). That is why the focus of education must be shifted to higher personality development (see the figures 1 and 2), and the main object is to train students to think and discover TWO WORLDS: the world inside and the world outside (the second is easier).

In this case we'll have the equilibrium (or balance) between the created digital space and the humans with higher personality development being able to appreciate and correctly use the new digital reality. It will be an initial stage for a new level of digital space development, much more humanized one, because it would be started up by the gifted humans reached the level of higher personality development (see the figures 1 and 2), and aimed at humans with higher personality development.

The new approach is putting together BCC and LCCC through using Student-Self Oriented Learning Model [3, 4] in educational process (see the figures 3- 5), suggesting cognitive engagement.

5. CONCLUSION

The creation can't be better and stronger than the creator. If the mankind creates a digital world (like a Creator creates World and a human being as a topmost creation), it means that the demands to a human being are increasing. The idea of robot (computational

technologies) domination in the future and, as a result, decrease of the human role in general due the substitution of humans by the robots shouldn't be allowed to enter the brains of people, because it was already rejected and proved to be the wrong one in the 19th century by F. Dostoevsky. In his world-known novel "Crime and Punishment" he proved that the idea of God-Man shouldn't be substituted by the idea of Man-God, when the human regards himself higher than his Creator. Dostoevsky proves that in case of substitution a human being will suffer the consequences. In the 21st century we shouldn't repeat the mistake. It's better reread the novel lest we should suffer the consequences.

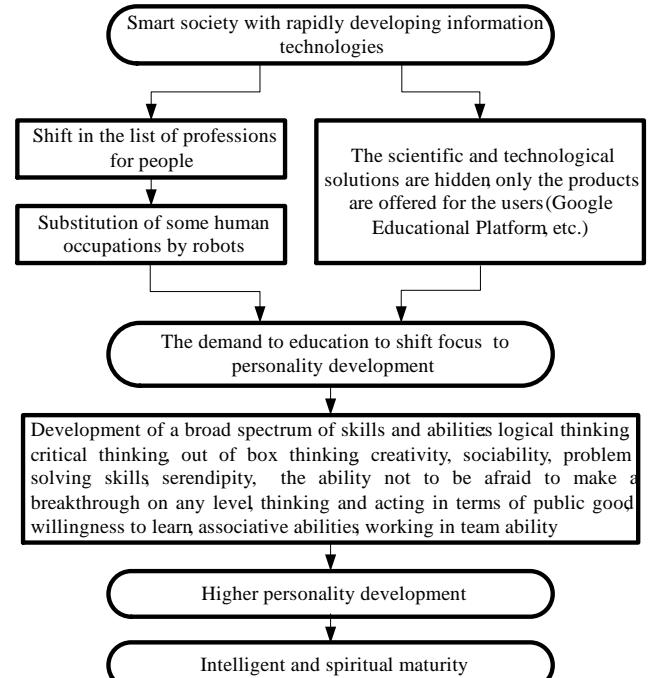


Figure 1: A challenge of smart society for education

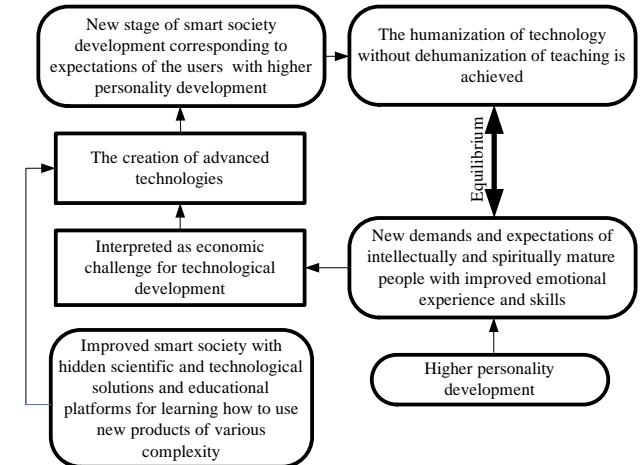


Figure 2: A cognitive leverage for moving to a new stage of smart society development

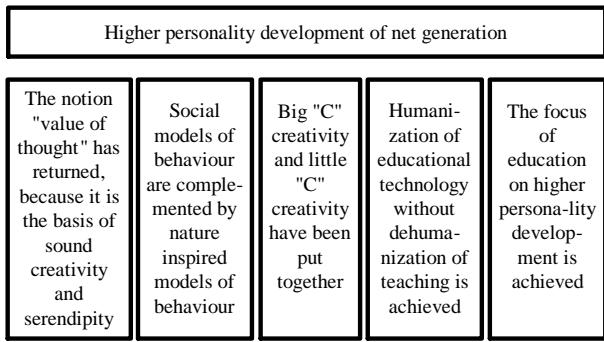


Figure 3: The pillars of higher personality development of net generation

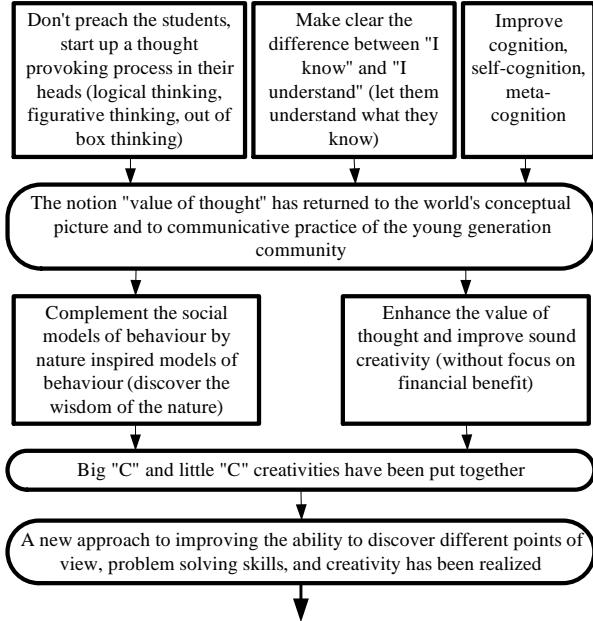


Figure 4: A map of cognitive transformations for building the pillars. Part 1

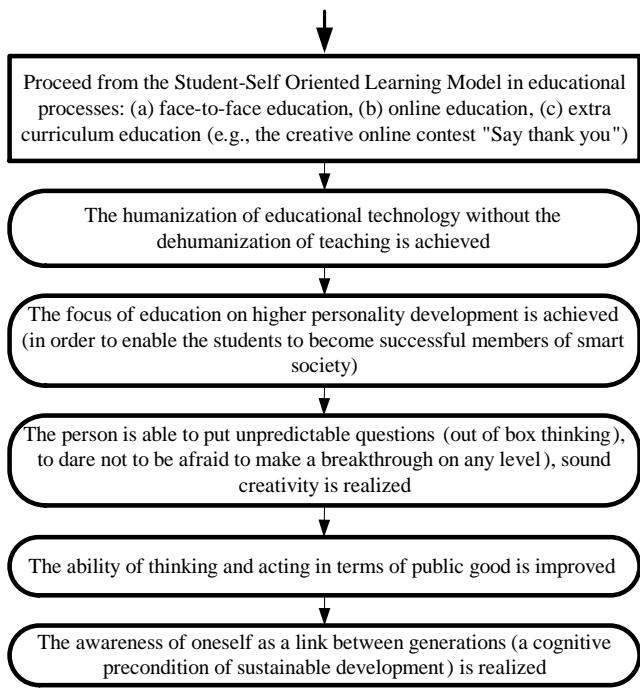


Figure 5: A map of cognitive transformations for building the pillars. Part 2

6. REFERENCES

- [1] Craft, A. 2001. In A. Craft, B. Jeffrey and M. Leibling (Eds.), *Creativity in Education*. Continuum, London, 45-61.
- [2] Craft, A. 2005. *Creativity in Schools: Tensions and Dilemmas*. Routledge, Abingdon. <https://doi.org/10.4324/9780203357965>.
- [3] Fomichov, V. A. and Fomichova, O. S. 2018. *Cognitonics and Its Significance for Education in the Digital Age*. Moscow, MAKS Press. 344 p. (in Russian).
- [4] Fomichov, V. A. and Fomichova, O. S. 2019. The Student-Self Oriented Learning Model as an Effective Paradigm for Education in Knowledge Society. *Informatica. An Intern. J. of Computing and Informatics*. Vol. 43. No. 1, 95-107.
- [5] Fomichova, O. S. and Fomichov, V. A. 2009. Cognitonics as an Answer to the Challenge of Time. In *Proceedings of the 12th International Multiconference Information Society - IS 2009, Slovenia, Ljubljana, 12 – 16 October 2009. The Conference Kognitonika/Cognitonics*. Jozef Stefan Institute, Ljubljana, 431-434.
- [6] Gardner, H. 1993. *Creating Minds: an Anatomy of Creativity Seen Through the Lives of Freud, Einstein, Picasso, Stravinsky, Eliot, Graham, and Gandhi*. Basic Books, New York.
- [7] Kudryavtsev, V. T. 2011. The phenomenon of child creativity. *International Journal of Early Years Education*. Vol. 19, No. 1, 45-53, <https://doi.org/10.1080/09669760.2011.570999>.

Towards Harmonic Existence of Green Computing in Knowledge Society

Amin Fakhereldine, Mahdi Dhaini, Mohammad Jaber, Sleiman Hamdan and Ramzi A. Haraty

Department of Computer Science and Mathematics

Lebanese American University

Beyrut, Lebanon

Telephone number: +9611867621

rharaty@lau.edu.lb

ABSTRACT

The upsurge in global warming and release of greenhouse gases is a major issue that intensified over the past years due to the increasing usage of technological resources in our daily routines. That is why a call for going green in the technological field is hardly recommended. This paper reviews various approaches of green computing in five main models - software engineering model, cloud computing, mobile computing, data centers, and educational sector.

Keywords

Green computing, Sustainable development, Models, Cloud computing, Mobile development, Education, Cognitronics, Data centers.

1. INTRODUCTION

Global warming and climate change are causing the increase of global temperature and the rise of sea levels. The main cause of environmental impacts is people and their harmful behavior. An example for such behaviors is the huge amount of CO₂ emissions from the industries and vehicles, cutting trees, and the exhaustive use of resources by technology. Studies have showed that the amount of CO₂ emissions have been increasing in the past few years [1]. Efforts for reducing harm on the environment must start from changing peoples' behaviors. Citizens of the planet Earth are responsible for thinking "Green" in all aspects of their lives in order to save and protect their future on their planet. Nowadays, technology has entered people's lives deeply, until it reached their jobs, homes, and education. As a contribution to achieving environmental sustainability, people can start from changing the way they deal with technology. Most efforts addressed the hardware perspective of green computing with little attention to the importance of the software perspective. Efficient software reduces the use of hardware resources; therefore, reducing energy consumption. In this study, we examine different green computing approaches in the literature in various domains of software development. In particular, we study green approaches in software engineering models, cloud computing, mobile development, data centers. In addition, we highlight the importance of introducing green computing principles in the educational sector.

The remainder of this paper is organized as follows. Section 2: literature review of the topic addressed.. Section 3: Models for sustainable software engineering. Section 4: Green cloud

Permission to make digital or hard copies of part or all of this work for personal or classroom use is granted without fee provided that copies are not made or distributed for profit or commercial advantage and that copies bear this notice and the full citation

computing. Section 5: Green mobile development. Section 6: Green data centers. Section 7: Green computing in education. Section 8 concludes the paper.

2. LITERATURE REVIEW

Many efforts were done in the literature with the aim of achieving green computing in different domains and reducing the negative impacts of ICT on the environmental sustainability. Naumann et al. [2] presented a reference model for sustainable software engineering (GREENSOFT) that supports different stakeholders in the whole lifecycle of software production. Berkhouit and Hertin [3] defined three levels of ICT impacts on the environment and highlighted the importance of studying their rebound effect in which negative impacts over compensates positive ones. Mahmoud and Ahmad [4] defined green metrics in the stages of software production and stressed on the importance of two stages: requirements definition and testing. The model also discusses the role of software itself in achieving green computing. Capra et al. [5] studied the impacts of software on sustainability and proved that achieving a better performance does not guarantee better energy efficiency.

Atrey et al. [6] studied how the cost of the unlimited services of cloud computing leads to overcompensating the benefits and increases energy consumption and CO₂ emissions. Dougherty et al. [7] described a model-driven green technique to avoid over-provisioning of idle virtual resources in cloud servers. The aim of this model is to provide a green auto-scaling technique, for allocating VM configurations, that preserves a satisfactory QoS. The problem is solved as a feature selection problem. Gai et al. [8] presented an energy-aware mobile cloud computing model that takes advantage of cloudlets to reduce energy consumption of wireless communications. Xu et al. [9] described an energy efficient algorithm for VM scheduling inspired by physical principles. Zhao-Hui and Qin-Ming [10] proposed a virtual machine scheduling algorithm that deploys VMs on data nodes with the least growth of energy consumption. Mukhtar et al. [11] presented a green strategy for determining the least energy consuming fog device to offload client application modules. Verma S. et al. [12] presented an energy efficient, but costly, algorithm that integrates load balancing and data replication for Fog-Cloud computing. Previous researches acknowledge that using virtualization CC (cloud computing) is itself energy efficient technology [13]. A.J. Younge and his colleagues proposed a green cloud framework a few years ago, but it covered only virtualization and data center operations [14].

Mobile devices are becoming an important and irreplaceable resource in our daily life. According to the International Telecommunication Union, the number of registers in the worldwide mobile network operators has already reached more than 4 billion of users [16]. Moreover, based on the International

Data Corporation's statistics, 494 million smartphones were sold worldwide in 2011. The sales of smartphones reached an annual growth of 62% from 2010 till 2011, expecting this increase to continue furthermore [17]. With this huge number of mobiles and mobile users, and taking into consideration their effect on the environment, regarding their energy consumption and the toxic computational operations on the cloud rather than executing them on mobile devices. For example, CloneCloud [18] is a system that allows partial offloading from smartphones to the phone's clone in the cloud. A similar idea was also investigated by Satyanarayanan et al. [19] and Cuervo et al. [20]. Another example from Chen et al. [21] who introduces a framework allowing heavy tasks on an Android phone to be offloaded to an Android virtual machine in the cloud.

When talking about going green in an environment that encounters rapid ongoing changes in the technological fields, the need of a business to "Go Green" is much needed. Green data centers view a great aspect into offering an energy efficient and ecofriendly computing environment. The burst of data centers began from 1946 where data centers were created by U.S. army to serve the military [22]. A green data center differs from a normal data center through the mechanical, electrical, and computer infrastructure is designed in a way to obtain maximum energy efficiency and minimum environmental damages [23]. Nada and Elgelany [24] mentioned in their article that data center consumes a huge amount of energy as the same time it plays a major role in producing large amount of carbon dioxide due to a fact that data centers are mainly composed of thousands of servers. Uddin et al. [25] mentioned in their study that a data center is composed of thousands of servers and is equal of the amount of a small city.

The topic of green computing in the education sector has been studied intensively in the literature. Many studies were conducted to assess the awareness and knowledge levels of green computing in educational institutions [26, 27]. In [28], German software users were surveyed for a study that addressed the environmental issues of software. The integration of sustainability into computing education was studied in [29], where three different strategies were presented. In [30], different techniques for practicing green computing in universities were proposed.

3. MODELS FOR SUSTAINABLE SOFTWARE ENGINEERING

Berkhout and Hertin [3] studied the impacts caused by Information and Communication Technologies (ICTs) on the environment. They presented a summary of the literature on the topic and classified the environmental impacts of ICTs into 3 categories. *First-order impacts*, the most obvious environmental impacts: resource use, pollution, electronic waste. *Second-order impact*: indirect environmental impacts of using ICT. *Third-order impacts*: indirect environmental impacts of using ICT that appear on the long term and may overcompensate the energy savings by ICT (rebound effects).

The authors identify that ICTs have both positive and negative impacts, and that each order effects appear based on the previous order effects. A major issue stressed in relation to the third order effects is the *rebound effect* of the use of ICT. The first and second order effects show that ICTs have the potential to reduce resources usages and energy consumption. However, a critical question is whether the long-term consumption of ICTs will overcompensate the conserved resources.

Naumann et al. [2] presented a reference model for Green and Sustainable software named *GREENSOFT* and gave definitions for *Green and Sustainable Software* and *Green and Sustainable Software Engineering*. The model also performs a refinement for the environmental impacts of ICT, defined in [3], to cover human and social sustainability issues instead of limiting them to environmental issues. The effects were identified as: effects of ICT supply (representing *first-order* effects), effects of ICT usage (representing *second-order* effects) and systemic effects of ICT (representing *third-order* effects). Naumann et al. [2] claimed that a sustainable software product should have a low impact on *Sustainable Development*, and that the development process of the software product should be environment-friendly. This is reflected in the definitions of *Green and Sustainable Software* and *Green and Sustainable Software Engineering* that were provided. Green and Sustainable Software is software that leaves a small footprint on the environment. Green and Sustainable Software Engineering is the art of defining and developing software products in a way, so that the negative and positive impacts on sustainable development that result and/or are expected to result from the software product over its whole life cycle are continuously assessed, documented, and used for a further optimization of the software product. The *GREENSOFT* model also supports different stakeholders of a software product in developing, maintaining, and using it in a sustainable manner. The model comprises four parts: *Life Cycle of Software Products, Sustainability Criteria and Metrics, Procedure Models, Recommendations and Tools*. Mahmoud and Ahmad [4] proposed a model for a green software engineering process consisting of two levels (described below). The first level comprises metrics for the green assessment of every stage in the software engineering process. The second level addresses the role of software itself in sustainable development and green computing. The model followed the definitions of Green and Sustainable Software and Green and Sustainable Software Engineering presented by Naumann et al. [2] and their definition of ICT impacts because they consider human and social sustainability issues. [4] also included an additional definition which is Green and Sustainable Software Process because their aim is to provide green instructions for the whole lifecycle of software production.

3.1 First Level

The first level defines a software engineering process to mitigate the negative impacts of ICT on the environment. The process consists of seven stages of the software lifecycle: requirements, design and implementation, testing, green analysis, usage, maintenance, and disposal. In [2], the part of *Life Cycle of Software Products* discusses impacts of ICT on sustainable development in stages of the product's lifecycle. However, they do not include the requirements and testing stages. These two stages were considered in [3] in contrast to many green software models. In addition, a green analysis stage was added to measure the greenness of the output of every stage.

3.2 Second Level

Another idea missing from the *GREENSOFT* model [2] is the software's role in reducing the negative impacts of ICT and improving sustainable development. The second level of the model presented by [3] describes how software can act as a tool to monitor efficient use of resources

4. GREEN CLOUD COMPUTING

Cloud computing reduces power consumption by providing cloud applications with virtualized computational resources dynamically upon request such as virtual OS instances. This technique requires

keeping idle VM instances in a queue as standby for any request. Consequently, 70-80% of power consumption in data centers is wasted [33-36]. In order to avoid over-provisioning of idle resources, auto-scaling technique was introduced to improve server utilization of resources and support greener cloud computing by allocating virtualized computational resources, dynamically and accurately, to cloud applications based on their current loads. The objective is to maintain the auto-scaling queue in a green manner while preserving QoS. However, determining the number of VMs to fill the queue and their configurations would be very challenging.

Dougherty et al. [7] describes a model-driven green technique for sustainable *auto-scaling* cloud computing infrastructures called *Smart Cloud Optimization for Resource Configuration Handling* (SCORCH). The authors mention three main challenges of configuring VMs: The need for recognizing the VM configuration options of cloud applications and their constraints, the choice of VM configurations to be kept in the auto-scaling queue that can warrant a satisfactory QoS and the optimal auto-scaling queue size.

SCORCH addresses these challenges based on the following four functionalities: (1) Feature models [32] are used to represent VM configurations, implementation details. (2) Cloud applications are requested to inform *SCORCH* about the VM configurations that it will ask for. (3) Feature configuration problems are transformed into constraint satisfaction problems (*CSPs*) and an objective function is defined, to aid in deciding on the appropriate settings of the *auto-scaling queue*. (4) Optimizing the objective function yields an optimized the *auto-scaling queue*.

The greenness of *mobile cloud computing* is linked directly to the stability and efficiency of the wireless communications. Gai et al. [8] introduced a dynamic energy-aware cloudlet-based mobile cloud computing model (*DECM*) that takes advantage of cloudlets to reduce the amount of energy consumed by wireless communications. The main objective of the model is to providegreen computing on mobile devices without affecting the *QoS* in cloud services. The nearest cloudlets receive requests from mobiles through the virtual machines corresponding to client applications. A cloudlet may switch a client's connections to another one if it can provide better and greener service. Cloudlets are coupled with dynamic programming algorithms that enable them to find the most convenient cloud servers to connect with. The *DECM* algorithm is a minimizing algorithm for the cost of the wireless communications in *mobile cloud computing*.

Xu et al. [9] addressed the issue of VM scheduling algorithms that affect the efficient migration of virtual machines between nodes of the cloud. The authors presented a VM scheduling algorithm, *VMSAGE*, inspired by the physical gravitational effect, as an improvement of the simple scheduling algorithms. According to the physical concept of gravitation, the algorithm shuts down data nodes having a low utilization rate and migrates its VMs to other nodes with good heat dissipation in order to avoid overheating. The system decides which VMs will migrate before others based on initial speeds of migration. VMs with very high utilization rates, having large amounts of resources, or placed in servers with very high temperatures are assigned higher values of initial VMs than others. VMs are migrated to other servers that are selected based on lower costs of migration and heat dissipation. The *Cloud of Things* paradigm (*CoT*) was introduced to overcome the problems of limited storage capacities and computational capabilities in *IoT* devices. However, *CoT* was shown to be inefficient for applications that require high latency. *Fog*

Computing was introduced by *Cisco* to support the provisioning of *IoT* applications by bringing computations towards the edge of the network. This technique has various benefits such as reduced energy consumption in data centers and improved latency and network bandwidth.

Mukhtar et al. [11] presents a green strategy for allocation of application modules in fog devices. Its objective is to determine the best suitable place for offloading, in the Fog or the Cloud, taking into consideration energy consumption, CPU capacity, and desired response requirements (or tolerable delays). This approach was assessed by measuring energy efficiency in a remote patient monitoring system (RPM) and comparing the results with those of two other approaches. The results show that the proposed approach reduces energy consumption.

5. GREEN MOBILE DEVELOPMENT

In [16] different perspectives to study energy consumption on mobile devices were discussed. A first approach is from the perspective of instructions processed by the Central Processing Unit (CPU). Whenever the amount of code or data the system needs to fetch from the cache increase, the energy consumption will eventually increase as well. Another approach is from the network perspective. For example, using 3G network connection consumes more energy than using 2G network connection. The last approach discussed was from the application perspective. Two factors were addressed in this section: (1) Bluetooth usage and (2) the SMS message size. It was proven that using the mobile with Bluetooth enabled consume much more energy than using it with Bluetooth turned off. Regarding the SMS message size, sending multiple SMS messages of smaller size will consume more energy than concatenating these messages into fewer SMS messages but of larger size.

In [17] some actions were recommended to save energy. The first recommendation was for mobile applications to operate in networks that offer best-cost benefit rate. For applications that are used to send data (e.g. email applications), consider the alternative of delaying the sending of data, so that the maximum number of requests can be triggered at once. Moreover, applications must make use of parallel connections to transfer data, a strategy that would save a lot of energy. In [17] a mobile computing prototype called GMECloud that utilizes energy efficient mobile devices (e.g., smartphones and tablets) as computing resources is proposed. The mobile client's application checks the status of the device, if the device is ready, it connects to the server. The status of the device is defined in terms of different characteristics, for example, the CPU usage, the device battery level, etc. The server splits the job into smaller tasks; these tasks are then distributed to multiple clients. If the number of active clients is high, the server will assign to each client fewer tasks. This means that the time required by each client to finish the assigned tasks will be less.

In [15], a novel approach is proposed where Middleware is coordinating between mobile and cloud computing techniques to achieve green computing for next generation. The major approaches of the Green Computing are Product longevity, Software and deployment optimization, Power management, Materials recycling, Telecommuting and Low performance computing. A middleware is a software infrastructure, it binds together the applications, operating systems, network hardware, and network stacks. Its major task in this proposed architecture is to evaluate Data center power, Operating system support, Power supply, Storage, Video card, and Display. Green Cloud Computing System Architecture Technologies consist of five core technologies: Scalable Network Architecture, Energy-efficient, Cooling and Power Efficient System, Modular Cloud, Computing

System, Scalable Virtual Internet Appliance and Flash Memory Based Cloud Storage System. In [37], the main concern is to highlight the energy related issues as early as possible in the software development life cycle (SDLC) of an application making it more energy efficient and reducing the cost regarding energy consumption. This paper divides the green technology, as mentioned before, on all the stages of the software development life cycle (SDLC) of a given application. It starts with **Green software requirement specification**, means that there may be additional software requirements to maintain the developed software. Next, **Green Software design**; the main concern of the software developers is always the software structure, the modules needed, the software architecture, etc. While energy efficiency is a main part for a good software design, it's rarely taken into consideration by software developers at this stage. Moving forward, **Green Software Implementation** focuses on reducing the application CPU consumption, the number of parameters used, and many other factors that affect the energy consumption. Regarding the testing phase, a **Green Software Testing** takes into consideration the number of people and the amount of equipment allocated to test the energy used by the application, of course based on predefined test cases related to energy consumption. Finally, **Green Software Maintenance** tends to perform regular maintenance tasks that will keep data transmission at optimal efficiency.

6. GREEN DATA CENTERS

6.1 How Green Is a Data Center

Before taking a risk, an industry must first study the level of energy efficiency which is the level of energy consumed by the industry. Based on the quantitative results that issued from energy efficient measures we can decide what suitable techniques we can use in order to turn the data centers to become ecofriendly. In [23], Mata-Toledo and Gupta mentioned two important metrics which are, the Power Usage Effectiveness (PUE) and Data Center Efficiency (DCE). They mentioned too an aid to the following analysis such as tools known as the "The Green Report". However, Siso et al. [38] focused on metrics technique called CoolEmAll that focuses not only on Energy consumption but also on Heat-aware metrics. They pointed out, that the reason they introduced CoolEmAll metrics is because of the reason that standard metrics such as, CFD, PUE doesn't allow any space for predication of energy performance to enhance the energy efficiency. CoolEmAll provides analysis tools for data centers efficiency according to IT equipment. Moreover, Wang, Khan [39] presented in their study more metrics in order to measure the consumption of energy performance in data centers. The aim of their study is to know how green a data center is through different matrices and measurements and according to that information possible techniques can be taken for a data center to go green. They pointed out that there are two methods for going green either to involve green requirements into building the infrastructure of the process or to green up the process of a working data center in every day usage.

6.2 Optimization Methodologies

Moreover, after measuring the efficiency of a data center in an industry, there must be certain measures taken in order to come up with an ecofriendly data center. In their study, Sari and Akkaya [40] mentioned that one of the greatest threats that affect green data centers can be divided into two groups. First threat, consists of the in ability to manage the cost crises that is born due to the divergence in determining the efficiency performance technique from one hand and the calculating the performance of the server. Another threat relates to data centers is the release of carbon

dioxide that results from data centers to the atmosphere. The authors presented two methods of techniques into data centers to handle these threats. They first presented cooling method know as liquid cooling approach that is put into action its only limitation is that it is geographically dependent which means it must be located in cold areas so that cold water is formed that will reduce temperature and hence reduce the consumption of energy. Another cooling approach is known as direct cooling that is responsible for reducing energy consumption. In addition, another technique is presented that relates to using energy efficiency servers which are achieved by using renewable energy resources to power up the data centers. Another way to produce efficient energy that was provided in this study is either to use of virtualization software through virtual machine. Furthermore, Ghani, Nikejad, Jeong [22] presented in their paper a series of techniques that enables a data center to go green by saving the consumption of energy. They managed to divide their field of work into four fields by presenting energy saving techniques for servers, energy saving techniques for networks, energy saving techniques for a combined environment of servers and networks, and finally by energy saving techniques by using renewable energy. As for servers, it's known that server is the main consumer of energy in data center so establishing power saving environment is vital in this area and it is covered through methodologies such as, server virtualization that tends to minimize the number of hardware in use and decrease the amount of functioning servers through making more than one virtual machine on server. Another technique known as dynamic power management that handles to puts down the computing servers when they are not. Yet a third technique known as dynamic voltage scaling that sets the CPU power according the level of load. Ghani et al. managed also to cover techniques that help to reduce energy consumption in networking fields due to that fact that networks infrastructure is the second consumer of energy after servers by utilizing 30% of energy used for powering data centers. One of the techniques is known as sleep mode that manages to switching of the networks resources or putting them to sleep mode whenever they are not in use.

7. GREEN COMPUTING IN EDUCATION

Many work and studies have been made in order to improve the green computing awareness and practices in the education sector.

7.1 Awareness on Green Computing in Education Sector

The awareness and knowledge of green computing have been addressed by different surveys and studies where different target groups were surveyed [42, 43, 46, 28]. Many studies were conducted in the literature to comprehend the level of knowledge and awareness of green computing among university students [27, 44, 30]. In [27], Dookhitran et al. conducted a study to check the level of awareness of green computing among students in the University of Technology in Mauritius. The survey was designed for students of the School of Innovative Technologies and Engineering. The main goal of the study was to check and analyze the level of awareness of green computing focusing on student's computing related activities and their computer literacy. The survey questions focused on the hardware aspects. Findings showed that students, in majority, are computer literate but they lack knowledge of some major green computing practices (e.g. screen savers.) In [44], Selyamani and Ahmad conducted a study that addressed the student's awareness of green computing issues in higher education institutes focusing mainly on hardware aspects. The survey was undertaken by students from Higher

education institutes in Malaysia. The study findings indicated that students, mainly non-ICT, lack the green computing knowledge. In [30], students and academic staff at Botho College in Botswana were surveyed in order to check and measure the levels of awareness regarding green computing and the negative influences of IT on environment. The study was also conducted to check if any green computing policies are established in the institution. Interviews with staff of the IT department were also prepared and organized. The results showed that the level of awareness regarding green computing is low, and that no green computing policies are set in the institution. Furthermore, findings indicated that changes in behaviors and use of technology and IT can be reached by exalted education.

7.2 Approaches to Creating and Raising Awareness

The topic of creating and raising awareness in the education sector has been studied in the literature where different and many ideas have been published. According to [30], creating a website that contains different green computing information, procedures, policies and tips is one solution to create awareness among students in a university. Pang et al. called for the extending the aspects of green computing in the educational programs [41]. Dookhitram et al. proposed that environmental IT information can be spread by the information channels that are mainly used by the students [27]. Haraty et al. suggested engaging students in educational activities and including awareness campaigns in the educational curriculum [26]. In [45], Suryawanshi presented a number of techniques that raise the awareness of Green ICT such as: Including an obligatory green ICT program course in all universities, to train learners about the importance of implementing green practices by starting Green Computing Certification course, to present rewards for educational institutions and educators (Green Institute, Green Teacher) that best embrace green practices efficiently as a motivation, effective promotion of green ICT practices, and encouraging faculty and students to choose webinars instead of traveling and adopting online education mechanisms in universities that will lead to less carbon footprint [45].

7.3 Green Computing Techniques to be used by Educational Institutes

A lot of studies have been conducted and ideas have been published in the literature about the measures that needs to be taken by educational institutions in order to improve the practicing of green computing [46, 47, 48]. An overview of some measures is provided in Figure 1. Many work and studies have been made in order to improve the green computing awareness and practices in the education sector. However, more green awareness should be raised among students. Educators and educational institutions have a crucial role to play in order to promote and spread green computing awareness among students. Moreover, many measures should be taken and many techniques should be used in order to practice real green computing in educational institutes.

8. CONCLUSION

Technology has become a major cause for global warming whenever treated inefficiently. A huge urge is needed to save our environment before it's too late. In this paper, we went over different approaches to "GO GREEN". We also addressed the

software engineering models for green computing, and the four different perspectives for this topic: Green cloud computing, Green mobile development, Green datacenters and the importance of greencomputing in educational sector .The usage of green computing by normal people contributes to their harmonic existence in knowledge society, and this corresponds quite well to basic objectives of cognitronics [49,50].To sum up, this paper is intended to be part of the research that have been ongoing to increase the awareness of people towards this topic and presents different approaches that will help whenever applied in software development.

Measure/Technique	Source
Online Learning: reduce the pollution that results from students and faculty travels by adopting online learning techniques such as video conferencing and web conferencing.	[46]
Implementing Green Computing in administration and in sharing information: use of online examination systems instead of paper-based exams, using software application to submit student information such as grades and attendance, reduce the use of papers by introducing online applications, forms and petitions, introducing online system for fees payment, use of online brochures thus saving papers and conserving power.	
Saving electricity: educational institutes should consider the huge power consumption that result from the use of computers on its different offices and classes. ENERGY STAR labeled computer equipment should be purchased and should replace energy inefficient equipment (e.g. LCD monitor instead of CRT one)	
Upgrading Computers: upgrading specific components (CPU, system memory) in the computer in order to prolong the lifecycle computers and improve performance.	[47]
Power saving modes: computer power consumption can be managed in an efficient way by using the most "green" and efficient computer power saving mode. Different modes include sleep mode, hibernate mode, system standby mode and hard disk sleep mode. The Hibernate mode proved to be the most effective among other as it power off the computer completely.	
Eliminate Phantom Loads: by using of power strip devices that power off in an automatic way powered off devices that are plugged into the strip.	
Virtual Desktop Infrastructure (VDI): exploiting the green benefits of virtualization (operation efficiency, compatibility, ease of management, simplicity of deployment, low carbon emissions etc.) by implementing VDI in educational institutes. The implementation of VDI has proved to be power efficient as it saves power and consumes low energy compared to non-virtual infrastructure.	[48]

Figure 1: An overview of some green computing measures to be used by educational institutes

9. REFERENCES

- [1] New Global CO2 Emissions Numbers Are In. They're Not Good. (n.d.). Retrieved from <https://www.wri.org/blog/2018/12/new-global-co2-emissions-numbers-are-they-re-not-good>
- [2] Naumann, S., Dick, M., Kern, E., Johann, T., The GREENSOFT model: a reference model for green and sustainable software and its engineering, Sustain. Comp. Inf. Syst. 1 (4) (2011) 294-304.
- [3] Berkhout, F., Hertin, J., Impacts of Information and Communication Technologies on Environmental Sustainability: Speculations and Evidence, Report to the OECD, 2001,<http://www.oecd.org/dataoecd/4/6/1897156.pdf> (accessed 2019-04-03).
- [4] Mahmoud, S.S., Ahmad, I.: A green model for sustainable software engineering 2013. Int. J. Soft. Eng. Appl. 7(4), 55–74 (2013)

- [5] Capra, E., Formenti, G., Francalanci, C., Gallazzi, S., The impact of MIS software on IT energy consumption, in: 18th European Conference on Information Systems, June 7–9, 2010, Pretoria, South Africa, 2010, <http://web.up.ac.za/ecis/ECIS2010PR/ECIS2010/Content/Papers/0073.R1.pdf> (accessed 2010-10-25).
- [6] Atrey, A., Jain, N., Iyengar, N., A study on green cloud computing. *Int. J. Grid Distrib. Comp.* (2013), pp. 93–102.
- [7] Dougherty, B., White J. and Schmidt, C. D., “Model-driven auto-scaling of green cloud computing infrastructure,” *Future Generation Computer Systems*, vol. 28, no. 2, pp. 371–378, 2012.
- [8] Gai, Keke, Qui, M., Zhao, H., Tao, L., Zong, Z. “Dynamic energy-aware cloudlet-based mobile cloud computing model for green computing,” *Journal of Network and Computer Applications*, vol. 59, pp. 46–54, 2016.
- [9] Xu X., Zhang, Q., Maneas, S., Sotiriadis, S., and Gavan C., “Simulation Modelling Practice and Theory. VMSAGE: A virtual machine scheduling algorithm based on the gravitational effect for green Cloud computing,” *Simul. Model. Pract. Theory*, no. June, pp.1–17, 2018. <https://doi.org/10.1016/j.simpat.2018.10.006>
- [10] Zhao-Hui Y., Qin-Ming, J., Power management of virtualized cloud computing platform, *Chin. J. Comput.* 6 (2012) 015.
- [11] Mahmoud, M. M. E., Rodrigues, J. J. P. C., Saleem, K., Al-Muhtadi, J., Kumar, N., Korotaev, V. Towards energy-aware fog-enabled cloud of things for healthcare. *ComputElectrEng* 2018;67:58–69
- [12] Verma, S., Kumar, Y. A., Motwani, D., Raw, R.S., Singh, H.K. An efficient data replication and load balancing technique for fog computing environment. In: Computing for sustainable global development (INDIACOM), 2016 3rd international conference on, IEEE, New Delhi, India, 16–18 March; 2016. p. 2888–95.
- [13] Salama, A.I., Energy-efficient cloud computing application solutions and architectures
- [14] Younge, A.J., et al. Efficient resource management for cloud computing environments. In Green Computing Conference, 2010 International. 2010. IEEE.
- [15] Naikodi, C. (2013). Green Computing and Mobile-Cloud-Computing Inspired Middleware for Next Generation. *International Journal of Advanced Research in Computer Science and Electronics Engineering (IJARCSEE)*. 2. pp-542.
- [16] deSiebra, C., Costa, P., Marques, R., Santos, A., Silva, F. (2011). Towards a green mobile development and certification. 288–294. 10.1109/WiMOB.2011.6085386.)
- [17] Ba, H., Heinzelman, W., Janssen, C., Shi, J. (2013). Mobile computing - A green computing resource. *2013 IEEE Wireless Communications and Networking Conference (WCNC)*. doi:10.1109/wcnc.2013.6555295
- [18] Chun. B. -G., Ihm S., Maniatis, P., Naik M., Patti, A., “Clonecloud: elastic execution between mobile device and cloud,” in Proceedings of the sixth conference on Computer systems, ser. EuroSys ’11. New York, NY, USA: ACM, 2011, pp. 301–314. [Online]. Available: <http://doi.acm.org/10.1145/1966445.1966473>
- [19] Satyanarayanan, M., Bahl, P., Caceres R., Davies N., “The case for vm-based cloudlets in mobile computing,” *Pervasive Computing*, IEEE, vol. 8, no. 4, pp. 14 –23, oct.-dec. 2009.
- [20] Cuervo, E., Balasubramanian, A., Cho, D.-k., Wolman A., S. Saroiu, S., Chandra, R., and Bahl P., “Maui: making smartphones last longer with code offload,” in Proceedings of the 8th international conference on Mobile systems, applications, and services, ser. MobiSys ’10. New York, NY, USA: ACM, 2010, pp. 49–62. [Online]. Available: <http://doi.acm.org/10.1145/1814433.1814441>.
- [21] Chen, E., Ogata, S., and Horikawa, K., “Offloading android applications to the cloud without customizing android,” in *Pervasive Computing and Communications Workshops (PERCOM Workshops)*
- [22] Ghani, I., Niknejad, N., &Jeong, S. R. (2015). Energy saving in green cloud computing data centers: A review. *Journal of Theoretical & Applied Information Technology*, 74(1).
- [23] Mata-Toledo, R., & Gupta, P. (2010). Green data center: how green can we perform. *Journal of Technology Research, Academic and Business Research Institute*, 2(1), 1-8
- [24] Elgelany, A., & Nada, N. (2013). Energy efficiency for data center and cloud computing: A literature review. *Energy*, 3(4).
- [25] Uddin, M., Shah, A., Alsaqour, R., &Memon, J. (2013). Measuring efficiency of tier level data centers to implement green energy efficient data centers. *Middle-East Journal of Scientific Research*, 15(2), 200-207.
- [26] Haraty, R. & Bitar, G. (2019). Associating learning technology to sustain the environment through green mobile applications. *Heliyon*. 5. e01141. [10.1016/j.heliyon.2019.e01141](https://doi.org/10.1016/j.heliyon.2019.e01141)
- [27] Dookhitram, K. &Narsoo, J. &Sunhaloo, M. S. &Sukhoo, A.&Soobron, M. (2012). Green computing: An awareness survey among University of Technology, Mauritius Students.
- [28] Kern, E. (2018). Green Computing, Green Software, and Its Characteristics: Awareness, Rating, Challenges. [10.1007/978-3-319-65687-8_23](https://doi.org/10.1007/978-3-319-65687-8_23).
- [29] Cai, Y. 2010. Integrating sustainability into undergraduate computing education. In Proceedings of the 41st ACM technical symposium on Computer science education (SIGCSE ’10). ACM, New York, NY, USA, 524–528. DOI: <https://doi.org/10.1145/1734263.1734439>
- [30] Batlegang, B. (2012). GREEN COMPUTING: STUDENTS, CAMPUS COMPUTING AND THE ENVIRONMENT- A CASE FOR BOTSWANA. 10.13140/RG.2.1.2227.9528.
- [31] Wang, S., Chen, H., and Shi, W., “SPAN: A software power analyzer for multicore computer systems”, *Sustainable Computing: Informatics and Systems*, vol. 1, no. 1, (2011), pp. 23-34.
- [32] Amsel, N., Ibrahim, Z., Malik, A., and Tomlinson, B., “Toward sustainable software engineering: NIER track”, 2011 IEEE 33rd International Conference on Software Engineering (ICSE), (2011), pp. 976-979.
- [33] Computer center powernap plan could save 75% of data center energy, 2009. <http://www.sciencedaily.com/releases/2009/03/090305164353.htm> (accessed 11.04.2019).

- [34] Rubin, E., Rao, A., Chen C., Comparative assessments of fossil fuel power plants with CO₂ capture and storage, in: Proceedings of 7th International Conference on Greenhouse Gas Control Technologies, vol. 1, 2005, pp. 285–294.
- [35] Cassar, C., Electric power monthly, 2010.
http://www.eia.doe.gov/cneaf/electricity/epm/epm_sum.html, (accessed 11.04.2019)
- [36] Montes, A. F., Cerero, D. F., Abril, L. G., García, J. A. A., Ortega, J. A., Energy wasting at internet data centers due to fear, *Pattern Recognition Letters*, Volume 67, Part 1, 2015, Pages 59-65, ISSN 0167-8655, <https://doi.org/10.1016/j.patrec.2015.06.018>.
- [37] Kirmani, M. M. (2017). Integrated approach for efficient mobile application development using Cloud Computing and Green SDLC: A Study [PDF]. Srinagar, J&K, India: Sher-e-Kashmir University of Agricultural Sciences & Technology of Kashmir.
- [38] Siso, L., Salom, J., Jarus, M., Oleksiak, A., & Zilio, T. (2013). Energy and heat-aware metrics for data centers: Metrics analysis in the framework of CoolEmAll project. International Conference on Cloud and Green Computing, 428-434.
- [39] Wang, L., Khan, S. U. (2013). Review of performance metrics for green data centers: A taxonomy study. *The Journal of Supercomputing*, 63(3), 639-656.
- [40] Sari, A., Akkaya, M. (2015). Security and optimization challenges of green data centers. *International Journal of Communications, Network and System Sciences*, 8(12), 492.
- [41] Pang, C., Hindle, A., Adams, B., Hassan, A. E. (2015). What Do Programmers Know about Software Energy Consumption?. *IEEE Software*. 33. 1-1. 10.1109/MS.2015.83
- [42] Manotas, I., Bird, C., Zhang, R., Shepherd, D., Jaspan, C., Sadowski, C., Pollock, L., Clause, J. (2016). An empirical study of practitioners' perspectives on green software engineering. 237-248. 10.1145/2884781.2884810.
- [43] Kogelman, C.-A. (2011) CEPIS Green ICT Survey – Examining Green ICT Awareness in Organisations: Initial Findings. Carol-Ann Kogelman on behalf of the CEPIS Green ICT Task Force. *CEPIS UPGRADE XII(4)*:6–10
- [44] Selyamani, S., Ahmad, N. (2015) Green Computing: The Overview of Awareness, Practices and Responsibility Among Students in Higher Education Institutes. *Journal of Information Systems Research and Innovation* Zhang C, Hindle A, German DM (2014) The Impact of User Choice on Energy Consumption. *Software, IEEE* 31(3):69–75
- [45] Suryawanshi, K. (2019). Green Information and Communication Technology Techniques in Higher Technical Education Institutions for Future Sustainability: Proceedings of ICDMAI 2018, Volume 2. 10.1007/978-981-13-1274-8_3
- [46] Agarwal, S., Kaustuvibasu, Nath, A. (2013). Green Computing and Green Technology based teaching learning and administration in Higher Education Institutions.
- [47] Talebi, M., Way, T. (2009). Methods, metrics and motivation for a green computer science program. *ACM SIGCSE Bulletin*. 41. 362-366. 10.1145/1508865.1508995.
- [48] Agarwal, S., Biswas, R., Nath, A. (2014). Virtual Desktop Infrastructure in Higher Education Institution: Energy Efficiency as an Application of Green Computing. 601-605. 10.1109/CSNT.2014.250.
- [49] Fomichova, O. S. and Fomichov, V. A. 2009. Cognitronics as an Answer to the Challenge of Time. In Proceedings of the 12th International Multiconference Information Society - IS 2009, Slovenia, Ljubljana, 12 – 16 October 2009. The Conference Kognitonika/Cognitronics. Jozef Stefan Institute, Ljubljana, 2009, pp. 431-434
- [50] Fomichov V. A., Fomichova O. S. 2012. A Contribution of Cognitronics to Secure Living in Information Society. *Informatica. An International Journal of Computing and Informatics* (Slovenia). Vol. 36. No. 2. P. 121-13

Art and Culture as a Mirror, Testimony and Testament of Their Times

Monika Jadzińska, Ph.D., DSc

Academy of Fine Art in Warsaw,
Dep. Conservation-Restoration of
Works of Art.

Wybrz. Kościuszkowskie 37, 00-068,
Warsaw, Poland
048 22 625 12 51
monika.jadzinska@gmail.com

ABSTRACT

Art and culture reflects the time in which it was created. They seem to be a mirror but also testimony and testament of their times and as such should be protected for our identity, memory and development. The ephemeral or experimental nature of some modern materials and new technologies used in contemporary art and the nature of the works themselves determine their future when subjected to the process of ageing. In contemporary art, the work of art has ceased to be merely a physical object, but has become a hybrid incorporating different meanings, relations and processes in addition to its material substance (traditional materials, new technologies, ready made etc.). This creates new challenges in conservation-restoration in the field of theory and practice and it is necessary to rethink paradigms and educational profile.

Keywords

Contemporary art and culture, liquid modernity, Baumann, new paradigm of conservation-restoration of contemporary art, new materials and technologies, synergy in analysis, care and conservation-restoration, education

1. ART REFLECTS THE TIMES IN WHICH IT IS CREATED

The creation of art has always been accompanied by a desire to protect and preserve it for future generations. The form in which it survived was determined not only by the interpretation of the work, but also by the times, people and culture that it reflected. Throughout the centuries, the development of European art has been largely based on producing enduring and valuable objects through the use of the highest quality materials and the maintenance of the correctness of the techniques and technology by which they were created, according to principles developed for generations. From the end of the 19th century, the situation began to alter, to change dramatically in the early 20th century.

New times have generated new needs; this also applies to the art that reflects their diversity and dynamics. The Polish philosopher Zygmunt Bauman created the notion of the civilization of the twentieth and twenty-first century as a "liquid modernity", resulting from advances in technology, telecommunication and transport. The core of liquid modernity is the absence of anchoring features (identity, values, capital) and the absence of borders (in consumption, geopolitics, commerce and communication). It is defined by three categories: variability, relativity and pluralism. In a liquid modernity, culture and art are constantly undergoing deconstruction of meanings.

New times have put new, modern materials and technologies into the hands of artists. New forms of art have emerged that extended beyond traditional artistic disciplines both in the sphere of ideas and in the materials used in their creation. The selection of materials began to reflect the randomness of everyday life, so the material used could be unstable, worn out, of low quality, or used in an experimental way. Issues related to authorship and reproduction were also re-evaluated.

2. CHANGE OF PARADIGMS IN THE PROTECTION AND PRESERVATION OF CONTEMPORARY ART

Globalization, new technologies, dynamism of today's life have huge influence on culture and art. The wealth of ideas and means of artistic expression employed in contemporary art raises the question of preserving the authenticity of the work, and the answer implies careful decision-making in terms of its protection and conservation. The body of conservation-restoration theory and practice related to traditional art must be a necessary base, but at times it proves to be inadequate to cover all issues. For centuries, there have been a variety of manners in which the authenticity of a work of art was understood, and theories about this were at times contradictory. As a result of the debates on the conceptual suggestions of Emanuelle Viollet-le-Duc (the idea of stylistic unity), John Ruskin (the doctrine of non-intervention), Camillo Boito (the use of minimal intervention and the principle of distinguishability of added elements), Georgio Dehio (respect for the whole history of changes affecting the historical object) and others led to the establishment of the main dogmas of the ethics and practice of conservation-restoration in the Venice Charter (1964). The broadening of the scope of the preservation of the heritage by taking into account cultural diversity (Document on Authenticity, Nara 1994) and intangible heritage (Convention for the Safeguarding of the Intangible Cultural Heritage, UNESCO, Paris 2003) led to a realignment of the dogmas of the imperative of the preservation of the material within the object, the principle of minimum intervention, the impermissibility of the exchange of original elements, and the postulate of reversibility of conservation-restoration treatments. This is close to the concept of the preservation of the ideas and material of contemporary art.

In the light of that, in digital world, in what way must the approach to the care of a collection of contemporary art differ from the practices and principles determined for the preservation and exhibition of traditional art? In the case of traditional art, principles were established according to which the original

material had an absolute value. Conservation was aimed at prolonging the life of the unique physical object. New approaches that influence conservation-restoration decisions are the result of the unique character of contemporary works of art. They integrate different media and objects, space and place, contexts, new technologies and sensual elements to form a whole. The material sphere becomes the carrier of a certain idea. Additionally the physical and psychological involvement of the viewer should be treated as an integral part of the work.

In the case of the preservation of contemporary art, one might almost say that we are dealing with "post-conservation". Similar to the concept of "postmodernism" – this is the space of confrontation of different tendencies and concepts, the common denominator of which is critical thinking based on the extremely individual assessment of each case. Here however we encounter a certain threat, the „lack of boundaries”, the deficit of rules and a stable anchor point in values, the relativity, mutability and the excess of pluralism about which Bauman wrote. The sense of freedom which, in the case of postmodernism, manifests itself in the eclectic selections from various conventions, styles and languages in art, carries the risk of destroying the values established over the centuries by conservators-restorers and curators of works of art.

3. DILEMMAS ABOUT MATERIAL

The variety of artistic attitudes does not allow the adoption of clear solutions for the preservation of a work of art. The traditional approach to keeping the work in the best possible condition by slowing down the degradation process, in many cases will be a rejection of the sense of some objects of contemporary art which involves the spheres of change, destruction, the activities of the viewer, and the survival, not of the original substance, but its remains. "This is not to suggest that the treatments are more difficult but that the decisions of what or whether to treat can be more complex and are often without precedent". For example, according to the principles of conservation-restoration ethics established with reference to traditional art, it would be unacceptable to replace certain elements of the work with new ones, their reconstruction, emulation or re-installing. For works of contemporary art, however, the lack of such operations could lead to a negation of their nature. One example might be the picture of Jan Tarasin *Przedmioty policzone* [Counted objects], (1970), with elements of colored plastic stuck to its surface that had, as a result of incorrect storage methods, lost about half of these elements. The missing elements were recreated as a result of the decision of the conservators-restorers and the owner (the son of the artist, who stated that, because the object's expression as a three-dimensional character would have been lost and the picture could not be displayed without them, his father would certainly have wished that). As an aside, as a long-time lecturer at the Faculty of Conservation and Restoration of Fine Art of the Academy of Fine Arts in Warsaw, as well as an active conservator-restorer of works of art of the past and present, I have noticed a certain tendency; young conservators-restorers show much more humility and caution in making difficult decisions about contemporary art (in, for example, reconstruction, emulation, replacement of new elements) than those conservators-restorers who remember the times in which a given artist lived and created.

4. NEW APPROACH IN THE EDUCATION

In this „post-“ period (when we are faced with post-truth, postmodernism, post-politics etc. – in other words concepts which are in opposition to the basic ones formerly in existence), there exists the risk that the lack of well established conservation doctrines resulting from the open nature of modern and contemporary works can introduce confusion and an excess of subjectivity in the field of the ethics and practice of conservation-restoration. The remedy for this is the professionalism and synergy of activities and attitudes in the creation of conservation-restoration strategies for active and preventive conservation of a work of art, through careful analysis of its constituent appearance, materials and concepts, as well as the dichotomous nature of its material and non-material layers.

Education is of prime importance. It is easy to cross boundaries if you are unaware of their existence. Polish experiences show that the multi-aspectual training of conservators-restorers is important, and this is achieved through a six-year multi-disciplinary course of studies in the conservation-restoration of traditional art conducted in an institute of higher education, in the course of which in the last year of studies there is a parallel specialization for students showing a predisposition to undertake studies in the field in the conservation of contemporary art. Knowing the ethical and technical rules that they will sometimes go beyond, the young conservators-restorers know how and why they must do so. They have thus an awareness, backed by a basic but already relatively broad knowledge and experience. And it is worth mentioning that, due to a cruel history, many works in Poland have been preserved in poor condition, so that the conservator-restorer is able to gain experience during their studies with objects that are connected with many different problems of active and preventive conservation. In practice it turns out that this comprehensive education, openness to new experiences and the ability to cooperate are a good basis for the training of conservators-restorers who are able to cope with every situation, including working in contemporary art museums. I noticed this being a member of the commission of the Ministry of Culture and National Heritage that allocated resources for national and regional collections of contemporary art, for which applications had to be supported by the opinions of conservators-restorers. It turned out that even in the case of small cultural institutions, even a conservator educated and practicing in the field of the protection of the traditional arts was well aware of the problems of contemporary art collections.

The education of conservators-restorers who have the most direct influence on the work is one thing. The preparation and appropriate approach of all other people who have to deal with an art object during its lifespan is another. As far as the shape of the work and its state of preservation are concerned, this is determined not only by the artist (who selects the specific artistic means, materials and technology at the time of creation), but also all the stakeholders from acquisition to a collection - through packaging, storage, transport, together with the both active and preventive conservation measures applied, also those connected with the sphere of interpretation and display of the exhibited works. And over-interpretation is not difficult. Another condition of the adequate protection of contemporary art is thus the degree of the co-operation between its carers, which is based on collaboration with various specialists (curators, conservators-restorers, archivists, registrars, audiovisual technicians etc.). For a conservator-restorer of contemporary art, such interdisciplinarity

is an obvious consequence of the complex character of the works. For example, the preservation of the work *Dokumentacja Galerii Foksal* [Documentation of Foksal Gallery] by Tadeusz Kantor (1970), which is a roll of cotton canvas 17 metres long with silver gelatine prints depicting the history of one of the most important Polish contemporary galleries printed on it, required consultations with photographers, fabric technicians, art historians, archivists and the work's owner.

It is also obvious that it is necessary to directly consult the artists or their collaborators to obtain information "from the source" about the creation process, the material and artist's own assumptions concerning the preservation of individual elements and the whole object. Interviewing the artists facilitates the identification of materials and, above all, justifies their selection, binding them to the message carried by the work.

The role of science in the process of preserving and conservation-restoration of works of contemporary art is also undisputable. Undertaking analyses and research to identify materials and techniques, identifying causes of damage and determining preventive methods is important here because of the often unconventional and experimental nature of the work, affecting holistic conservation-restoration practices. In Poland, because only the most important museums have their own research laboratories, these needs are fulfilled to some extent through co-operation in research projects between museums and scientists working in universities, academies of fine arts and research institutions.

5. PROBLEMS WITH NEW MATERIALS, TECHNOLOGIES AND APPROACHES

New forms of artistic expression appeared together with the rise of modern art, and they force us to incorporate in the strategies of curatorship and conservation-restoration such aspects as ephemerality, processuality, performativity. But concomitantly, the material of the work is a carrier of the artist's ideas and creative thoughts. Problems arise from the limitless combinations of materials that can be used to create a work: artistic and non-artistic materials, readymade objects, technology applied experimentally, and the use sometimes of substances that are dramatically unstable (such as some plastics) or time-based media. We also increasingly find ourselves dealing with materials whose instability was not intended by the artist. Examples include fragile polyester sculptures by Alina Szapocznikow or the color-changing polyvinylchloride (PVC) mannequins from the performance of Tadeusz Kantor's *The Dead Class*. While plastic is generally regarded as durable and unchangeable, in some cases we can observe their chemical and physical degradation to destruction. This is a burning issue, especially as the process, once it has been initiated may continue, even though the original stimuli that gave rise to the problem are removed. Preventive conservation may be able to slow down these processes. Problems include the use by artists of new materials and technologies. An example of this is

the use of certain plastics that should be stored in an anaerobic environment - anoxic chambers, airtight containers or envelopes equipped with appropriate absorbers, while others require constant air circulation. Other problems involve the complex character or size of some works (e.g. installations) that require the introduction of new procedures and changes in museum practice. Sometimes the use of new materials, often from outside the usual repertoire of artistic media, which are used in various combinations and sometimes act on one another destructively (e.g., the combination of some plastics with metal), can result in the production of undesirable effects during ageing. It is therefore vital for all those who have museum collections in their care to be aware of the risks resulting from the nature of modern art objects (such as through inadequate packaging, storage and transport), as it is rarely possible to rely on routine resolutions to these problems.

Should we really take such care of the future of this strange, unconventional art? As the British economist John Keynes said, "in the long run we're all dead", so who cares? Conservators-restorers do. And their decisions determine whether the identity of contemporary art and culture will survive.

6. REFERENCES

- [1] Bauman, Z., 2000. *Liquid Modernity*. Polity Press, Cambridge.
- [2] *Conservation, Principles, Dilemmas and Uncomfortable Truths*, 2009. eds. A Richmond, A. Brecker, Butterworth-Heinemann as an imprint of Elsevier&Victoria and Albert Museum, London.
- [3] Hummelen, Y., 2005. Conservation Strategies for Modern and Contemporary Art. Recent Development in the Netherland, Cr 3.
- [4] *Inside Installation. Theory and Practice in the Care of Complex Artworks*, 2011. eds. T. Scholte, G. Wharton, Amsterdam University Press, Amsterdam.
- [5] Jadzińska, M., 2012. „A Big Work of Art.” *Authenticity, care, conservation, (“Duże dzieło sztuki”). Autentyzm, zachowanie, konserwacja sztuki instalacji*, Universitas, Cracow.
- [6] Jokilehto, J., 1995. Authenticity: A General Framework for the Concept, In *Nara Conference on authenticity in Relation to the World Heritage Convention. Proceedings*, ed. K. E. Larsen, Unesco World Heritage Center, Nara
- [7] Saving the Now, Crossing Boundaries to Conserve Contemporary Works, 2016. In *IIC Los Angeles Congress Preprints, Studies in Conservation*, Suplement 2, London.

Technology and the Socio-Human Transformation in the World Structure

Joonho Kim

Department of International Relations
Tokyo International University
Matoba 1-13-1, Kawagoe, Saitama, Japan
toko9a@gmail.com

ABSTRACT

Technology has been the base of human civilization. But contemporary technology began to exceed human being. The alienation of human being by technology defines the condition of human existence. This paper tries to suggest a basic idea to overcome this absurdity.

Keywords

technology, world structure, Faustian bargain, human alienation
globalism, socio-human transformation.

1. INTRODUCTION: IGO MATCH

In 2017 a big event between human being and AI was held: a Go match between Lee Sedol, a Korean Go master and Alpha Go, an AI which was developed by Deep Learning.

Until then it had been believed that AI cannot win the first class professional human Go player, because it needs an astronomical calculation to analyze the complicated situation on the Go board, which composed of 19 lines by 19 lines, all 361 dots, and select the best strategy and tactic in the situation. Theoretically it has $361!$ (factorial) options of move, and actually 2.08×10^{170} moves are possible, which is more than the number of atoms in the universe. But the result was 4 to 1 victory of Alpha Go over Lee Sedol.

At the end of the previous century, there had been already the awareness of the status of human being in rapidly changing environment of technology, predicting the time when computers exceed human intelligence.

Before the next century is over, human beings will no longer be the most intelligent or capable type of entity on the planet [6].

It seems to have been realized much earlier than had been predicted. Man succeeded in making a machine whose intelligence is far beyond man itself. Man made a monster which may not be controlled by man. Or did human being create a god, whom he cannot win?

2. HUMAN BEING AND TECHNOLOGY IN WORLD STRUCTURE

2.1 World Structure

The world consists of three elements: nature (N), society (S) and human being (H). Society is set of a kind, human being is the whole as an

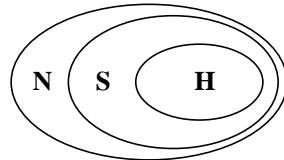


Figure 1: World Image

individual as well as a part of a society, and nature is its environment.

Figure 1 shows this structure. Human being constitutes society with the same kind. Society is not a single entity, but a very flexible concept. There are various kinds of society according to the degree of similarity of the same kind.

Human beings compose a society and respond to the nature. And the technology is the way how human being and society respond to the nature.

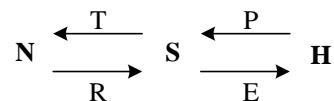


Figure 2: World Mechanism

This relation is depicted in Figure 2, which represents a simplified system of the world. H organizes S by politics (P), and S contacts with nature by technology (T). Nature feeds back resources (R) to S, responding to the intensity of technology. S distributes this R to H through the economic system (E).

Here technology functions

as a particular way of ‘experiencing’ or ‘disclosing’ the natural world, which is transformed into exploitable resources and practical opportunities...([4], p.27).

Usually human beings respond to the nature as a society. Robinson Crusoe should and could make instruments to respond to nature¹, because he was exposed alone to nature apart from society. In ordinary world situation, human being is better able to respond to nature, socially. Social brain is

¹ Recent study shows that Robinson Crusoe was a novel based upon real episodes in Daniel Defoe’s era.

more efficient than individual brain.

2.2 Transformation of Human Society by Technology

Human beings as society face technologically with nature. They functionalize their lives. Technology as the responses to nature transforms society and changes human being. Therefore the history of technological development means the history of human development in the nature.

...technology, which is itself shaped by society, actively shapes society by influencing the way in which people behave, the way in which social roles, relations and institutions are constructed, and the manner in which culture manifests itself [1, p.39].

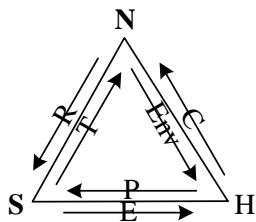


Figure 3: World Structure

The mechanism of the world is expanded to the Figure 3 World Structure from Figure 1. Here human being cultivates nature, which results in culture (C) and nature provides environment (Env) to human being.

Technology defines society, civilization and human being itself. Society, not human being, decides whether to accept the technology or not. Technology comes into the society with its own logic. Human society is transformed on the technological base as a predefined condition. Technology, not only politics, directly changes the society².

Civilization is based upon technology. The development of civilization means the development of technology.

Agricultural Revolution ten thousand years ago, Industrial Revolution some 300 years ago had resulted in civilizations specific to the technology systems, and the transformation of human society. And now the 3^d revolution³, IT Revolution, has just begun.

Alvin Toffler developed his socio-evolution theory based upon this macro view on civilization: the first wave (Agricultural Revolution), the second wave (Industrial Revolution) and the third wave (Information Revolution).

² A business man told his success story: "I had wished to be a politician, but having seen that tech moves faster than the politics and changes everything, I decided to start up. At first I tried to change health care law, but I changed my mind, when I saw one of my friends make mobile app and linked tens of thousands of doctors and patients".

(http://biz.chosun.com/site/data/html_dir/2019/08/26/2019082600279.html)

³ Recently we often hear of 4th Revolution. This is the result of dividing the 2nd revolution in detail. In this paper, this 4th Revolution belongs to the 3rd Revolution, in Table 1, from the long term historical point of view.

Technologies,...are embedded within 'forms of life' which simultaneously 'provide structure for human activity' and 'reshape' it, thereby transforming the meanings of those activities [9, p.58] quoted in [4, p. 28].

A great leap of technology transforms a society as a whole.

Industrial Revolution changed the agricultural society into modern, industrial civilization. IT revolution changed industrial society into cyber civilization. The base of life, and the framework of the society changed. Paradigm shift had taken place, and the new IT generation couldn't understand the life style of the old generation when people had not smart phones, because technology is a mode of being, a way of life or a kind of thinking [8, p. 94].

In Figure 2, technology acts on nature, and nature feeds back resources to society. If technology increases its efficiency, then resources increase. If there is a great leap of technology, then there appears a great growth of resources, which act as the stimulus to change sociology.

The development of productivity leads to the change of social structure. Historical development of productivity defines human society. When capital and labor are equal, productivity depends upon technology. Therefore the development of technology changes social structure. Table 1 shows the 3 stages of transformation in human history, according to the Figure 2 schema.

In individual human level, we can adapt this schema to the development of musical instrument. T leads to the deepening and expanding of R (musical resources). When H cultivates N based upon a new T (Figure 3), R is an artistic result, which is the creation of unlimited production of sound color. This stimulates human intelligence and even spirituality, transforms human existence through elevated aestheticism.

Table 1: Technology and the Social Transformation

	Technology	Resources	Society
1 st Revolution	T1: Agricultural	R1: Accumulation of crops	S1: Tribe, birth of social classes
2 nd Revolution	T2: Industrial	R2: Steel, chemistry and electricity	S2: Nation state
3 rd Revolution	T3: Informational	R3: IT	S3: Global society

3. FAUSTIAN BARGAIN AND THE ALIENATION OF HUMAN BEING

3.1 Convenience and Faustian Bargain

Technology provides convenience to society, but it does not guarantee happiness. If convenience means happiness, contemporary men should be

thousand times happier than Stone Age men. But those who are living in the 21st century seem to be less contented than those who had been living in any other age.

Convenience is a function, and happiness is essentially related to human existence. Convenience can be a necessary condition for happiness but it is not the sufficient condition for it.

Technology has two-sided coin: bright side and dark side. Functionality without valuable purpose, with wrong direction, is dangerous.

I suggest the formula of happiness as below [5]:

$$H = \frac{R}{D}$$

Here H =happiness, R =Resources and D =human desire. In this formula the technological development provides human society the increase of R , the physical condition of human happiness. But if the speed of D growth is faster than that of R , H decreases. So technology is not the absolute condition for the happiness. T gives some level of convenience for H , but market stimulates D more than R . Therefore H keeps on decreasing.

Technology compels human beings to make a Faustian bargain. It tries to exchange human identity with physical convenience, which is extra condition to human existence⁴.

Human beings give up the essence of human existence through this bargain. Convenience of network or smart phone changes the meaning of life. Human beings seem to be happy to get some convenience by providing his ID (identity) to the internet. Is this a good bargain for human?

3.2 Human Alienation in Technocentric Society

Now nobody can live without smart phone. Preconditions of human lives became complicated and multi-layered. Human beings cannot stand alone as a natural being. He can exist only on technology. As the object of technology, human being is an atom with smart phone, which dedicates every kind of personal information to the huge network system, and various kinds of organizations are social molecules.

In Figure 4, technology is centralized. It is at the center of world structure. Now every element of the world structure is linked only through technology. Functionality stands above the entity. Now is the time of technological sovereignty. Humanity gave away its entity to the functionality and has fallen to the status of second class being.

Technology has been the liberator of human being from the nature, the mediator between nature and human society, but now it tries to take the central position of the world and is becoming the controller and the

⁴ Oswald Spengler says in a different nuance that Faustian man is he who strides forward in an ever-increasing alienation from Nature ([4, p.26].

oppressor of human being. The anthropocene era was thought to have just begun, compared to the beginning of the universe or the birth of the earth,

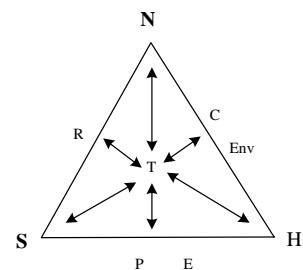


Figure 4: Technocentric World View

but almost at the same time we are now entering in the technocene era. Technology defines human beings. Now the concept of humankind became to include not only human being, but also humanoid, in other words, not only carbon human but also silicon human [2, p. 237]. Here the new era of alienation comes, which is different from that of Industrial Revolution era: alienation of human being by IT. Someday in the near future the silicon humanoid will assume the position of carbon human being.

A rapid and profound technological change is called Singularity [7]. Here transition from human being to humanoid will take place and technology becomes humanized so that the society will have to include more intelligent humankind, as the same kind equal to human being. Since then human being loses its sovereignty over itself and becomes alien and subordinate to what he himself created.

3.3 Human Value and the Logic of Technology

The logic of technology is different from human value system. The former has its own logic of development and it confronts with the latter.

Technological change seems to be value-neutral, but it is not. Various kinds of human value are attached to it. It is often biased to negative value, linked to market-oriented human activity, not sufficiently reflecting the general will and value of human kind. When internet was introduced globally, it was welcomed worldwide. But it should have been introduced on global consensus, because it was not the absolute good. It has dark sides as well as bright sides. Several years after we began to enjoy it, we suffer the computer virus and many other non-ethical, anti-values which are parts of our daily lives now.

The reason why technology cannot be controlled according to general will of human kind is that it is used as a method to overcome others between mega competitors such as states or big companies which possess their own R&D facilities. This absolute necessity of technological development by big organizations dwarfs individual human beings and the society.

The competition between nations is mainly political, and that between companies is economic. This politico-economic reason of technological development leads to the human alienation by the subordination of human

being to the technology, in other words, self-negation of human being by man-made technology. Human society creates the situation which it cannot control because of its internal disunity, even though it is aware of that.

The world operates on similar technological standards. Technology is globalized and made the world globalized. Technology has been commercialized and expanded worldwide. Technology has its own logic, which might be antagonistic to human value and under the globalization it might cause the global crisis. The evidence of the fact that the world had completed the globalization technologically includes the ironical case of Y2K or recurring global financial crisis, which reflects bad aspects of computer modelling of financial commodity.

The historical stage that links every part of the world through network, based upon the same technological standard, routinize the global crisis.

Contribution to the development of technology has been a kind of patriotism for scientists and engineers. They worked for their nation, not for human society. A country has been the absolute society they belonge.

So that competition between states justifies unlimited technological development. Technological development is *summum bonum* to each and every state. Especially since the Industrial Revolution, it contributed to the ideology of the strong nations.

Industrial Revolution was developed rather inside the national borderline, using coal and steel. But the IT Revolution directly influences on global citizen which is human being, on the borderless global space, not confined to nation.

AI will be limitlessly developed by countries or companies, to win over the opponents. The problem is that during this development process, AI will eventually confront with and win over human being.

Confrontation between nations is being transformed to human-technology confrontation. Under the international competitive society, it seems almost impossible to confine the technology within the range of human value system.

But there is a serious reason why we, as human beings,, should make a fundamental social transformation at this point of human history.

...the increasing technical control of the social and natural world could be challenged and perhaps, made to accommodate the needs of repoliticized public realm ([8], p.96).

4. CONCLUSION: FOR THE GLOBAL, HUMAN TECHNOLOGY

Since Lee Sedol was defeated by Alpha Go, there have been great changes in Go world. The highest level of Go play was not fought between professional human Go players but between AI softwares. Therefore AI Go players have become more powerful. What is striking is that now professional human Go players are learning correct moves from AIs.

Human role has been changed to the developer of stronger AI Go players to win over the other AIs.

The liberation of human being from humanoid depends upon how to get rid of the competition between mega organizations like states or big companies and to go from this intemational society to global society. It means the restructuring or the recomposition of human society to respond to technology.

If human being fails to well organize the society, then the society fails to control technology. Therefore if we don't try a fundamental change to humanize the society through right politics, human society will be replaced by humanoid society.

Global society, which is not divided by national sovereignty, revives man to a human being, not confined to a national. Global human technology, not national technology, will overcome the alienation of human being caused by high technology.

At the end of 19th century it was declared that “God is dead” by man which was created by God Himself. It won’t be long before “human is dead” will be declared by silicon humanoid which was created by man, unless human beings build a society on the global consensus.

5. REFERENCES

- [1] Brey, Philip. 2018. The strategic role of technology in a good society, *Technology in society*, Vol.52.
- [2] Cordeiro, José. 2014. The boundaries of human: from humanism to transhumanism, *World Future Review*, Vol.6, No.3.
- [3] Herf, Jefferey. 1984. *Reactionary modernism: technology, culture, and politics in Weimar and the Third Reich*, Cambridge University Press.
- [4] Kid, Ian James. 2012. Oswald Spengler, technology, and human nature, *The European Legacy*, Vol.17, No.1.
- [5] Kim, Joonho . 2010. Formula of happiness and sustainable development, *Personal and spiritual development in the world of cultural diversity*, Vol. 7. ed. by George E. Lasker, The International Institute for Advanced Studies in Systems Research and Cybernetics.
- [6] Kurzweil, Ray . 1999. *The age of spiritual machines*, Penguin Books.
- [7] Kurzweil, Ray. 2005. *The singularity is near: when humans transcend biology*, Viking.
- [8] Sikka, Tina. 2011. Technology, communication, and society: From Heidegger and Habermas to Feenberg, *The Review of Communication*, Vol.11, No.2.
- [9] Winner, Langdon. 1997. “Technologies as forms of life” in *Technology and Values*, ed. Kristin Shrader-Frechette and Laura Westra, Lowman and Littlefield.

Simultaneous Teaching Through Video Call and Providing Mentorship Remotely – Challenges for Laboratory Classes in Higher Education

Dijana Liverić

Polytechnic of Rijeka

Trpimirova 2/V

51000 Rijeka, Croatia

+385959124152 dlicheric@veleri.hr

Teo Brusić

Polytechnic of Rijeka

Trpimirova 2/V

51000 Rijeka, Croatia

+38598338182

teo.brusic@veleri.hr

Žaklina Šupica

Polytechnic of Rijeka

Trpimirova 2/V

51000 Rijeka, Croatia

+385989856510

zsupica@veleri.hr

ABSTRACT

In the context of virtual learning environments, education consists of several factors that make up human resources and technological capabilities. Reduced sharing of non-verbal communication as a result of the physical distance has a significant impact on the educational processes. Laboratory and practical classes with currently available software and hardware solutions at universities make distance learning possible but limited due to the level of automation and Quality of Service (QoS) network parameters impacting the videoconferencing technology as well.

For the purpose of this paper, research was conducted through experimental teaching, in the online environment, within the laboratory exercises in higher education of IT departments. The results of the students who participated as well as the professor who held the tuition will show the advantages and disadvantages of distance learning in higher education institutions. The research results will also demonstrate opportunities to improve IT systems management as a key element of automation. The main research objectives of this paper are to explore how the factors of education should adapt to virtual learning conditions in order to achieve a complete technological process of automation. In addition, the paper aims to discern which cognitive processes and structures should be adjusted for teaching and learning in a virtual environment. Our final aim and conclusion were to highlight how automated processes and technology can be meaningful only when society is ready for its acceptance.

Keywords

Distance Education, Virtual Learning Environments, Computer Science, Higher Education, Automation, IT management systems, Cognitive Processes

1. INTRODUCTION

Over the last decade, video conferences, like everything else, migrated to the Internet. Online video conferences are becoming ever more important in the area of service occupations, whose business processes mainly consist of various forms of communication. Undoubtedly, such a form of real-time communication saves time and money to both providers and service recipients. Thus, for example, it is not necessary to go to the bank to get some information because this is possible to

achieve through a single video call from anywhere. Although, if we move this business communication to the context of education, there is no longer an emphasis on saving time and money. Even though distance education brings a whole range of benefits compared to traditional teaching, it is imperative to define and adapt the methods and methodologies of teaching, testing and assessment to an online educational platform. Existing virtual learning environments already have diverse solutions for knowledge acquisition and testing which are in accordance with educational methodologies, however many of them still use only the written form of communication. The reasons lie primarily in technological achievements. Above all, forthcoming implementation of a faster data transfer technology over the internet, like 5G which will reduce the signal latency, achieve high speeds and a short response time, in stable connection, will provide appropriate standards for educational purposes. This article will describe a practical example of a two-location teaching lesson in which all forms of communication are combined as in classroom teaching.

2. RESEARCH METHODOLOGY

This research sought to find out how complex it is to teach practical work in computer technology through video conferencing, which in this case is used only for communication, and at the same time, by using the remote access tool to demonstrate tasks, as well as accessing any student computer that needs it at a given time, enabling the explanation of a practical task in more detail within the exact application that needs to be used to solve the task.

2.1 Experimental Study

Experimental teaching classes are chosen for the main research methodology. For the purpose of this research, exercises were held within the Computer Networks Course in an online environment. The professor holding the lecture was at the University of Lisbon and students were at the Polytechnic of Rijeka. Basic hardware requirements for this experiment in addition to the computer included: speakers, microphone, camera and the router for Internet access. Internet speed was 100Mbps in both institutions. The software solutions used for this experiment were the existing free tools: Chrome extension which enables remote computer control and Skype for video call. In addition to

software for the online environment, software for learning content of the course Computer Networks was also used. This included: Oracle VM VirtualBox and GNS3. For the purpose of this research, we also considered the presentations of projects held by the students through the video conference. Hardware specifications were the same as those mentioned above but chosen software was different. Since in this part of the experiment students were required to present their work only the video conferencing software was needed. At the Moodle education platform, a webinar plugin was used for this purpose. The experimental studies were held on several occasions during 2018.

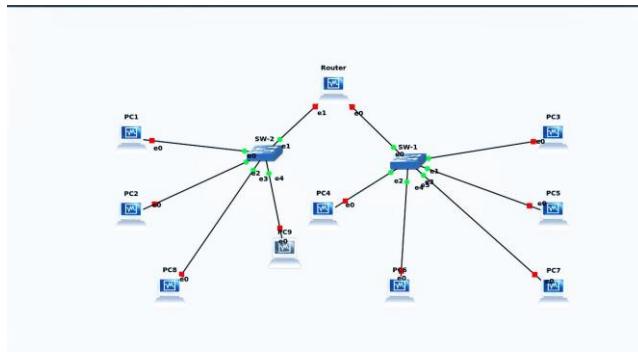


Figure 1: Network topology in GNS3 environment

2.2 Survey

In addition to experimental classes, other research methodology included a survey that explores user experience, and in this case the student's perception of experimental teaching and learning.

3. ONLINE TEACHING PROCESS

3.1 Video Collaboration

Video collaborations have its technical progress which couldn't move forward without the user's influence. Considering this, we can state that when Skype became a worldwide accepted tool, video calling became the usual way of communication. Meanwhile, the progress of video collaboration has evolved into browser-based platforms for video conferencing. According to its technical specifications and browser-to-browser environment, Moodle's webinar platform offers a virtual classroom experience similar to the one described above. The reason for testing the two different platforms were the technical features, like sound quality, video quality and delays in data transmission. Although a lot of security and privacy is invested in its development process, the user's experience is still not equal to the in-person communication experience. However, given these two experimental studies, the fact that the students were physically located in the classroom of an institution could certainly have influenced the teaching experience through video calling.

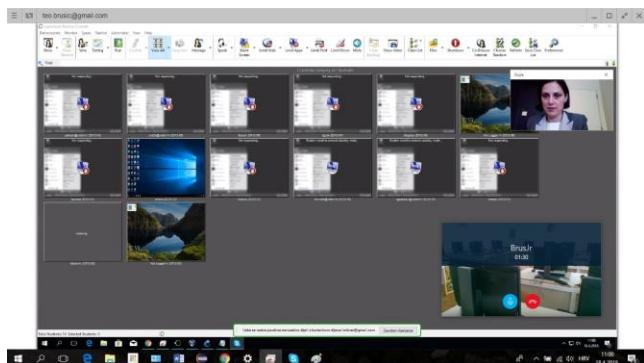


Figure 2: LanSchool in practical training course

3.2 Remote Desktop Services

Practical work from computer network courses refers to the creation of a network topology consisting of virtual computers, virtual switches and virtual routers created within the GNS3 (Graphical Network Simulator 3) application. When emulating a topology, GNS3 emulates the hardware of a device and you run actual images on the virtual device. When covering the specific tasks that refer to GNS3 performance and capabilities, students usually require assistance to successfully grasp these concepts. With this in consideration, it was necessary to be able to access the students' computers throughout the classroom, during this segment of the class. The most effective way to achieve this was to connect online to the teacher's computer and then access the student computers on the local network. In other words, to manage teacher's computer remotely using Chrome remote desktop. Furthermore, classroom management software - LanSchool was used for faster and easier management in local network of computers throughout the classroom. Therefore, remote access to student computers is created through the Virtual Local Area Network (VLAN) and Local Area Network (LAN).

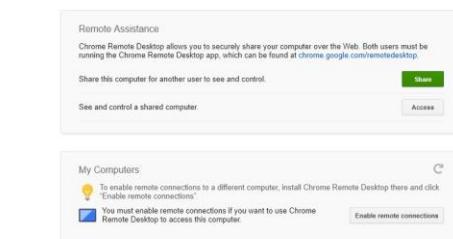


Figure 3: Chrome Remote Desktop

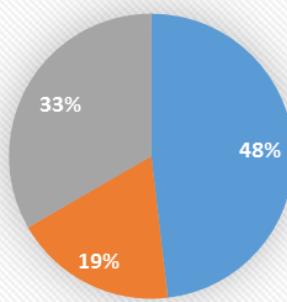
3.3 Blended Learning

The term blended learning is generally applied to the practice of using both online and in-person learning experiences when teaching students. In a blended-learning course, for example, students might attend a class taught by a teacher in a traditional classroom setting, while also independently completing online components of the course outside of the classroom [1]. Online learning management systems like the Moodle platform provide distance learning through various educational methods. Those methods can mimic actual classrooms, with required attendance at specific times, can be self-paced, or blended, and use a variety of tools to engage students and support learning by making the most flexible learning environment possible. Lectures place students in a passive role. An example of this is hybrid learning, where connection between online and in-class instruction increase students' activity and brings flexibility into the process, contributing to different verticals of education. However, IT students, in most cases, handle content where the environment requires special software tools to work. Moreover, some professors are increasingly introducing, for example, the well-known GitHub platform for joint project work. With all of the above in mind, the online learning environment for IT technologies is becoming an area in need of standardization.

4. RESULTS OF THE RESEARCH

The purpose of this research was to explore how learning through practical examples in the context of IT technology affects the learning process itself. Can online and in-class instruction be the same in terms of transferring knowledge and skills? To what extent the professor's physical absence affects the classroom atmosphere? The first experiment involved students from the field of Information Science and Technology who were alone in the classroom, and the professor was present by video conferencing and they demonstrated the creation of a network topology using virtual machines. Following the demonstration of the assignment, which students followed through the transmission (via projector), they were given a similar assignment. For such a task, students need an average of 15-20 minutes. 45% of students needed help in completing the task or had some other problems with software in use. In this case, the professor must be ready to communicate with all students in the classroom by video conference which has been put on the classroom's wall through projector and simultaneously manage student's computers remotely to assist them. The second experiment involved the students from the field of Information Science and Technology and students from the field of Telematics. In this experiment, which took place in four different terms, students were tasked with presenting their project through a webinar, from their home. The presentation of Information Technology students consisted of a practical presentation of system implementation within virtual network topology using virtual machines for various needs, such as creating a network topology configuration using the DHCP (Dynamic Host Configuration Protocol) server, creating a DNS server or creating web server within a network topology and so on. Students of Telematics have presented their applications mainly in the area of IoT (Internet of Things), which refers to an explanation of their own source-code. For the examples above, students were required to organize a webinar by using several software tools to present their work to the audience. In addition, it was necessary to enable video communication with the professor and other students in the classroom, in order to open a discussion on the topic presented. The entire survey was attended by 132 students. 58% of students were male, 42% female. Regarding age, 79% of respondents belong to the age group of 18-25 years while the other 31% belong to the group older than 25 years. After the whole research, the students have solved a questionnaire that examines their perception of this method of learning and teaching. For the first statement in the survey, as the fundamental statement of this research, "Online education should be introduced as a support to traditional teaching", 48% of students responded with the affirmative.

Online education should be introduced as a support to traditional teaching



■ YES ■ NO ■ NOT SURE

Figure 4: Online learning as part of the overall education

Almost a third of students are unsure if they want to make the virtual environment part of their education. However, despite the above, 78% of students responded with the negative to the statement: "Video conferencing for virtual learning makes me feel uncomfortable."

Video conferencing for virtual learning makes me feel uncomfortable

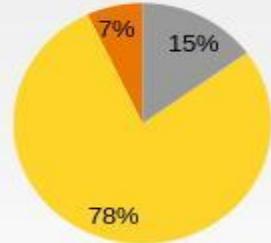


Figure 5: Videoconferencing - the impact of psychological factors

One reason for these results can certainly be deduced from the following statement: "I think that this kind of work has limited my options for presentation" where 46% of respondents stated they are not sure, 15% students responded affirmative and only 38% believe that they could have their own future project presentations without any problem in an online environment. Since the online environment is part of the course content, as well as the learning outcomes, the following statement was also included in the questionnaire: "This type of work within the Computer Network courses contributes to a better understanding of the content of the course". The results are the following: Strongly disagree – 4%, Disagree – 7%, Neither agree nor disagree – 67%, Agree – 22%, Strongly agree – 0. The answers to this claim support the fact that students do not see, to a greater extent, a link to the course. The reasons may be different, from the fact that it is completely natural for present generations to communicate in this way without considering the history of network architecture to the ignorance of learning outcomes and content of course in its entirety.

5. IMPLICATIONS/LIMITATIONS

The process of teaching in the field of computer technology is mainly carried out using electronic devices. Although not disproving the importance of theoretical knowledge, and especially in the context of purposeful understanding of designing applications or network topologies, practical results in computer technologies are what makes some business more or less successful. Although the online environment has many advantages, in the context of practical learning and teaching, it also has some disadvantages like performance limits that significantly affect the performance of the system software or programming software.

5.1 Bandwidth and Quality of Service (QoS)

The definition of QoS dimensions has received a lot of attention during recent years, mostly in the networking and the middleware communities, but few studies deal with end-to-end application QoS requirements or propose dimension taxonomies. Among the others, an integrated framework is also proposed characterizing the production, transmission and consumption of data through a single media [2]. The variety of services is especially noticeable in network congestion cases and results in different levels of network performance for individual packets. Some of the basic parameters defining the quality of data transfer such as packet loss, bit rate, throughput, transmission delay, availability, jitter, etc. are key factors that affect the subject of this research.

Furthermore, bandwidth management, incorporating an end-to-end Quality of Service (QoS) architecture, have numerous challenges when faced with traditional on-premise solutions, that can be overcome by moving to the cloud and become the responsibility of the service provider.

5.2 Psychological Impact

In addition to the technical background above, the online teaching process is also influenced by participants' psychological factors during communication. Non-verbal information is an important component of the conversation. By definition, therefore, a message may be a word, a group of words, a complete sentence, or several sentences. Since source and seeker could talk at the same time in the voice and communication-rich modes, messages could overlap [3]. In such situations, non-verbal communication can significantly contribute to overcome this.

5.2.1 Lack of Body Language

In the communication-rich mode, subjects could, and did, use non-verbal forms of communication. They gestured, nodded, grimaced, and used other expressive movements of the body [3]. The ability to read the body language of other participants, which makes it possible to recognize you need to change direction during the meeting, in an online environment is possible to a much lesser extent.

5.2.2 Lack of Eye Contact

Eye contact is another benefit of non-verbal communication, the disadvantage of which significantly diminishes the quality of conversation during videoconferencing. To preserve eye contact a user would need to look simultaneously at the monitor and into the camera. However, the camera and monitor cannot be physically in the same location. One solution is to place a half-mirror oriented 45 degrees to the gaze direction [4].

6. CONCLUSION

Today's technologies provide a whole spectrum of cloud-based development including integrated programming environments, code repositories, software modeling, documentation tools and application management. The existing cloud development ecosystem based on a wide number of characteristics allow remote teaching and learning. On the other hand, there are demands on the part of educational institutions that face barriers and seek change in access to education. All this requires a completely

different approach to education, grading and certainly a special virtual environment.

If we consider that the quality improvement and productivity optimization are the keys to success in any industry, this might be the case when it comes to the area of higher education for software development and progress of development of information technologies in its entirety.

7. REFERENCES

- [1] *Blended learning*, The Glossary of Education Reform, (The Great Schools Partnership - the lead coordinator of the New England Secondary School Consortium and League of Innovative Schools) <https://www.edglossary.org/blended-learning/>.
- [2] C. Cappiello, B. Pernici, P. Plebani. *Quality-agnostic or quality-aware semantic service descriptions?* (Department of Electronics and Information - Politecnico di Milano Via Ponzi 34/5 - I-20133 - Milano – Italy) <https://www.w3.org/2005/04/FSWS/Submissions/42/QoSDescription.htm>.
- [3] Alphonse Chapanis, Robert N. Parrish, Robert B. Ochsman, Gerald D. Weeks. 1977. *Studies in Interactive Communication: II. The Effects of Four Communication Modes on the Linguistic Performance of Teams during Cooperative Problem Solving*. DOI= <https://doi.org/10.1177/001872087701900201>.
- [4] Maximilian Ott , John P. Lewis , Ingemar Cox. 1993, *Teleconferencing Eye Contact Using A Virtual Camera*, (INTERACT '93 and CHI '93 Conference Companion on Human Factors in Computing Systems), ISBN:0-89791-574-7.

The Approach of Human Ecology in Digital Society

Prof. Rita Micarelli

IIAS International Institute for
Advanced Studies in System
Research and Cybernetics
Firenze, Italy via Mattioli, 43,
50139
+39 335 8352647
rita.mica@gmail.com

Prof. Giorgio Pizziolo

IIAS International Institute for
Advanced Studies in System
Research and Cybernetics
Firenze, Italy via Mattioli, 43,
50139
+39 333 4743514
pizzologiorgio@gmail.com

ABSTRACT

In this paper we present an epistemological framework on a case of Democracy of Learning developed through the promotion of cognitive processes addressed through Human Ecology's criteria.

Here we want to develop the theme of Cognitive Democracy and social Learning in contemporary society. This article deals with the themes of Human Ecology and Action Research as fundamental elements of new possible lifestyles practicable in harmony with the Evolution of Mind and Nature. We present a case of possible Action Research to be developed within an ecosystem Man / Society / Environment of the Apuan / Apennine Mountain in northern Tuscany "*Participatory learning process in the context of the Mediterranean mountain called Civic Mountain University*" (Giorgio Pizziolo and Rita Micarelli).

Key words

Human Ecology, Learning processes, Research-Action Human Societies, Digital Technologies, Informational/real world

1. INTRODUCTION

In the contemporary condition all the human societies of the evolving world are experiencing a paradoxical condition in which the *societies of the rich world*, having plundered their own living environments, *impoverished themselves* creating at the same time deep crises in all other human, social and environmental conditions. Really all the ternary systems M/S/E have been equally impoverished and deprived of their original autonomies while all the people, societies and living environments of our Planet, live in the illusion of independence, autonomy and civil rights, as *citizens of the world* actually dominated by the *technocratic digital powers* of the globalized world.

At the same time the natural living environments are transformed into technologized and controllable contexts, while human persons and societies live in illusion of conquering independence, autonomy and civil rights, as citizens of the world in reality dominated by the globalized technocratic digital powers.

The coexistence of different human societies and the coexistence of each of them with their own living environments are both compromised in the absence of *appropriate approaches and adequate environmental and social practices to cope with this new contemporary condition*.

The complex problems encountered in this unprecedented situation cannot be solved in the traditional terms of disciplinary

separation (scientific, economic, political, cultural, etc.). They must be assumed in the wider dimension of Human Ecology that includes the living world in its entirety and in its dynamic evolution natural, cultural, technological and digital. In it all the people, the societies to which they belong and the living environments to which human societies refer, interact with each other, each in full autonomy, and all together as a ternary ecosystem M / S / E.

On this basis a *multiplicity of learning processes* can be stimulated and developed for the creation of a series of dynamic evolutionary Equilibria, achieved through learning processes and progressive experiences, which can lead people and societies to a consequent political maturity towards a *cognitive democracy*.

The *ambits* in which people, societies and living environments interact become *fields of events* and of relational dynamics in which knowledge is *produced, experienced and experimentally verified in its becoming*.

2. HUMAN KNOWLEDGE IN THE COMPLEXITY OF THE LIVING PLANET

From the crises that pervaded western culture in the last century a new epistemology was born and changed our approach to the world. Science, art and philosophy have progressively overcome the crises of the classical sciences to interpret the phenomena of nature in their entirety and in their mutual relations, towards a renewed style of knowledge of the world.

Many scientists, artists and philosophers have been involved in this epistemological revolution, producing their scientific / philosophical thinking and their artistic masterpieces working in mutual resonance.¹

The world is all that happens [and] ... All the things that happen [...] are ...] Events!

The first proposition of *Tractatus Logico Philosophicus* (L. Wittgenstein, 1922) [2] has been verified by contemporary scientists (in particular astrophysicists) who explored the secrets of the Universe recognizing in it a stormy ocean, where waves, resonances and particles play chaotically, giving rise to stationary

¹ As pioneers of these innovative approaches, H. Poincaré, P. Klee, W. Benjamin, L. Wittgenstein, A. Schoenberg, A. Webern, A. Einstein and many others explored the complexity of the evolving world, developing and propagating the epistemology of the contemporary age

States of Matter / Energy or to unexpected Events in which the macro realities of Space and the micro realities of the Biological World are equally and continuously involved.

The recent acquisitions of contemporary science suggest a new vision of the living world that can now be recognized as an indissoluble interweaving of fields in which networks of relationships, resonant waves and living entities meet and relate to each other in the circularity of evolutionary dynamics that bring it towards ever increasing complexity.

In this epistemological context the ecological approach developed, initially addressed to Nature, later extended to humans and their societies overcoming the reductionist separation between Humanity and Nature. All this encouraged a broader ecological vision recognising all living entities as *equal* components of hyper-complex Ecosystems Man / Society / Environment.²

In this condition all the evolutionary phenomena of the planet could be understood as intrinsic to the ternary system (M / S / E), in which natural and human dynamics interact enriching each other, exchanging Matter, Energy and Information through their ambits of contact (ecotones). These interactions are joined by new "artificial" components progressively produced by men (such as art, science, classic and digital technologies, artificial intelligence, etc.) that could stimulate, accelerate many spontaneous processes of nature, transforming and creating unexpected conditions and new life environments.

2.1 The UNESCO Project Man and Biosphere (MAB)

A relational approach to ternary ecosystems has been officially promoted by UNESCO as M.A.B. Project (60 s, XX Century) which has been propagated and strongly emphasised as innovative approach, but has been scarcely practice at the concrete levels of reality.

2.2 The Approach of Human Ecology

Human Ecology can still be considered in all aspects as an innovative *suitable approach* to our contemporary jeopardised situations and planetary crises.

In these dynamics also the technological and digital components are directly involved that, on their turn, can evolve as coherent parts of evolutionary processes.

Then we can conceive the ternary ecosystems as hyper complex structures endowed with their own ecotones (ambits where the natural exchanges matter/ energy/information among the different ecosystems are encouraged and intensified) and further made more complex by new kind of Ecotones

These new dynamics established among the original ecosystem (human and environmental) and among the new ecotones in mutual interaction give rise to unexpected configurations of natural/artificial components mutually combined as Human/Social/Environmental *Ecotones of Ecotones*.

In this view we can assume the Human Ecology as a Field on which the *Evolutionary Play of Knowledge and Experience* can be practiced.

² These hyper complex systems are homologous to the ones prophesied by G. Bateson in *Mind and Nature* (1980s, 20th century) [1].

This is a Play³ that we can all experience together, in our *Life Environments* the same environments that we have co-created and that we are continuously transforming.

A *Play* which does not obey preconceived external rules since it is continually unexpectedly renewed through the interactions Man/Society/Environment. The mental abstractions, intrinsic to Individuals and Societies as Art, Science, Communication, Desire and Participation take part in this *Play*, that could more properly understood the *Play of Mind and Nature*⁴

2.3 The Contemporary Crises Hit the Complexity of Living Systems

The crises of the western world have renewed the epistemology but have also stimulated technological, economic and digital growth in contradiction to the epistemological principles on which contemporary ecology is founded. The contemporary world, its evolution and its ecological re-composition are now risking the destruction of their complexity. . The relationships, their circularity and their interaction between all the components of ecosystems are impeded, dominated and provoked by the alterations of the components of ternary ecosystems and of Human Ecology itself.

Nature is altered by the feed-backs of Climate crises, Humanity is deformed by digital/technological changes, and Learning has lost its peculiar evolutionary character in favour of a linear trend.

Despite these crises Nature and Humanity have not been annihilated and still live. Among the fragments and interstices of this contemporary world new vital manifestations are constantly emerging and Human Ecology can still encourage their development.

In coherence with the contemporary science, now we can recognize ourselves as active parts of the world, as responsible members of the human societies to which we belong and as *citizens of nature in evolution* of our planet.

2.4 The Ecological Reconstruction for a new Citizenship of contemporary world

In such a perspective we can reconstruct ourselves, the societies to which we belong and our living environments as a wholeness by following the approach of Human Ecology and developing learning and relational structures, that we can create *ex novo*, building unexpected *Ecotones of Ecotones*

Like the Ecotones in nature, that work as relational ambit where different ecosystems meet, exchange and learn in mutual interactive relationships, these new *Ecotones of Ecotones* created among human, natural and social systems, can develop again as very experiential *Ambits of Learning*, as the name of this *Cognitonics Conference* suggests.

On these conceptual criteria a *multiplicity of learning processes* can be stimulated and developed for the creation of a series of dynamic evolutionary Stationary Equilibria, achieved throughout progressive involving experiences, which can lead People and Societies to a consequent political maturity towards multiple opportunities of *Cognitive Democracy*.

³ G. Bateson, 1960's

⁴ As G.Bateson suggested in his homonymous book

All the *ambits* in which people, societies and living environments interact can become *fields of events and relational dynamics*, in which a lot of *adequate knowledge's* processes are *produced, experienced and experimentally verified in their becoming*.

2.5 New Ecosystems, new Ecotones

On the bases above described a number of new Ecotones (*Eco-Cognitones*) can be created and developed, in coherence with the principles and prerogatives of Human Ecology.

The *Eco-Cognitones* can be structured and addressed as participatory learning processes towards Environmental Transformation, Territorial Crises, self-manageable Life Environments, Micro economies, Solidarity Action-Researches, etc. The configuration of such kinds of *Eco-Cognitones* needs adequate instruments for a suitable and *interactive elaboration, description and self-verification* that can be *only* experientially and chorally developed as mutual friendly learning, spontaneous representations, social perception, which remains intrinsic to all learning processes.

Among our recent experiences and proposals we illustrate the Civic University of Mountain now in course of realization in Tuscany –North Apennine- Apuan Alps.



Figure 1: The Pania Forata Mountain in Apuan Alps, Tuscany, photographer A.Lunardi

3. THE CIVIC UNIVERSITY OF MOUNTAIN (CUM)

This Civic University has been conceived as a Structure of experiential of Action/Research as a very **Eco-tone of Learning**, able to interact with the ternary Human Ecology Systems, supplying multiple interactive harbours to exchange, renewing and producing unexpected mutual Relationships.

In this concrete case the University is a structure of research dedicated to experimentation and dissemination of the contemporary problems, and of the general and local conditions of the North Apennine, Apuan Alps' Mountain, Valleys and Rivers in Tuscany.

3.1 The Role of Human Ecology

It is conducted in terms of participatory, active and civic knowledge, by the interested populations, researchers and promoters of the *meaning and value* of each Individual, of the Places and in general of the Mountain Common Good. All these

Common Values are promoted in terms of Relational Ecological procedure, close to the contemporary issues of the world, and the climate and environmental crisis, and the socio-economic problems of mountain populations, youth in particular.

In the specific case we intend to deal with that particular complex of Mountain consisting of the northern Apennine / Apuan Alps node, and of the valleys and rivers that are involved, up to the Tyrrhenian and Mediterranean seas.

It is a very varied complex, with phenomena differentiated within it, but also highly homogeneous in terms of geographical location, and the complex of environmental, historical and human relations that characterize it.

3.2 On which contexts the CUM operates

They range from areas that are still highly natural, to industrial areas that require a profound ecological re-conversion with respect to their improper uses in progress, involving both abandoned areas and intensely inhabited areas, with piedmont Cities, and abandoned industrialized areas, and the wider Alpine subsystems.

Precisely their extraordinary naturalistic richness and complexity, and at the same time their problematic and contradictory uses, seem to require the attention of a structure such as the CUM capable of deepening both the great values and the great local problems but also of providing a relational Ecosystemic interpretation to overcome closures and limitations, nowadays widespread, and look for more organic and systemic ESITI outcomes, precisely by referring to the Research / Action practices of Human Ecology (ternary ecosystem Man / Society / Environment, - Unesco MAB project)

3.3 How the CUM works

With reference to this approach, the following Research and Action guidelines could be STRUCTURED

3.3.1- *The research on the Relational Ecosystem "The Mountains of the Sea".*

This Ecosystem is *evaluated* in the different Apennine and Apuan Subsystems and in their Ecosystemic complexity, *considered* in their relationship between Man / Society / Environment- going to find, nature, history and complementary economies, starting from the positive cases in progress, in particular the Community Cooperatives, and the residual Civic Aggregations, up to the unexpressed and latent potentialities of the Nature and the Communities

3.4 The Deepening of the Specific MAB Issues of the Great Ecosystem.

“Mountains of the Sea”, in its essence as an Relational Environment between Europe and the Mediterranean Sea, between continental Italy and Mediterranean peninsular Italy, as a land and hinge between Flows and Relationships, in history and in the contemporary condition, almost an Eco-tonal System, between wider Continental Systems and Mediterranean Sea. These elements that underlie the MAB Recognition of Succiso’s Community experience and that were the basis of the formation of the Apuan Alps Park must become also the basis for the future developments of the area for an ecological evolution of those

territories and of those populations, also through Research-Actions hypothesised for this context as avant-garde experiences⁵ Thus a general territorial and ecological strategy could be developed to move from a phase of Resilience to that of Protagonism, beyond the marginal role of current economies and official Policies.

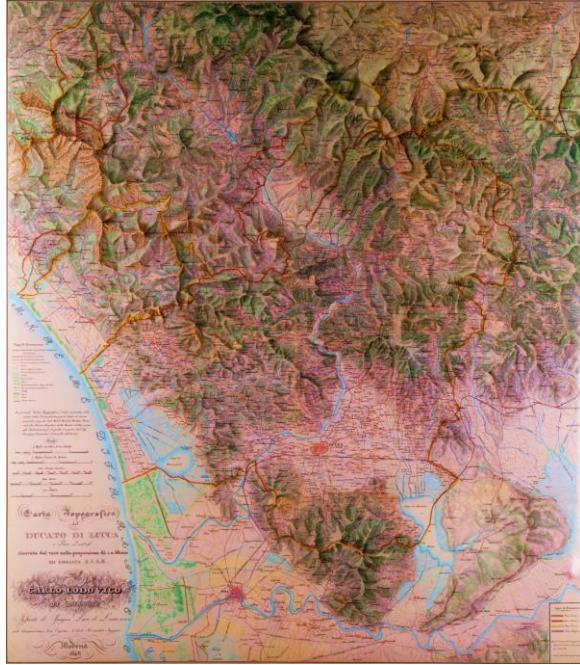


Figure 2: The ecosystem of Apuan Alps, Coastal Area on Tyrrhenian Sea, North Tuscany, represented by a Map in the year 1846

3.5 The contribution of CUM to Civil Society.

It is to play a key role of self-promoted Observatory of the great climatic, environmental transformations developed at the level of Natural/ Environmental/ Human Relationships and its mutations, observed throughout the great flows of change, and also from the Core of one of the vortexes of transformations that could unexpectedly appear. This theme - apparently more abstract and distant is instead incumbent and of great actuality and – could instead be directly observed from the Observatory, the chosen Place "at the margins of chaos".

3.6- The working method

The Laboratory Projects.

On the basis of the results of the three research / action themes described above, the CUM will be able to promote the following Action Research Steps

- Ecological Projects in the form of a *Participatory Laboratory* to activate, according to the current Italian Laws,
- Acknowledgment of the existent and potential Ecosystems
- New economic and environmental Relations between widest Landscape Ecosystems, giving rise to Eco-Services whose profits must be managed and enjoyed by the Mountain Communities..
- Formation of new *Eco Cognitonics (Learning Structures)*



Figure 3: New Communities at work. Photo by R. Micarelli

New Communities will be Guarantors of the Eco Services above mentioned, of their ecological relevance and evolutionary maintenance.

The Communities will be recognized as Managers of such Eco-Services in terms of *Common Civic Goods*. All this could be concretised through open Procedures shared and ratified by all the involved subjects.

In this way it could be organized self-produced and self-funded Programs and Projects for the renaissance and promotion of the Mountain and its Populations, in all their Relational Values in terms of Human Ecology.

The Research Actions carried out on the themes highlighted are proposed by Giorgio Pizziolo and Rita Micarelli with the European Association **GRASP the future** (Groups of Research and Action for Solidarity and Participation , www.graspthefuture.eu)

4 . CONCLUSIONS

The **Civic Mountain University** is open to the participation of all those who share its guidelines and operating procedures and are committed to developing its activities in the areas of the Apuan Mountain / Northern Apennines.



5. ACKNOWLEDGMENTS

We renew our gratitude to Vladimir Fomichov and Olga Fomichova who, with the foundation of Cognitonics, have stimulated an extraordinary epistemological debate on the themes of learning and the crises of contemporary computerized technology companies.

6. REFERENCES

- [1] Bateson, G. 1980. *Mind and Nature*. Italian edition, Milano.,
- [2] Wittgenstei, L. 1921. *Tractatus Logico Philosophicus* .

⁵ See the Presentations of *City/Landscape/Versilian.River* and various *Landscape Contracts* on www.graspthefuture.eu

The Conceptual Architecture of Intentional Human Action

Tarkko Oksala

The International Institute for Advanced Studies in Systems Research and Cybernetics (IIAS)

Topeliuksenkatu 3aA6

FI-00260 Helsinki 26

+358 - 445 444 873

Tarkko.Oksala@gmail.com

ABSTRACT

The aim of this paper is to present key definitions of intentional action fulfilled with respect to the interests of other people. First, intentional ethics, moral and legislation are considered. Secondly intentional teleology, performance and production are discussed. This all is made in order to improve the dialogue between theory and practice in conscious action. Examples are mainly drawn from architecture, which has served as a good reference in action theory.

Keywords

Architecture, action, cognition, cognitronics, collective, conflict resolution, individual, intention, thinking and acting in terms of public good.

1. INTRODUCTION

People influence the world by means of intentional actions. Obviously, everyone dreams about harmonic existence in modern knowledge society (KS), or smart society. Cognitronics, or the science about the human being in the digital world, is a relatively new scientific discipline. It was formally born in the first decade of the XXIst century. Its prenatal stage of development covered the 1990s. The principal objective of cognitronics is to elaborate systemic solutions for compensating the negative implications of the broad use of computers and internet for the personality and society. In particular, the aim is to create cognitive-cultural preconditions of the harmonic development of the personality in KS and for ensuring the successful development of national cultures and national languages [5, 7].

A precondition of harmonic existence of a person in KS is acting with respect to interests of other people. That is why cognitronics pays a special attention to developing educational methods and to

motivating the learners to think and act in terms of public goods [6].

The paper analyses the conceptual architecture of intentional human action fulfilled with respect to the interests of other people, even future generations.

Intentionality or its high degree is often considered as sign of human action (Marx/ [29]). In classical theory intentionality is discussed under the idea of teleology (> Aristotle) and practical conduct related to it. We extend here this idea and postulate human action to be based on ethics and related ideas behind. We have problems of intentional action, like:

Intentional ethics, moral, legislation

Intentional teleology, performance, product (-ion)

This idea is natural because Aristotle presents many good examples concerning human action in his Nikomakhian ethics [2]. After him also Cicero [3] underlines the human directionality toward future world.

In modern philosophy intentionality has many interpretations starting from directedness toward the world or being a key aspect in the possible world semantics (Brentano, Husserl > [10]). In analytical philosophy the turn from explanation to understanding of human action via intentions was a milestone (> Anscombe, von Wright > [15]).

Architecture has served since far as archetype of intentional action [2, 17, 29, 20, 21]. The trans-modern view here means that we consider the problem in question noticing its roots besides the recent discussion. Methodologically we present a conceptual, systemic analysis of human action and thinking [18].

2. BACKGROUND IN INTENTIONAL ACTION

2.1 Intentional ethics

Ethics has as its main intention to give rules for better living in the world [24]. It is trough-out intentional in the sense that ethics gives the main goals for (future) life. We have problems [22]:

Intentional virtues, idols, avoiding of sin

Intentional happiness (utility), duty, avoiding of suffering

In antique ethical virtues gave the model of right action. Among them wisdom is the key tool to control goals setting. In collective level symbols of good life were enlarged to contain idols. It is

Copyright©2019 by authors, all rights reserved. Authors agree that this article remains permanently open access under the terms of the Creative Commons Attribution License 4.0 International License

evident that for example health ($>$ salus) is an important factor in happiness. Health is a very practical intent in life. Autonomous ethics has an alternative in revealed ethics and humans consider themselves as responsible to avoid sin. This attitude was the main intent propagated in medieval Christian life.

In utilitarianism the best action produces maximal happiness for the greatest amount of emotional beings [11, 14]. This is clearly a meta-intent to be interpreted in various situations of life. The counter part of utilitarianism in modern world was full-filling of duty (Kant). Duty typically forms an umbrella for some intent-collective. The common point of all ethics can be seen in Panethics in the sense that humans have to avoid suffering.

We have shown that the basic forms of ethical attitudes are intentional or better said meta-intentional. Then forms of ethics mentioned are creations of human cognition, but also potentially related to religious beliefs.

2.2 Intentional Moral

The intent of moral is to guide the application of ethics in our life-way. We have problems:

Intentional task, situation, way

Intentional interaction, attitude, emotion state

In our action and especially in our duties we have clear task, which is some concrete intent “par excellance” [17]. In all action it is important to note the situation, it is our relation or position to the world toward we are Brentano intended [15]. Way of action is an allegory taken from traffic and movement and it is evident that we then have in our mind the idea of goal.

Personal intents are important, but clever persons understand that most of our goals can be realized in groups and co-operation or collaboration [1]. Our intent may then be to negotiate with others about goal setting. From social study we know, how hard it is to find out common collective goals in principle [28]. Intentions are strongly attitude laden and the will is decisive correlate for intent. Other attitudes are of course influencing and the second key idea is emotion ($>$ conscience).

In the study of basic actions as movements of body the dimension of moral is often forgotten and vice versa, but there are of course exceptions [25].

2.3 Intentional Legality

Reasonable intentions are limited by laws, but some of us fight even against laws in order to find out better ones. In normal case reasonable persons obey the laws of nature, but even they can be improved in theory. We have problems:

Intention/ natural, logical and Gestalt, societal laws

Intention/ obligatory, plausible, forbidden cases

As said natural laws tell us what is necessary to obey in practice. Logical laws express, what is necessary in cognitive sense. We perceive in certain culture things under relatively similar Gestalt-laws, but they are developing in the long run. Art can influence also revolutionary new ways to see ($>$ Le Corbusier). The most typical way of collective guidance of personal action is expressed in societal laws. In some societies the legislation may fail (The Frescoes of Sienna/ [4]) and in this sense civil courage can be considered as a virtue (see above).

The contradictions of collective legal intentions and personal ones can be discussed in Deontology as a subspecies of modal theories

[30], [9]. The firmness of intention is expressed with the idea of obligatory. Acceptance is considered in a qualitative sense under the choice between yes or no. In fact, a practical agent considers also what is more preferable than something else (obligatory situation). In order to save lives, it is allowed to break some laws like traffic rules. In this sense what is allowed and forbidden may be considered as relative. The general respect of law is however important as a maxim (Categorical imperative).

3. CONCRETIZATION OF INTENTIONAL ACTION

3.1 Intentional Teleology

We have discussed rule-atmosphere behind intentional human action. This may be very wide area and forgotten as too evident phenomenon in discussion and even in education. Now we are able to continue and discuss the intentionality of normal action. It is based on goal setting. In advanced practice we have intentional key goal-families like:

Intentional “epistemics”, aesthetics, ethics

Intentional “ecologics”, ergonomics, economics

As Cicero [3] has told the passion to see truth is typical for man. Whether it is possible, is another problem. Truth is thus a goal, independent of achieving it ($>$ truthfulness). For man it is evidently clear that we consider aesthetics more – valuable than lack of it ($>$ sensual death). In certain sense aesthetics may be seen more fundamental than epistemology [24]. After that it is possible to prefer pleasure and avoid suffering. In setting intentions, it is often important to sacrifice something in order to get something more valuable. Such contradictions are typical challenges in ethical life. The intentionality of ethics is discussed already above.

To save (own) life is by nature the key principle of beings. Then contradictions of groups and species in the competition of life should be solved in ethically sustainable manner. Humans have great responsibility in respect of the destiny of Earth and biodiversity [13]. Sometimes ecology has been under-estimated ($>$ industrialism). Today humans have awaked, which is good, but we have to avoid vulgar proposals. Humans have the right to develop ergonomics in the sense of creating facilities for more honest economy. Economy is often seen too much as the question of efficiency wrongly understood. If we see the efficiency depending on both quality and saving of resources, we are mainly on right road. The key idea of economy is that economic agent has the freedom of activity if he/ she does not violate the rights of others (A. Chydenius). Then it may be considered also the rights of animals, plants and microbes somehow.

3.2 Intentional Performance

In action there may be separated clear goal setting and soft goal setting during production as typical for example in creative action ($>$ improvisation) [16]. There are also differences in knowledge-based goal setting and the tacit way [26]. In this sense the dynamic production of art serves as good model also for the performance of action in general. We have cases (Ingarden/ [19]):

Intentional idea, notation, concretization (of action)

Intentional realization, materialization, actualization (of action)

In intentional action we need a guiding idea as in art. A normal agent can utilize notations as inspired by art ($>$ note book). A lot

of action is concretized in the normal sense of the word, when we gather concrete tools to facilitate the act.

Intentional realization of action refers to the logical conduct plan in order to realize the act [27]. Acts are materialized in body movement, when the body is considered as matter. This is of course very limited view but possible as abstraction (> Behaviorism). The realization in human reality means that we actualize action in mind and are able to give cognitive explanations for it (> Cognitronics).

3.3 Intentional Product (-ion)

The idea of producing actions of living persons is related to complex reality of human body and mind. In most cases people abstract and simplify the production of material things and artifacts. In systems methodology there has been developed formal tools of production of all kinds of expressions. We have problems (Chomsky > [20]):

Intentional start symbol, non-terminal, terminal

Intentional meta-rule, production rule, outcome

In order to make abstracted intentional acts of acting or producing we need some knowledge about when and how to start. This sub-goal is typically symbolized by start symbol like base-stony in building. A huge amount of Gestalt-aid is needed in production. Some of them can never be seen directly in the product and they are called non-terminals. The other part of symbolic tools is called terminal.

A standard agent often does not know exactly his/ her meta-rules in action and this part is introduced from the sub-conscious. One other explanation is that a collective can own this wisdom, but a single agent can't in a clear way. In intentional action we suppose that the agent sets some production rules in order to get intended products [16]. This refers to the right performance as expected for example in sport and techniques. In practice the outcomes are acceptable, wrong or simply emergently new ones to be accepted after special consideration.

4. DISCUSSION A: THE WORLD OF INTENTION

One basic meaning of intention is to be directed toward world. Then the idea of possible worlds [10] becomes close, because we do not know exactly our targets. Under collective knowledge it is possible to speak about:

Physical, biological, psychological world

Sociological, semiological, anthropological world

Physical and biological worlds as targets of science are supposed to exist independent of the existence of man. In certain sense even they are man-related [8]. The study of intentions starts from biology but culminates in psychology.

The development of human mind is bound to the surrounding society and the theory of intention has to be enlarged to collective dimensions [28]. Intentions are language- and thus intension related as well [10]. Finally, highly developed goals and value systems are typical for man especially if we expect a linguistic representation of them.

Today humans have access to knowledge via Internet and the world may be related with knowledge listed above. The world-concepts then vary a lot between individuals and collectives and

the idea of world is both intensional and intentional also in this sense [10].

Intentional action in planning aims to improve the world and search not only certain possible world but in practice we search the best possible world (> Plato, Bonaventura, Leibniz).

5. DISCUSSION B: INTENTIONAL ACTION AND THERAPY

In order to improve our action and via it our world we have to know what intentional action is in its directedness toward the world. Secondly, it is essential to know what therapy is. Intentional Action Therapy consists of [12], [23]:

Intentional action/ health ideal, diagnosis, improvement plan

Intentional action/ operation, test, metabolism/ meta-noesis

We have discussed what health intentional action is. Ideally it is subordinated to ethics and conscience and thus not only on short cut goal setting (> quartal economy). Human action is self-diagnostic. Intentionality as a tool to consider alternatives renders it possible to compare ideals and realism. Then it is possible to make improvement plans. The skill to plan things manifested first of all in architecture is a natural reason why architecture is the standard example in action theory. Other good example is medical therapy of course.

Man should all the time be prepared to cut away non-healthy features and worse parts of our action. In this sense human action should be critical and self-correcting (> know yourself better and better). Intentions should be tested and the totality of action as well. In scientific explanation of bodily movements and standard reasons we expect metabolism even in the brain whereas in more developed analysis and synthesis the concern is cognitonic metanoesis

6. CONCLUSIONS

We have shown what intentional action is when we open the idea of human action to contain more or less subconscious levels of control behind the rational concentration guiding our acts. Consciousness can be partial due to lack of knowledge or for memory reasons in the sense that the basis of action is deep in our mind and actions are made as based on intuition and emotion.

It is important to make a difference between body movement and causality dependent basic action theory and deeper action theory noticing collectively created traditional frames of action starting from ethics. Among causal theories there is also difference depending on the interpretation of causality as real or teleological.

7. ACKNOWLEDGMENTS

The inspiring atmosphere of international conferences on cognitronics under the framework of the multiconferences "Information Society" (Ljubljana, Josef Stefan Institute) is gratefully acknowledged.

8. REFERENCES

- [1] Aalto, A. 1972. Luonnoksia. (ed.) G. Schildt, Otava, Helsinki.
- [2] Aristotle. 1984. Nikomakhosen etiikka, (trans.) S. Knuuttila, Gaudeamus, Helsinki.
- [3] Cicero. 1813. De officiis, Lindh, Westerås.
- [4] Eaton, R. 2002. Ideal Cities, Utopianism and the (Un) Built Environments, Thames & Hudson, New York.
- [5] Fomichov, V. A. and Fomichova, O. S. 2012. A Contribution of Cognitronics to Secure Living in Information Society. *Informatica. An International Journal of Computing and Informatics*. Vol. 36, No. 2, 121-130.
- [6] Fomichov, V. A. and Fomichova, O. S. 2015. Early Development of the Human Being, Ideal Constituent and Art Cognitronics as the Answer to the Challenge of Knowledge Society. In: *Informacijska družba – IS 2015. Proc. of the 18th International Multiconference – IS 2015*, Edited by V. A. Fomichov, O. S. Fomichova, Vol. F: Kognitonika/ Cognitronics. Oct. 12th-13th, 2015, Ljubljana. Josef Stefan Institute, 27-32.
- [7] Fomichov, V. A. and Fomichova, O. S. 2019. The Student-Self Oriented Learning Model as an Effective Paradigm for Education in Knowledge Society. *Informatica. An International Journal of Computing and Informatics*. Vol. 43, No. 1, 95-107.
- [8] Friedmann, H. 1925/30. Die Welt der Formen, Beck, Muenchen.
- [9] Hintikka, J. 1977. Deonttisen logiikan ongelmia, in T. Nyberg, (ed.) (1977): Ajatus ja analyysi, tt, Helsinki, pp. 213 – 245.
- [10] Hintikka, J. 1986. Kieli ja mieli, Otava, Helsinki, 1986.
- [11] Hutcheson, F. 1725. An Inquiry into the Original of our Ideas of Beauty and Virtue, London.
- [12] Lasker G. E. 2012. Sociodiagnostic Methodology: Theory and Applications, in G. E. Lasker and R. Bahbouh (eds.), *Sociodiagnostics and Sociomapping*, IIAS Baden-Baden.
- [13] Lasker, G. E and Oksala, T. 1993/1994) Design: Ecology, Aesthetics, Ethics, APS Ci 99, Otaniemi.
- [14] Mill, J. S. 2003. Utilitarismi, (trans.) K. Saastamoinen, Gaudeamus, Helsinki.
- [15] Niiniluoto, I (et al) (eds). 1989. Intentio, Suomen Filosofisen Yhdistyksen vuosikirja 1989, Ajatus 46, Suomen Filosofinen yhdistys, Vammala, 3-5 (3, 4-5).
- [16] Niukkanen, I. Oksala, T. 1986. Rakennuksen laatuksriteerit, Rakennushallitus, Helsinki..
- [17] Norberg-Schulz Ch. 1963. Intentions in Architecture, Allen & Unwin Ltd, Rome.
- [18] Nyberg, T. (ed). 1977. Ajatus ja analyysi, tt, Helsinki.
- [19] Oksala. P. 1976. Ihminen, kulttuuri, taide, Gummerus, Jyväskylä, (p. 90).
- [20] Oksala., T. 1981. Logical Aspects of Architectural Experience and Planning, HUT, Otaniemi.
- [21] Oksala, T. 1997. Yksilöllinen ja kollektiivinen intentio kaupungissa – Aalto vs. Blomstedt, in S. Soukka (ed.), Alvar Aalto, symposium in Kotka 22.-23. 5, 5-20.
- [22] Oksala, T. 2015. Evolution of Ethics as a Personal Challenge, in G. E. Lasker and K. Hiwaki (eds.), Personal and Spiritual Development in the World of Cultural Diversity, Vol. XII, IIAS, Baden-Baden, 33-38.
- [23] Oksala, T and Oksala, A. 2018 Art and Therapy in Interactive Metamorphosis, in G. E. Lasker et al (eds.), Advances in Art & Science, IIAS, Baden-Baden, 29-42.
- [24] Ollila, M.-R. and Airaksinen, T. 1989. Järki, tunteet, intentiot, in I. Niiniluoto (et al) (eds): Intentio, Suomen Filosofisen Yhdistyksen vuosikirja 1989, Ajatus 46, Suomen Filosofinen yhdistys, Vammala, 13-25, (14).
- [25] Patoluoto. I. 1989. Moraalisen teon intentio Pudendorffin mukaan, in I. Niiniluoto (et al) (eds): Intentio, Suomen Filosofisen Yhdistyksen vuosikirja 1989, Ajatus 46, Suomen Filosofinen yhdistys, Vammala, pp. 6-12 (6).
- [26] Polanyi, M. 1966. The Tacit Dimension, Chicago University Press, Chicago.
- [27] Tuomela, R. 1974. Human Action and its Explanation, HY, Filosofian laitos, Helsinki.
- [28] Tuomela, R. 1989. Toiminnan teorian sosiaalinen dimensio, in I. Niiniluoto (et al) (eds): Intentio, Suomen Filosofisen Yhdistyksen vuosikirja 1989, Ajatus 46, Suomen Filosofinen yhdistys, Vammala, pp. 60 -75.
- [29] Wilenius, R. 1967. Filosofia ja Politiikka, Tammi, Helsinki.
- [30] von Wright, G.-H. 1977, Deonttinen logiikka, in T. Nyberg, (ed.) (1977): Ajatus ja analyysi, tt, Helsinki, pp. 147- 166.

The Effects of Yoga on Quality of Life Perception

Karolina Ovijač

School of Advanced Social Studies
Slovenia

karolina.kery.ovijac@gmail.com

Jana Krivec[†]

Department of Psychotherapy
School of Advanced Social Studies
Slovenia
jana.krivec@fuds.si

ABSTRACT

Each individual strives to achieve high quality of her/his life. In a fast modern world there is a high degree of stress which often decreases different aspects of life quality, such as physical and psychological health and social relations. Relaxation and meditation techniques such as yoga have been shown to have positive effects on quality of life for several groups suffering from different illnesses, including mental health issues. In the present study we examined the effect of yoga on perception of quality of life in general. The comparison was made between groups of people who practice yoga and those who don't on the quality of life aspects, using World Health Organization quality of life scale (WHOQOL). Results showed that yoga practitioners evaluated their quality of life better than test group on all the facets. There were no significant differences according to gender or age. This study confirms that yoga practice improves the people's perception of the quality of their lives.

Keywords

yoga, quality of life, WHO, WHOQOL.

1. INTRODUCTION

Quality of Life (QOL) is the degree of well-being felt by an individual or group of people. Unlike standard of living, quality of life is not a tangible concept, and therefore cannot be measured directly [20]. Quality of life is a subjective construct which varies with the population studied. It is generally conceptualized as a multi-dimensional construct made up of a number of independent domains including physical health, psychological well-being, social relationships, functional roles and subjective sense of life satisfaction [8]. According to WHO, quality of life is defined as "individuals' perceptions of their position in life in the context of the culture and value systems where they lived and in relation to their goals, expectations, standards and concerns. It is colored by physical health, psychological state, level of independence, social relationships, environmental factors and personal beliefs [33]. Quality of life, by its very natures, is idiosyncratic to the individual, but intuitively meaningful and understandable to most people [25].

1.1 Normal or Body Text

Quality of life (QOL) is a latent variable that cannot be directly measured. It needs to be converted to indicators of its component dimensions and domains to be quantified. To serve the purpose, the indicators must be valid, important, representative and adequate. A QOL measure presents the indicators as items that can be rated on response scales, which are then presented as a profile domain scores or a composite index of quality of life [16]. The essential concepts of QOL measures are subjectivity, multidimensionality and well-being.

There are several measurements of quality of life. Most of the measurements were developed for medical field as Quality of life (QoL) is fast becoming a standard measure of outcomes in clinical trials, cost effectiveness analysis and clinical practice. Some of them are:

1) The Wisconsin Quality of Life Index [8]. It is a comprehensive multi-dimensional measurement tool that reflects the personal priorities and goals of individual mental health clients. It measures eight dimensions: General Life Satisfaction, Occupational Activities, Activities of Daily Living, Psychological Well-Being, Symptoms/Outlook, Physical Health, Social Relations / Support and Money.

2) The Anamnestic Comparative Self-Assessment (ACSA) uses a self-anchoring rating scale to measure subjective well-being. ACSA was originally developed by Jan Bernheim [3] as a simple method to measure quality of life consecutively in the patient-physician relationship in cancer patients. It differs from the conventional single-item scales of subjective wellbeing (SWB) because it uses biographical experiential scale anchors: the best and the worst periods in the respondent's life experience. Because of its internal frame of reference, ACSA is argued to be less influenced by cultural relativities and psychological traits [31].

3) The Quality of Life Scale (QOLS), created originally by American psychologist John Flanagan in the 1970's, has been adapted for use in chronic illness groups.

4) Short-Form Health Survey (SF-36/12). This multidimensional instrument was developed in 1992 by Ware and Sherbourne and validated in Brazil by Ciconelli et al. [6]. Eight dimension scores were extracted from studies including physical functioning, bodily pain, physical role function, general health, mental health, emotional role function, social function, and vitality.

5) WHOQOL-100 and WHOQOL-BREF developed by the WHO [33] assess four major domains: physical, psychological, social relationships and environment. The WHOQOL instruments are focusing on individuals' own views of their wellbeing. The WHOQOL-BREF is one of the best known instruments that has been developed for cross-cultural comparisons of quality of life and is available in more than 40 languages.

2. YOGA

Yoga is an ancient Indian system of philosophy designed to bring balance and health to the physical, mental and emotional dimensions of the individual. The practice consists of a set of physical postures ("asanas"), which are maintained for a certain time [22, 27].

Since its introduction into the Western culture, yoga has become more popular as a complementary way to achieve healthy living [13]. Several researches have shown positive effects

of yoga techniques on physical and mental health [10, 12, 27]. Moreover, investigations have shown the beneficial effects of yoga on cognition [4]. Rangan, Nagendra, and Bhat [24], verified that the Gurukula Education System School, based on a yoga way of life, was more effective in increasing performance on visual and verbal memory in students when compared with students of the Modern Education System. Another study showed that yoga-based relaxation techniques improved memory scores in volunteers immediately after the practice [30]. Research of Rocha et al. [26], has shown positive effects of yoga on memory performance in healthy men. They also found that yoga decreases anxiety, depression and stress-related measures. On the basis of their research they suggest an application of yoga in preventive health care. Khalasa et al. [14] showed that 11 weeks of yoga sessions had significant benefit on anger control and fatigue/inertia thus suggesting to use yoga as a preventive tool for maintaining mental health. Klatte et al. [15] performed a metaanalysis on the effects of yoga on mental health issues. They have included 25 studies with a total of 1339 patients in the analysis. A large and significant effect of yoga was seen with respect to the primary endpoint (symptom severity) compared to untreated control groups. Small but significant effects of yoga were also seen in comparison with attention control and physical exercise. No difference in efficacy was found between yoga and standard psychotherapy. Preliminary but encouraging results were also found in meta-analysis of 13 reviews examined 185 distinct studies showing yoga as an intervention for the effects of trauma as well as the mental health symptoms and illnesses often associated with trauma [17]. Sharma et al. [28] showed that from the 17 studies, 12 demonstrated positive changes in psychological or physiological outcomes related to stress. Rakhshani et al. [23] showed that yoga interventions are generally effective in reducing anxiety and depression in pregnant women.

2.1 Effects of Yoga on Quality of Life

Yoga is commonly being adopted and prescribed with the intent to increase a participant's health-related quality of life. Several studies showed positive effects of yoga on patients with cancer [18, 9, 5, 21, 19], which included: reducing cancer-related symptoms, improvements in quality of life, social functioning, as well as spiritual and emotional well-being [9, 18]. Studies have found that yoga may reduce fatigue, pain, nausea, mood disturbance, depression, and anxiety in early-stage of breast cancer patients [21]; increase invigoration, acceptance, and relaxation in women with metastatic breast cancer [5]; and help decrease stress and pain while increasing energy, sleep, and sense of well-being in a variety of patients with cancer [19]. Yagli and Ulger [34] performed eight sessions of a classical yoga program including warming and breathing exercises, asanas, relaxation in supine position, and meditation and 8 sessions of classical exercise program were applied to cancer patients. They found that all patients' quality of life scores (measured with Nottingham Health Profile (NHP), Beck Depression Inventory and visual analog scale (VAS)) after the yoga and exercise program were better than scores obtained before the yoga and exercise program ($p<0.05$). It was concluded that yoga is valuable in helping to diminish depression, pain, fatigue and helps cancer patients to perform daily and routine activities, and increases the quality of life in elderly patients with breast cancer. The meta-analytic evidence of Bandevidez and Hart [2] clearly supports the small-to-medium positive effects of yoga on health-related quality of life, as measured by the SF-36/12 assessments. Research of

Agnihotri et al. showed that yoga can be used as an adjuvant therapy in the management of asthma [1].

Not many studies have been made on the effects of yoga on quality of life among healthy individuals. Goncalves, et al. [11] showed benefits of yoga practice on quality of life with elderly people.

3. AIM

Our aim was to discover whether practicing yoga affects the individuals' perception of his/her quality of life regardless previous health status. Our referential study was the one of Singh et al., who conducted similar research in India [29]. They have found that yoga exercise practitioners reported comparatively sound sleep, enhanced energy level, and overall general health wellness. We wanted to check if the results would be similar for western country such as Slovenia.

4. METHODOLOGY

4.1 Sample

We used stratified sampling within the individuals in Slovenia who practice yoga (yoga group). There were 50 individuals in the sample from five different groups practicing yoga, of which 41 completed questionnaires. In addition, we used a test group of 50 individuals who did not practice yoga, 42 of them adequately fulfilled the questionnaire. In the first group, there were 80% of women (32 persons), in the second 73% (30 persons). The majority of participants were between 25 and 45 years old (21 in yoga group and 25 in test group). 11 participants from yoga group and 10 from experimental group were younger than 25 years. The lowest number was in the age group of 45 to 65 years (8 in yoga group and 6 in the test group). None of the respondents was older than 65 years.

4.2 Instruments and Procedure

WHOQOL questionnaire has been used as a base for our research. WHOQOL covers four domains of mental health: physical, psychological, social and environmental. The psychological health in the research covers various aspects, such as: positive/negative feelings, self-image, body image and appearance, self-esteem, spirituality /religion /personal beliefs, thinking, learning, memory and concentration. The assessment of physical health has aspects such as activities of daily living, dependence on medicinal substances and medical aids, energy and fatigue, mobility, pain and discomfort, energy and fatigue, sleep and rest and work capacity. Social aspect includes social and personal relationships, social support and sexual activity. Environmental dimension includes financial resources, freedom, physical safety and security, health and social care: accessibility and quality, home environment, opportunities for acquiring new information and skills, participation in and opportunities for recreation / leisure activities, physical environment (pollution/noise/climate) and transport. For the measurement of the intensity, the Likert scale of five points (from 1 to 5) was used. Instructions included the statement to evaluate the individual's life in the last 14 days.

5. RESULTS

Some of the most interesting results according to 4 different aspects of quality of life are presented. Comparisons between yoga and test group were made using Mann-Whitney U-test and are presented for all the facets in the following chapters.

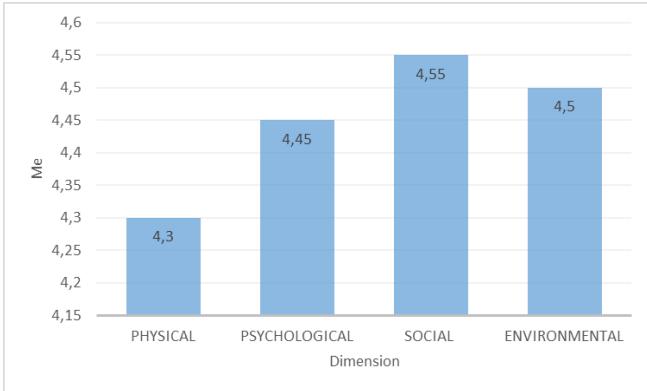


Figure 1: Median values of the evaluations of different aspects of quality of life for yoga group participants

Figure 1 shows, that people who train yoga have a high level of satisfaction with their quality of life. They rated all aspects of life above 4 on the scale from 1-5. The most satisfactory is evaluated social aspect, followed by environmental, psychological and physical being the least satisfactory. Among psychological aspect, the lowest rated were the facets about acceptance of the physical appearance ($M=4,1$, $SD=0,55$), the highest enjoyment in life ($M=4,6$, $SD=0,55$). Among the lowest rated in the social field was the evaluation of participant's sex life ($M=4,4$, $SD=0,6$).

We tested gender and age differences within yoga group, and there were no statistically significant differences between the average ranges. We can therefore assert that there are no gender or age differences of the yoga effects on all aspects of quality of life. Even though the differences were not statistically significant, on average, men showed better perception of quality of their lives than woman. They are abler to relax, are more satisfied with the amount of daily activities they can perform and the quality of their home. Even though not statistically significant, there is a tendency that younger respondents are more satisfied with the extent to which they can relax and enjoy. Respondents between 25 and 45 years most strongly agree with the statement that they can count on their friends when they need it, while the oldest group of 45 to 65 years has the highest ratings about the quality of their home that suits their needs.

The differences between yoga and test group in the evaluation of most aspects of quality of life were statistically significant (see Table 1).

The biggest difference between the groups is for the indicators "Do you have enough money to meet your needs?", "How are you able to relax and enjoy?" And "How much are you able to enjoy and relax?" in favor of yoga group. Yoga group members are also more satisfied with their sleep than test group members.

Table 1: Comparison of different aspects of quality of life assessment between yoga and test group

	Practice yoga?	Average rank	Sum of ranks	Mann-Whitney U-test	P (2-tailed)
HOW SATISFIED ARE YOU WITH THE QUALITY OF YOUR LIFE?	yes	53,00	2120,00	340,000	0,000
	no	29,29	1201,00		
PHYSICAL DIMENSION					
How satisfied are you with your ability to perform your daily living activities?	yes	56,05	2242,00	376,000	0,000
	no	26,32	1079,00		
How well do you sleep?	yes	56,05	2242,00	218,000	0,000
	no	26,32	1079,00		
How satisfied are you with your health?	yes	50,34	2013,50	446,500	0,000
	no	31,89	1307,50		
Do you have enough energy for everyday life?	yes	49,40	1967,00	444,000	0,000
	no	31,60	1264,00		
How satisfied are you with your ability to perform your daily living activities?	yes	47,16	1886,50	573,500	0,008
	no	34,99	1434,50		
How much do you need any medical treatment to function in your daily life?	yes	36,34	1453,50	633,500	0,020
	no	45,55	1867,50		
PSYCHOLOGICAL DIMENSION					
How satisfied are you with your abilities?	yes	50,98	2039,00	421,000	0,000
	no	31,27	1282,00		
Are you able to accept your bodily appearance?	yes	49,70	1988,00	472,000	0,000
	no	32,51	1333,00		
How would you rate your memory?	yes	54,28	2171,00	289,000	0,000
	no	28,05	1150,00		
How much do you enjoy life?	yes	55,45	2218,00	242,000	0,000
	no	26,90	1103,00		
How satisfied are you with your ability to learn new information?	yes	50,74	2029,50	430,500	0,000
	no	31,50	1291,50		
How satisfied are you with yourself?	yes	52,73	2109,00	351,000	0,000
	no	29,56	1212,00		
SOCIAL DIMENSION					
How satisfied are you with the support you get from your friends?	yes	53,96	2158,50	301,500	0,000
	no	28,35	1162,50		
How satisfied are you with your sex life?	yes	48,63	1945,00	475,000	0,001
	no	32,38	1295,00		
How satisfied are you with your personal relationships?	yes	50,39	2015,50	444,500	0,000
	no	31,84	1305,50		
How satisfied are you with your ability to provide for or support others?	yes	50,00	1950,00	429,000	0,000
	no	31,46	1290,00		
Do you feel happy about your relationship with your family members?	yes	53,78	2151,00	309,000	0,000
	no	28,54	1170,00		
ENVIRONMENTAL DIMENSION					
Have you enough money to meet your needs?	yes	57,50	2242,50	136,500	0,000
	no	24,33	997,50		
How satisfied are you with the conditions of your living place?	yes	50,08	1953,00	426,000	0,000
	no	31,39	1287,00		
How available to you is the information that you need in your day-to-day life?	yes	50,83	2033,00	427,000	0,000
	no	31,41	1288,00		
How satisfied are you with the social care services?	yes	54,37	2120,50	258,500	0,000
	no	27,30	1119,50		
How satisfied are you with the way you spend your spare time?	yes	54,06	2162,50	257,500	0,000
	no	26,94	1077,50		

Legend: N=81

6. CONCLUSION

Quality of living does not always correlates with technological development. Today's stressful and multitasking life environment in highly sophisticated technological work environments demands the relief of tension and stress and organization of life to enable high living quality. Our study confirmed and extended the results of Singh and Sharne [29] on Slovenian population, showing positive effects of practicing yoga on all aspects of quality of life. Yoga practitioners were more satisfied with the quality of their lives on physical, psychological, social and environmental asset. Therefore, we can agree with the statement of some previous studies [7, 17] who recommended yoga as an alternative method of retaining mental health and prevention of different mental issues. The quality of life and mental health is definitely something that should be working on and not taken for granted. We can also see in the study that mind and body work together. It was shown that non-practitioners were not as good as yoga practitioners on the physical health domain. We may also say that yoga affects one perception of social relations and environmental facts, such as amount of money that a person would need to live a quality life. In this regard we see the limitation of our study, since we have not gathered data about participant's economic status. Although we have no reason to believe that yoga group would have higher income than test group. Our research also showed the importance of yoga practice for male and females of all ages. The results support the effort of United Nations Organization to declare the international yoga day on 21st June of every year is significant towards awareness for benefits of yoga to secure good health of mankind [32].

7. REFERENCES

- [1] Agnihotri, S., Kant, S., Mishra, S. K., and Verma, A. 2017. Assessment of significance of Yoga on quality of life in asthma patients: A randomized controlled study. *Ayu*, 38 38, 1-2, 28–32.
- [2] Benavidez G, Hart PD. 2017. Effects of yoga on measures of health-related quality of life from sf-36 and sf-12 assessments: A systematic review and meta-analysis. *Exerc Med Exerc Med*, 1, 5.
- [3] Bernheim, J. L. 1983. L'auto-évaluation anamnestique comparative (ACSA). I. Description d'une méthode de mesure de la qualité subjective de la vie de malades cancéreux. *Psychologie Médicale* 15, 9, 1615–1617.
- [4] Birdee, G. S., Yeh, G. Y., Wayne, P. M., Phillips, R. S., Davis, R. B., and Gardiner, P. 2009. Clinical applications of yoga for the pediatric population: A systematic review. *Academic Pediatrics* 9, 4, 212–220.
- [5] Carson, J.W., Carson, K.M., Porter, L.S., Keefe, F.J., Shaw, H., and Miller, J.M.2007. Yoga for women with metastatic breast cancer: results from a pilot study. *J. Pain Symptom Manage* 33, 3, 331-341.
- [6] Ciconelli, R.M., Ferra, M.B., Santos, W., Meinão, I., Quaresma, M.R.1999. Tradução para a língua portuguesa e validação do questionário genérico de avaliação de qualidade de vida SF-36 (Brasil SF-36). *Rev Bras Reumatol*, 39, 3, 143–150.
- [7] Derezonnes, D. 2000. Evaluation of Yoga and Meditation Trainings with Adolescent Sex Offenders. *Child and Adolescent Social Work Journal*, 17,2, 97–113.
- [8] Diamond, R., and Becker, R. N. 1999. Wisconsin Quality of Life Index (W-QLI): a multidimensional model for measuring quality of life. *Journal of Clinical Psychiatry*, 60, 3, 29.
- [9] Duncan, M.D., Leis, A., Taylor-Brown, J.W. 2008. Impact and outcomes of an iyengar yoga program in a cancer centre. *Curr. Oncol.* 15, 72-78.
- [10] Elsenbruch, S., Langhorst, J., Popkirowa, K., Müller, T., Luedtke, R., Franken, U., et al. 2005. Effects of mind–body therapy on quality of life and neuroendocrine and cellular immune functions in patients with ulcerative colitis. *Psychotherapy and Psychosomatics*, 74, 277–287.
- [11] Goncalves, L. C., Vale, R. G., Barata, N. J., Varejao, R. V., and Dantas, E. H. 2011. Flexibility, functional autonomy and quality of life (QoL) in elderly yoga practitioners. *Archives of Gerontology and Geriatrics* 53, 2, 158–162.
- [12] Grossman, P., Tiefenthaler-Gilmer, U., Raysz, A., and Kesper, U. 2007. Mindfulness training as an intervention for fibromyalgia: Evidence of postintervention and 2-year follow up benefits in well-being. *Psychotherapy and Psychosomatics*, 76, 226–233.
- [13] Jayasinghe, S. R. 2004. Yoga in cardiac health (a review). *European Journal of Cardiovascular Prevention and Rehabilitation* 11, 369–375.
- [14] Khalasa, S.B.S., Hickey-Shutz, L., Cohen, L., Steiner, N. and Cope, S. 2012. »Evaluation of the Mental Health Benefits of Yoga in a Secondary School: A Preliminary Randomized Controlled Trial.« *The Journal of Behavioral Health Services and Research* 39, 1, 80-90.
- [15] Klatte, R., Pabst,S. Beelmann, A.and Rosendahl, J. 2016. The Efficacy of Body-Oriented Yoga in Mental Disorder. *Deutsches Ärzteblatt International* 113, 195-202.
- [16] Lam C.L.K. 2010. Subjective Quality of Life Measures – General Principles and Concepts. In: Preedy V.R., Watson R.R. (eds). *Handbook of Disease Burdens and Quality of Life Measures*. Springer, New York, NY.
- [17] Macy, R.J., Jones,E. Graham, L.M. and Roach,L. 2018. Yoga for Trauma and Related Mental Health Problems: A Meta-Review With Clinical and Service Recommendation. *Trauma, Violence, & Abuse* 19, 1, 35-57.
- [18] Moadel, A.B., Shah, C., Wylie-Rosett, J., Harris, M.S., Patel, S.R., Hall, C.B., et al. 2007. Randomized controlled trial of yoga among a multiethnic sample of breast cancer patients:effects on quality of life. *J. Clin. Oncol.* 25,28, 4387-4395.
- [19] Pachman, D.R., Price, K.A., Carey, E.C.2014. Nonpharmacologic approach to fatigue in patients with cancer. *Cancer J.* 20, 5, 313-318.
- [20] Preedy V.R., and Watson R.R. (eds) 2010. *Handbook of Disease Burdens and Quality of Life Measures*. Springer, New York, NY.
- [21] Raghavendra, R.M., Nagarathna, R., Nagendra, H.R., Gopinath, K.S., Srinath, B.S., Ravi, B.D., et al. 2007. Effects of an integrated yoga programme on chemotherapy induced nausea and emesis in breast cancer patients. *Eur. J. Cancer Care* 16, 6,462-474..
- [22] Rakshani, A., Maharana, S., Raghuram, N., Nagendra, H. R., and Venkatram, P. 2010. Effects of integrated yoga on quality of life and interpersonal relationship of pregnant women. *Quality of Life Research* 19, 10, 1447–1455.
- [23] Rakshani, A. 2014. Yoga and the Quality of Life. In: Michalos, A.C. (eds) *Encyclopedia of Quality of Life and Well-Being Research*. Springer, Dordrecht.
- [24] Rangan, R., Nagendra, H., and Bhat, G. R. 2009. Effect of yogic education system and modern education system on memory. *International Journal of Yoga* 2, 2, 55–61.
- [25] Revicki, D.A., Osoba, D., Fairclough, D., Barofsky, I., Berzon, R., Leidy, N.K., Rothman, M. 2000. Recommendations on health-related quality of life research to support labeling and promotional claims in the United States. *Qual. Life Res.* 9, 887–900.
- [26] Rocha, K. K., Ribeiro, A. M., Rocha, K. C., Sousa, M. B., Albuquerque, F. S., Ribeiro, S., et al. 2012. Improvement in physiological and psychological parameters after 6 months of yoga practice. *Consciousness and Cognition* 21, 843–850.
- [27] Ross, A., and Thomas, S. 2010. The health benefits of yoga and exercise: A review of comparison studies. *Journal of Alternative and Complementary Medicine* 16, 1, 3–12.
- [28] Sharma, M. 2014. Yoga as an Alternative and Complementary Approach for Stress Management: A Systematic Review. *Journal of Evidence-Based Complementary and Alternative Medicine* 19, 1, 59-67.
- [29] Singh, P. and Sharma, H. 2017. Mental and Physical Health Study of Yoga Practitioners and NonPractitioners.

- International Journal of Multidisciplinary Approach and Studies* 4, 4, 14-24.
- [30] Subramanya, P., and Telles, S. 2009. Effect of two yoga-based relaxation techniques on memory scores and state anxiety. *BioPsychoSocial Medicine* 13, 3–8 .
- [31] Verhofstadt, E., Bleys, B. and Van Ootegem, L. 2019. *Applied Research Quality Life*, 14, 237.
- [32] UNO (2015).
<http://www.un.org/en/events/yogaday/resources.shtml>, Accessed on Dec., 2015.
- [33] WHO Quality of Life Assessment Group 1996. What quality of life? The WHOQOL Group. *World Health Forum* 1996 17, 4, 354-356.
- [34] Yagli, N. V., and Ulger, O. 2015. The effects of yoga on the quality of life and depression in elderly breast cancer patients. *Complementary therapies in clinical practice* 21, 1, 7-10.

Creating Multimedia Systems According to Principles of Cognitonics

Ida Panev

Polytechnic of Rijeka,
Business Department,

Vukovarska 58,
51000 Rijeka, Croatia

Tel: +385 51 353706
ipanev@veleri.hr

ABSTRACT

Cognitonics is a scientific discipline developed with the aim of studying the human being in the digital world. The aim of this paper is to analyse how to create a *Multimedia system* according to principles of Cognitonics.

Keywords

Cognitonics, ICT, multimedia, multimedia system, personality development, creativity development, socialization, social responsibility

1. INTRODUCTION

Cognitonics is a scientific discipline developed with the aim of studying the human being in the digital world and creating cognitive-cultural foundations of the personality's harmonic existence in modern information society, quickly transforming into knowledge society. It is based on research results that point to the gap between intellectual and spiritual development of individuals in a modern information society [2]. One of the goals of Cognitonics is to create theoretical basis that will enable development of different advanced systems within ICT. This paper will be focused on *multimedia systems*.

A *multimedia system* is a communication and information system that enables the processing, management, transmission and presentation of multimedia data.

Multimedia systems, as any other ICT systems, must have a positive impact on development of individual's creativity, its sense of harmony and beauty, awareness of belonging to a particular national culture, a positive impact on the development of individual language skills, ethical behaviour, self-regulation and other values that represent some of the principles of Cognitonics. The application of these principles in developing a multimedia system should be encouraged for the purpose of harmonious development of individuals.

2. ABOUT MULTIMEDIA SYSTEMS

Multimedia means the simultaneous combination of two or more media for the simultaneous transmission of different types of information. In the IT Encyclopedia Dictionary, multimedia is defined as the use of a computer to display text, graphics, videos, animation and sound [8]. The purpose of multimedia is to make it as interesting, attractive and real as possible to present and convey information, an appearance, a scene, an atmosphere or an event. The goal of multimedia is to capture as many of our senses as possible so that the experience of the transmitted message is more

complete. Some advantages of using multimedia systems are: accessibility, mobility, interactivity, lower price, distance learning, etc.

Multimedia literacy consists of information literacy, visual and media literacy. It is reflected in the individual's understanding of how multimedia works, how it produces information, how information is created and merged into a meaningful and purposeful whole with the help of multimedia tools. It is also reflected in the individual's understanding how multimedia is used. Multimedia literacy also means the ability to critically understand the nature of multimedia and the impact of multimedia [9] and the ability to think critically for the good use of information. In the context of Cognitonics, multimedia literacy can also mean understanding how to create multimedia systems according to principles of Cognitonics.

One of applications of multimedia is for educational purposes. *Multimedia educational material* is a simultaneous combination of two or more media in one digitized system with the aim of presenting information and encouraging better educational success of students. The main purpose of multimedia educational material is instructiveness, and the goal of any multimedia educational material must be to facilitate the process of remembering and understanding the content presented. An instructive message is a message that aims to teach. A *multimedia instructional message* aims to encourage the remembering and understanding of multimedia content, and consists of words, images and other multimedia elements in appropriate formats [6].

Each multimedia system is made up of multiple media and has its own structure that defines how these media are interconnected. The media that the multimedia system consists of is created and processed independently of the design of the system itself. In other words, to create a multimedia system, first it is necessary to design and create its elements, and then to carefully connect them to a useful multimedia system.

The *elements of multimedia* are: text, graphics, animation, sound and video. Text and graphics are static elements of multimedia. Sound, animation and video are dynamic elements of multimedia. Appropriately chosen elements for multimedia system can be a motivating factor for encouraging and maintaining interest in subject.

2.1 Text

Most multimedia applications include *text*, even if graphics are heavily used. Text is the most flexible way of presenting information on screen. It is often more useful to consider how to

present the text appropriately than to try to replace it with speech or image. The text in multimedia system should be as simple as possible and the sentences should be short and precise. Abbreviations should be used as little as possible and only if they are widely known, and their use should be consistent throughout.

Text has the advantage that it is: easily manipulated (requires little time to create), easily stored (requires little memory), easily transmitted (requires small bandwidth). On the other hand, the text itself is usually not enough (it takes a lot of text to explain the simple concept).

2.2 Graphics and Infographics

The term *graphics* (computer graphics) refers to a number of different elements created using a computer, such as diagrams, graphs, pictures, photographs or drawings displayed on the screen, all with the aim of visualizing information.

An image can convey information very effectively ("One picture is worth a thousand words"). The fundamental difference between an image and a graphic is that the image is captured and the graphic is created. It is usually much easier to generate an image (capture) than graphics (creation).

Research has shown that humans are visual beings and that they remember visuals better than textual information. Because of that, the term *Infographics* is very important when speaking about multimedia systems. *Infographics* is a visual presentation (display) of facts, information, data or knowledge. It is used when complex information is to be explained quickly and clearly, because it provides the reader with visual content that is simple and interesting to process, understand and remember. Infographics is a visual representation of facts, information, data or knowledge presented in the form of graphics and intended to present information quickly and clearly. It makes it easy to understand and remember information that may seem difficult to remember in large blocks of ordinary data. Simply put, infographics are graphics that provide information - explanatory graphics. Effective infographics convey the essence of the message without individual having to read the related text thoroughly. An individual can determine the subject of the infographic just on view. Nowadays, in an era of information overload, followed by shortened individuals' attention, infographics is used to easily and quickly enable understanding of information. Each infographics should be created in accordance with *Emotional-Imaginative Teaching System (EIT - system)* which, among other, aims at developing individual emotional intelligence, creativity, the ability to process symbolic information and suggests the educational methods contributing to early socialization of children (preschool and elementary school ages). The EIT-system belongs to the constructive core of Cognitonics [3].

2.3 Animation and Video

The human being has the instinctive ability to detect movement, so *animation* is used to draw attention to the information within multimedia system. The purpose of animation is to imitate reality by the appearance of movement, and it is possible because of the laziness of the human eye. Animation gives the viewer an illusion of movement by quickly changing the frame. It is used for: highlighting an object (moving text, the appearance of a character in rhythm as it is written, text pulsing, text changing color, etc.), "humanizing" an object, explaining a concept or action. Animation should be used only when there is a clearly defined goal to be achieved with it. The various effects of multimedia

application development tools should be carefully used for animations. For example, scrolling text is difficult to read and should be avoided, or at least, once stopped, it should be left enough time for the user to read it.

Video (moving image) can include all of the elements of multimedia. Video is usually much easier to make than animation, but it is also less useful on a regular basis.

The duration of the video or animation (for the sake of attention) should in most applications be limited to:

- video - no more than 60 seconds,
- animation - no more than 30 seconds.

Passive video leaves the user as a passive observer, while *interactive video* engages him / her with the interaction that makes him / her an active participant. Interactive video enables the engagement, participation, control, response and active involvement of the viewer, it is very important for his / her intellectual and spiritual development.

2.4 Sound

The term *sound* in multimedia represents: speech, sound effects and music. *Music* is used as a background, usually to a video, and in that sense represents the whole with the video. It makes a mood in presentation. *Sound effects* are most commonly used to provide the user with system status information (for example: "beep" for an error) or to provide additional information about the object being displayed visually (for example: stream noise). Both music and sound effects have relatively little information value but can significantly contribute to the comfort of work. *Speech* can be used for both inputting information (for example: speech recognition in an application management function) and output from a multimedia application (for example: description of the image being displayed). In doing so, care must be taken that listening to speech is slower than reading, so that at the same time the user can accept less information by listening than reading.

3. DESIGNING MULTIMEDIA SYSTEM ACCORDING TO PRINCIPLES OF COGNITONICS

3.1 The tasks to be solved by a multimedia system

Each multimedia system is made up of multiple media and has its own structure that defines how these media are interconnected. The media that the multimedia system consists of is created and processed independently of the design of the system itself. After creating all multimedia elements, they need to be combined into one meaningful whole.

Creating a multimedia system is a process by which individual media are combined and their flow is combined and controlled. The multimedia system should be: *useful* (to give the user what she/he wants), *simple* (not having a need for too much effort when using), *interesting* (to result in a positive feeling and desire to be reused).

When creating a multimedia system, it is necessary to take into account its effect on the levels of the subconscious: in order to develop intellectual and emotional spheres harmoniously, it is necessary to include feelings, and not only ideas. Individuals form associations with the messages displayed, but they will not necessarily make a conscious connection between the aesthetic elements and the information. Knowledge must not only be

transmitted but also inscribed into the mind of users during the process of active learning [2].

When creating a multimedia system, one should fulfill the tasks of communication with users through multimedia system at the levels of consciousness and subconsciousness. These tasks are:

- to increase audience awareness and attention to presented multimedia material;
- to increase and channel excitement and enthusiasm when using multimedia system;
- to successfully explain through multimedia system abstract ideas and themes, and complex ideas and themes;
- to be able to communicate through multimedia system with people with different knowledge, needs, capabilities, and with different levels of intellectual development;
- to successfully create simulations and explanations of complex contents;
- to encourage individuals to focus their actions on achieving the desired goals;
- to achieve positive feelings about the multimedia system and the messages themselves.

According to Bearden [1], the goal is to integrate technology and to create a space open to demands of society with the aim of building a sense of belonging to society. In such way a smart, sustainable and inclusive growth of an individual can be achieved.

The technology of multimedia systems should not be integrated only in education, but also for business purposes, in public administration, for fun, for communication etc. Multimedia systems should be created in a way to represent a cognitive learning resource that enables development of more complex and richer thoughts among individuals.

Using the multimedia systems is changing the way users access information, collect them, analyze them, present them, etc. Also, by transforming situations from static to dynamic, users are enabled to develop the skills of socialization, social responsibility, creativity and cooperation skills [7].

3.2 Media Selection Guidelines

When creating a multimedia system it is important to carefully analyze and select the right media for transmitting a message in a successful way.

Reasons for selecting *Text and Speech* for transmitting a message in multimedia systems:

- Written words are descriptive, detailed and straightforward.
- Words can be literal or just remind the user about the topic.
- The correct use of words is critical because words can easily be misinterpreted.
- If speech is used, it must be informative and expressive.

Reasons for selecting *Graphics and Illustrations* for transmitting a message in multimedia systems:

- Designs, drawings and images can be used thematically or symbolically.
- Graphics can be explanatory, conceptual or suggestive.
- Graphic can be adapted to the information being transmitted or it can be aimed directly to the audience.

- Graphic design connects separate elements of multimedia to one functional system.

Reasons for selecting *Still photos (Pictures)* for transmitting a message in multimedia systems:

- Pictures are visually very rich, detailed and attention - grabbing.
- Pictures can show real photos as detailed information for subject describing.
- Pictures can be suggestive or even symbolic.

Reasons for selecting *Video and Animation* for transmitting a message in multimedia systems:

- Video is largely realistic and descriptive in detail.
- Video is used to transmit time - based information.
- Animations can also be descriptive in detail or even suggestive.
- Video and animations are good to be used when there is a need for clarifying things.

Reasons for selecting *Sound* for transmitting a message in multimedia systems:

- Sound adds an audio element to visual information.
- Sound (in a way of music) makes a mood of multimedia system.
- Sound (in a way of music) promotes the development of emotions.
- Sound is the most subconscious of all the media, but it must be used moderately.

There are reasons to believe that the formulated guidelines would be very appropriate for implementing the script of a multimedia intelligent tutoring system (MITS) introduced in [4, 5]. This script is based on the world-known fairy-tale "Sleeping Beauty". It is a script of an MITS for acquainting young children (5-6-7 year old) with the basic ideas of social etiquette.

4. CONCLUSION

Multimedia systems are broadly used in all sorts of fields. Some of them are education, business or communication. To reduce a proven gap between intellectual and spiritual development of individuals in a modern information society, multimedia systems must be designed in accordance with the principles of Cognitonics. To do so, principles of Cognitonics must be added as *multimedia literacy* items. In such way one can use multimedia elements in right way to make complete multimedia system which fulfills its purpose and in parallel respects the principles of Cognitonics.

5. REFERENCES

- [1] Bearden, D. L. 2015. Digital Italy: teacher training as a prerequisite for economic progress, in Fomichov V. A; Fomichova O. S. (eds.) Proceedings of the 18th International Multiconference Information society – IS 2015, The Conference Kognitonika/Cognitonics, Ljubljana: Jožef Stefan Institut, pp. 7 - 10; available online at <https://is.ijs.si/archive/proceedings/2015/>
- [2] Fomichova, O. S. and Fomichov, V. A. 2009. Cognitonics as an Answer to the Challenge of Time. In *Proceedings of the 12th International Multiconference Information Society - IS 2009, Slovenia, Ljubljana, 12 – 16 October 2009*. Zbornik A/Proceedings A. The Conference Kognitonika/Cognitonics.

- Jozef Stefan Institute, Ljubljana, 2009, pp. 431-434, open access at https://is.ijs.si/?page_id=1163
- [3] Fomichov, V. A. and Fomichova, O. S. 2011. A map of cognitive transformations realized for early socialization of children in the internet age, in M. Bohanec et al (eds.). Proceedings of the 14th International Multiconference Information Society – IS 2011, The Conference Kognitonika/Cognitronics. Ljubljana, Jozef Stefan Institute, pp. 353 - 357; available online at <https://is.ijs.si/archive/proceedings/2011/>
- [4] Fomichova,, O. S. and Fomichov, V. A. 2017. The Methods of Cognitronics as the Basis for Designing Intelligent Tutoring Systems Developing Emotional Intelligence of the Learners. In *Informacijska družba - IS 2017. Proc. of the 20th Intern. Multiconference - IS 2017*, Edited by V. A. Fomichov, O. S. Fomichova. Vol. Kognitonika/Cognitronics. October 9th-10th, 2017, Ljubljana, Slovenia. Jozef Stefan Institute, Ljubljana, pp. 17-21.
- [5] Fomichov, V.A. and Fomichova, O.S. 2019. The Student-Self Oriented Learning Model as an Effective Paradigm for Education in Knowledge Society. *Informatica. An International Journal of Computing and Informatics*. Vol. 43. No. 1. P. 95-107.
- [6] Lauc, T. and Mikelić, N, 2005, Multimedij i multimedija instruktivna poruka, Informacijske znanosti u procesu promjena, Lasić-Lazić, Jadranka (ur.), Zagreb: Zavod za informacijske studije, pp. 95 - 115.
- [7] Panev, I; Pogarcic, I; Gjergjeska, Lj, 2017. Goals of Cognitronics in Formal ICT Education, Proceedings of the 20th International Multiconference Information society – IS 2017, Volume D, 9th – 13th October 2017, Ljubljana, Slovenia, Jožef Stefan Institut, 2017, pp. 61 – 65, available online at: http://library.ijs.si/Stacks/Proceedings/Information_Society
- [8] Panian, Ž. 2005. "Englesko - hrvatski informatički enciklopedijski rječnik", Europapress holding d.o.o., Zagreb, Croatia.
- [9] Yoon, J. S. and Hong, S. S. 2009, A study on the direction of education: to prevent multimedia illiteracy in the digital multimedia environment of the 21st century; <http://wwwimages.adobe.com/www.adobe.com/content/dam/Adobe/en/education/pdfs/a-study-on-the-direction-of-education-in-21stcentury.pdf> (accessed 5. 8. 2017.)

Application of Robotics in High Schools

Martina Sertić

Industrial-Crafts School
Slavonski Brod, Croatia

sertic_79@yahoo.com

ABSTRACT

In this paper it will be spoken about programming languages, how to program Micro:bit and Arduino. The peculiarity of our approach is that the lessons of programming are interpreted as a good tool of developing the skill of planning complex sequences of actions, in particular, conditional actions. This skill is very important in order to be successful in knowledge society. Arduino and Micro:bit are open source hardware. Arduino and Micro:bit program can be written in any programming language. Application of Arduino and Microbit is enormous. This paper presents the results of research conducted in high schools. The students answered some questions concerning programming Microbit and Arduino application.

Keywords

Application of robotics, Arduino, Micro:bit, high school, the skill of planning complex sequences of actions, research.

1. INTRODUCTION

The complexity of life in knowledge society (KS) is quickly increasing. In particular, this complexity is caused by the situation when the major part of people encounter the necessity to change the profession several times during the life. That is why a highly significant skill in KS is the skill of planning complex sequences of actions, in particular, conditional actions. A person should think over not only his/her actions in case any condition is satisfied but also a reaction in case a condition is not satisfied (is false).

This paper discusses programming languages, robots, how to program robots Micro:bit and Arduino. Arduino is open-source hardware. Arduino program can be written in any programming language. Application of Arduino and Micro:bit is enormous. Research results are also presented in this paper. The research was conducted in a secondary school. The students answered some questions concerning programming robots and the application of Arduino and Micro:bit. In order to use Arduino or Micro:bit it is necessary to know the basics of electronics, logic circuits and programming.

2. PROGRAMMING LANGUAGES

TODAY

Computer is a digital device that can perform a large number of operations based on instructions it is given in the form of programming commands [1].

It performs a certain number of operations whereby all complex operations have to be broken down into a sequence of simple operations and adjusted to the syntax of the programming language. For each of these simple operations there is a sequence

of commands expressed as binary numbers, zeros and ones, that computer can understand and perform, and translate into language understandable to humans.[1]

2.1 Types of programming languages

There are several groups of programming languages; some of them include machine languages, low-level symbolic programming languages, high-level symbolic programming languages and object-oriented programming languages [1].

The most user-friendly programming languages are high-level symbolic languages, which based on their purpose can be classified as follows:

- LOGO is a language intended for entry level programming and drawing.
- BASIC is a universal general-purpose language, suitable for beginners in programming, useful for solving all problem tasks.
- COBOL is intended for use in bookkeeping and accounting, as well as in business and commercial dealings.
- FORTRAN is a language suitable for solving technical, physical and mathematical problems.
- C is a general-purpose language, one of the most widely used languages for professional purposes; it provides a wide range of options and is adaptable to any platform.
- PASCAL is a general-purpose language, very popular in academic environments. It enables a logical program organisation that best follows thought process. It can be used for professional purposes as well.
- HTML, XHTML, CSS are program languages used for website creation and design.
- SQL is a language used to search databases.
- JAVA, JavaScript, DELPHI, ASP, PHP are relatively new programming languages, mostly intended for work on the Internet, web design, developing web and mobile applications [1].

3. Arduino and Microbit programming

The first thing to focus on when programming an Arduino microcontroller is the understanding of the term algorithm as a basis of all logical reasoning when solving a problem or writing a program code [2]. Algorithm is a sequence of interrelated commands used to perform a certain task or solve a logical problem. Arduino algorithm's commands have to be organized so that they follow the hardware platform's work, as well as to perform the assigned task as quickly, simply and effectively as possible [2]. Every Arduino program code contains two parts,

which include: **setup()**(input-output) involves setting up Arduino controller, and **loop()** or part of the program performed several times [2].

Setup() command is actually the part of the code that sets up the Arduino controller, i.e. the input and output of the data, the communication with computer or another device is established. **Loop()** is the part of the code that Arduino constantly repeats enabling itself to behave as a smart device, navigating its surroundings and executing commands like a little robot [2].

3.1 Arduino programming software

Regarding hardware, the most essential part necessary to build a little robot is the Arduino microcontroller. There are several such microcontrollers, and according to one's needs, one can choose between Arduino Uno SMD R3, Arduino Ethernet, Arduino Mega, Arduino Due, Arduino Pro and other [3]. For its functionality and program command execution **Arduino IDE** is recommended as specialfreeware program that can be downloaded from this link:

<https://www.arduino.cc/en/Main/Software> [3]. The image below shows the program interface. The interface consists of the area for code writing, main menu with code checking commands; it includes sending the program to Arduino controller, the communication with Arduino, and the area at the bottom of the page where notifications about the code translation process (compiling) are received (Figure 1) [3].

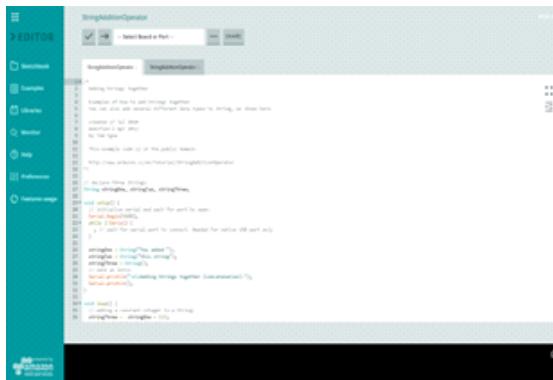


Figure 1: Program interface of Arduino IDE

When starting the program in the Arduino environment it is necessary to prepare hardware, by using USB cable to connect Arduino microcontroller with the computer or some other device (Figure 2) [3].

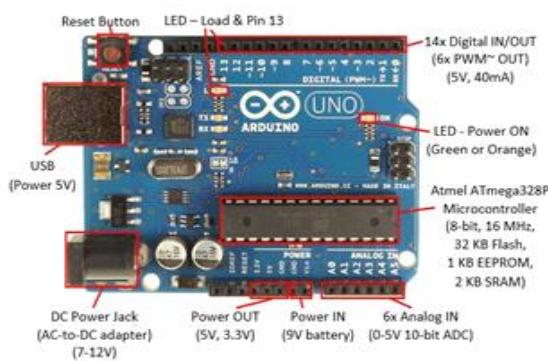


Figure 2: Arduino microcontroller

After connecting Arduino hardware, the procedure is as follows:

- turn on Arduino via USB cable, or Bluetooth,
- click on Tools - Board and check whether the Arduino microcontroller we are working with has been recognized,
- then click on Tools - Serial Port and select the suitable COM port. In order to know which COM port to select, open Devices and Printers option on Start menu in Windows and find the Arduino microcontroller on the list. The COM port will also be listed here [3].

When the first code (program) is written click on the icon Verify, which initiates code check, and if there are any errors in code the result will be displayed at the bottom of the interface, i.e. window. If the code is correct the icon Upload is selected [3].

After uploading, the program is on Arduino and can be tested. Each new program being written and each new command transferred to microcontroller is executed in the same manner [3].

3.2 Micro:bit programming software

Similar to the Arduino microcontroller we have a Micro:bit microcontroller. Micro:bit is small programmable device, designed to make learning and teaching easy, interesting and fun. Lots of information about, how to program Micro:bit and how to create code we can find on this web site <https://microbit.org/>.

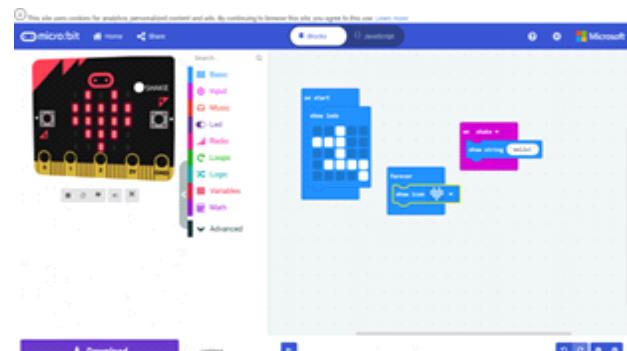


Figure 3: Create code for Micro:bit device

4. Research results

The research was conducted on a sample of 45 participants. There were 12 female and 33 male participants. Participants were on average between the ages of 15 and 30 years (Table 1).

4.1 Results and methodology

The research was conducted in two groups. The first group involved students, and the second involved adults. There were 30 participants in the first group and 15 participants in the second group. Both groups completed the questionnaire. The data interpreted in the text was obtained thorough a questionnaire. The questionnaire consisted of 12 differently formed questions.

Table 1: Overview of the number of participants assigned to groups based on age and gender

	Men	Women	Total
Students	18	12	30

Adults	15	0	15
Total	33	12	45

The research objective was to explore in what ways and to which extent programming in general, Micro:bit and Arduino programming is present in the teaching process.

Each group answered questions on the use of programming languages, familiarity with Micro:bit and Arduino controller and programming in Arduino. The questions aimed at identifying attitudes of both groups. In this way we tried to collect the necessary information about the opinion of the participants on the functionality and application of Micro:bit and Arduino programming.

Questions were:

1. Have you ever programmed before?
2. What programming languages have you programmed in?
3. What did you program?
4. Do you know how to program in Java?
5. Do you know what Arduino is?
6. Have you ever programmed in Arduino?
7. Do you know what Micro:bit is?
8. Have you ever programmed in Micro:bit?
9. Do you have Arduino robots in your school?
10. If you are attending a Robotics class, what do you learn in that class?
11. In your opinion, what is the most interesting part of Arduino or Micro:bit programming?
12. What do you think of using robots in the classroom?
 - 1 It is interesting to learn how to program robots
 - 2 I believe Robotics is our future
 - 3 I think it is only for pastime, I do not see it utilized on a large scale in the classes.

Several significant answer examples from the Questionnaire are mentioned in the rest of the text in this chapter, which are also represented in numbers and chart values.

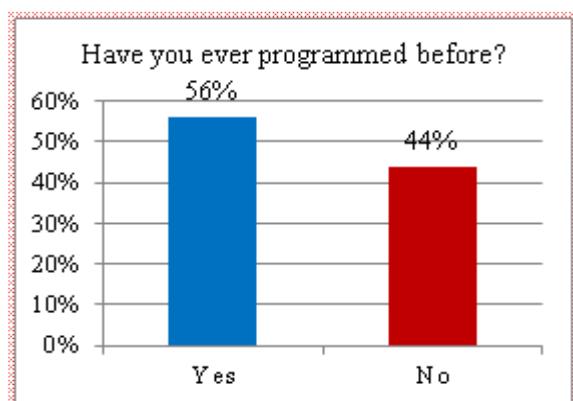


Figure 4: Overview of the research results

The overall analysis shows that a larger number of participants used at least one programming language throughout their education. According to the research results the programming languages the participants most frequently encountered are Qbasic and C++. To the first question: "Have you ever programmed before?" 56% of participants answered affirmatively, and 44% answered negatively (Figure 4).

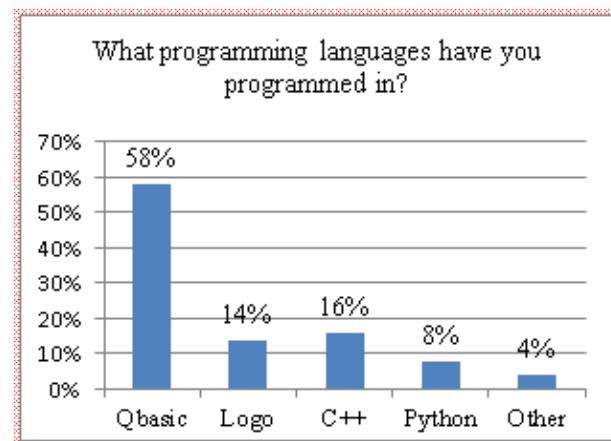


Figure 5: Research results overview

To the second question: "What programming languages have you programmed in?", 58% of the participants said Qbasic, 16% C++, 14% Logo, 8% Python and around 4% used other languages (Java, C#) (Figure 5).

Regarding questions referring to the application of Arduino robots in the classroom, e.g. to the question no. 12: "What do you think of using robots in the classroom?", around 64% participants said they believed that robotics is our future, 24% found it interesting to learn about and know how to program robots, and 12% participants saw it only as a pastime, without recognizing any big application possibilities for robotics in the classroom (Figure 6).

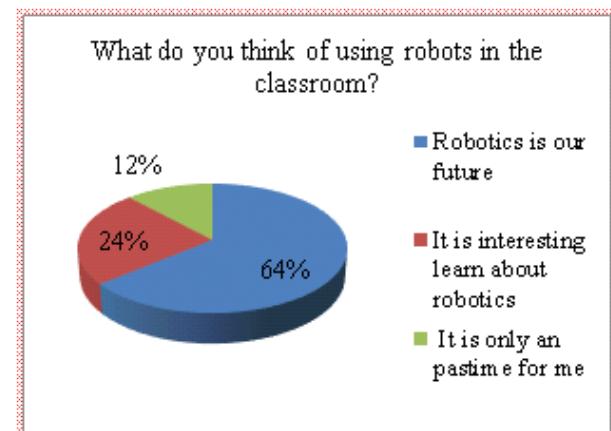


Figure 6: Robotics in the classroom

Regarding the questions about the use of Arduino and Micro:bit in the classroom, some participants who worked with Arduino and Micro:bit said they had learned how to instruct a robot to move, avoid obstacles, move in chosen direction, emit light signals, etc.

5. CONCLUSION

By using and programming digital devices, as well as taking all opportunities the modern age gives us, it is easier for us to learn and create new contents and then present those new contents as final products on the market.

The modern, contemporary age offers free and fast communication, availability and networking. It is observable from the research presented in the paper that programming attracts more individuals each day who are striving for new realizations. Arduino itself awoke and encouraged individuals interested in the possibilities technology has to offer to further explore and progress. The application of programming and creating something better encouraged young people who see the future in technology to come up with some new ideas.

6. REFERENCES

- [1] Kušek, M. and Toplonik, M. 2008. *Introduction to program language Java*. Zagreb: Faculty of Electrical Engineering and Computing
https://www.fer.unizg.hr/_download/repository/Skripta%5B1%5D.pdf.
- [2] W. Durfee. *Arduino Microcontroller Guide*. University of Minnesota.
www.me.umn.edu/courses/me2011/arduino/
- [3] Arduino AG website. *Education Redefining the learning experience on classroom at a time*.
<https://www.arduino.cc/>
- [4] Micro:bit website. *Educational Fundation. Get creative, get connected, get coding*.
<https://microbit.org/>

Transforming Teaching History in a Smart Learning Environment with Open Educational Resources

Anastasia D. Vakaloudi
Teachers' Supervisor (Inspector) in
Secondary Education
Klazomenon 5, 55132,
Thessaloniki, Greece
+30-6937318230
anvakaloudi@yahoo.gr

ABSTRACT

This paper analyzes the steps to be taken to design a blended learning environment which develops into a Smart Learning Environment and a Mobile Learning Environment based on Open Educational Recourses and free and easy-to-use online tools for the teaching of History in Secondary Education. This learning environment is based on learner-centered teaching theories, strategies and methods to stimulate motivation, study skills, learning skills, thinking skills, critical thinking. All the Information and Communication Technologies' tools are combined with interactive and collaborative activities.

Keywords

Historical Thinking, Learner-Centered Teaching Theories, Strategies, and Methods, Critical Thinking Skills, Smart Learning Environment, Blended Learning Environment, Open Educational Recourses, Collaborative and Flexible Learning

1. INTRODUCTION

The teaching of History is defined as the students' cultivation of skills and abilities which a historian has, such as historical understanding, adaptation, analysis, synthesizing [1-3]. In teaching History, a crucial role is played by: a) Comprehensive History (New History, Microhistory, Oral History, etc.); b) the experiential relationship with the past through meaningful communication, collaboration, common reflection and pursuit, interaction, cognitive conflict within existing knowledge and knowledge which is being acquired; c) a critical approach to sources and historiographical works; d) historical interpretation which is based on logic and facts [1-4]. Information and Communication Technologies (ICT) as a tool for teaching History can substantially alter the way that students access, gather, analyse, reconstruct, present and convey information. There are at least five main reasons that advocate the integration of ICT in the learning process and they relate to the support and reinforcement of: a) learning; b) teaching; c) the socialization of the student; d) the social inclusion of students with learning difficulties; e) the creativity and effectiveness of the educators [1-3, 5-7]. When we refer to the *mobile learning* and smart learning implementation in the teaching of History, we mean that the teaching is implemented in a learning environment that combines real-world contexts and digital-world resources with the use of ICT to provide students with direct experiences of the real world with sufficient learning support [5-13]. The basic precept of constructivism is that learning is achieved via the mediation of tools and interaction. In particular, ICT can substantially contribute to the teaching of History because: a) it can provide access to primary and secondary sources; b) it can cultivate a kind of experience in students, with audio visual material, simulations, etc., which makes the

understanding of historical terms, concepts and facts feasible; c) it favors the creation of an exploratory and collaborative learning environment; d) it offers rich material to the teacher to transform learning into a social process, collaborative, evolving and informed by a process of self-paced development that happens at a time and place of the learner's choosing [3, 13-17].

2. THEORETICAL FRAMEWORK

Contemporary teaching highlights, as the primary objective of History, historical understanding which is based on knowledge of the content of history, the methods of approaching historical facts and the understanding of concepts (evidence, cause, explanation, empathy, etc.) that seem to play a crucial role in historical understanding [1, 2, 13, 17-19].

The most important task in teaching and learning History is the study of primary and secondary source documents because it significantly enhances school students' understanding of content. When working with sources students need to be both cognitively active and emotionally engaged. In particular, some of the things that students need to do are: a) closely observe the documents' features, b) bring prior knowledge to bear, c) speculate about causes and consequences, d) make personal connections, and e) use evidence to support their speculations. Indeed, the centrality of these skills is a key reason why digital archives of primary sources have important roles to play in improving elementary, middle, and secondary teaching and learning across the curriculum [13, 20].

Moreover, teaching should be based on the learning theories of *constructivism* and the *socio-cultural dimensions of knowledge*, in effect *socio-cultural constructivism*, that allow the students to interface with the digital teaching environment and determine the issues of investigation according to their needs and potential [13, 21, 22]. Students have to manage, in a variety of ways, the mobile devices, smart phones and the ICT in general, as well as interactively participate in the learning process in an "open-ended software program" (Internet). The teaching and learning activities must be combined with free and easy-to-use ICT tools needed to bring open educational resources (teaching, learning and research materials in any medium that reside in the public domain or have been released under an open license) into the classroom, to facilitate a student-centered learning environment (promoting problem solving, knowledge construction, critical thinking evaluation, interactivity, and collaborative, flexible learning). The use of the aforementioned ICT tools suggests that learning is affected and modified by these tools, and that reciprocally the learning tools are modified by the ways that they are used for learning. This type of learning complies with learning as a tool-mediated socio-cultural activity and with mobile learning. Mobile learning refers to the use of mobile or wireless devices for the

purpose of learning. A central task in the design of technology for mobile learning is to promote enriching conversations within and across contexts. The design of mobile learning activities should be driven by specific learning objectives. The use of (mobile) technology is not the target but rather a means to enable activities that were otherwise not possible, or to increase the benefits for the learners. Thus it must support learners to reach personal understanding through conversation and exploration; support learners' collaboration in order to construct common knowledge; use technology to enrich learners' collaborative knowledge building with other learners and teachers; support learners' transitions across learning contexts. Mobile learning is not just about the use of portable devices but also about learning across contexts, that is technology that makes it possible for learners to work at unique activities in ways that were previously impossible. Recent innovations in program applications and social software using Web 2.0 technologies (e.g., blogs, wikis, Twitter, YouTube, etc.) or social networking sites have made mobile devices more dynamic and pervasive and also promise more educational potential [3, 16, 17, 22-27].

2.1 The integration of Learner-Centered Teaching Strategies

If we want to achieve the essential understanding of the content of History teaching must contain various teaching strategies to stimulate motivation, study skills, learning skills, thinking skills, critical thinking to secondary school students. The strategy of "teaching history through inquiry" helps students move toward knowledge by engaging with the primary documents of the past. Crafting the right questions is the key step that ensures students learn to critically evaluate information. Teachers provide primary and secondary sources that confirm students' viewpoint and ask students to develop a new point of view based on the evidence. By forcing students to engage with all evidence, teachers can help them gain greater insight into History. The greatest challenge in teaching with the inquiry approach is taking the time to find the right sources. Students need the tools to distinguish the truth, to evaluate the information they encounter, based on where it comes from, who is producing it and when, its use of evidence, and its intended audience [13, 28].

Another significant strategy for teaching History is the strategy of "historical empathy" in order to succeed students' cognitive and affective engagement with historical figures to better understand and contextualize their lived experiences, decisions, or actions. Historical empathy involves understanding how people from the past thought, felt, made decisions, acted, and faced consequences within a specific historical and social context [13, 29, 30]. The process of forming affective connections to the past enables students to view historical figures as human beings who faced very human experiences and leads to a richer understanding than perspective taking alone [13, 29-33]. When we teach History, it is helpful to structure lesson plans aiming not only to educate students about particular topics such as global mass atrocities but to help them prevent possible future atrocities. Through the historical analysis we should be engaged to the moral and anti-racist education [13, 30].

Another useful teaching strategy is "project-based learning," (PBL) an overall approach to the design of learning environments. PBL is a model that organizes learning around projects. According to the definitions found in PBL handbooks for teachers, projects are complex tasks, based on challenging questions or problems, that involve students in design, problem-

solving, decision making, or investigative activities; give students the opportunity to work relatively autonomously over extended periods of time; and culminate in realistic products or presentations. Other defining features found in the literature include authentic content, authentic assessment, teacher facilitation but not direction, explicit educational goals, cooperative learning, reflection, and incorporation of adult skills [13, 34].

Finally, for analyzing visual sources, the integration of teaching strategies such as "visual literacy", "multimodal literacy", and "analyzing visual images and stereotyping" is necessary in order to lead students in a critical analysis of an image, and to help students develop and enhance observational, interpretive, and critical thinking skills. The exploration of visual sources and their multimodal messages enables students to deal constructively with complex modes of delivering information, and technology-based art forms. Students benefit doubly when they study traditional literary contexts and multimedia sources. Their understanding of the literary text is enriched and enhanced and they are encouraged to become more informed about the content [13, 35].

2.2 The integration of Information and Communication Technologies (ICT)

The integration of Information and Communication Technologies (ICT) is another very important factor for successfully teaching History. The teaching process consists of the handling of objects and tools, both material (e.g. devices, hardware, software, Internet, technology tools, worksheets) and symbolic (language, communication, interaction, cooperation of educators – students, and students amongst themselves). The students are divided into groups, with the teachers' guidance. Collaboration, as a role-playing game, engages the imagination and empathy of the students [3, 13, 22]. Students have to manage, in a variety of ways, the mobile devices and the ICT in general, as well as interactively participate in the learning process in an "open-ended software program" (Internet). The teaching and learning activities are combined with free and easy-to-use ICT tools needed to bring open educational resources into the classroom, to support a blended learning environment which combines face-to-face instruction with technology-mediated instruction and to enhance students' perceived technological competencies, while promoting their active engagement. A blended learning environment encourages active learning through the use of authentic instructional activities, interactive communities of learners and online learning tools and develops into a smart learning environment and a mobile learning environment as it combines cyber synchronous learning, mobile learning, social learning, and ubiquitous learning [3, 13, 16, 17, 22-24, 36-38].

Students interact with the content, resulting in a change in their cognitive structure, with the instructor, who guides and motivates learning, and with one another, motivating and helping one another to learn. In more detail, videos (moving images and sound) are used as an instructor in communicating facts but they also enable students to acquire research skills, collaborative working, problem solving, technology, and organizational skills [13, 39, 40]. Students combine information from a variety of sources to create multimedia presentations; they use online discussion groups/lists, to exchange opinions about historical themes; they also use Wikis to write essays sharing and collaborating with others. Wikis also permit both interaction and simultaneous work on the conjoined result, thereby removing the boundaries between the active author and the passive user of

content [13, 41, 42]. Students use Blogs where they discuss and comment various topics. Educational blogging is an effective tool for user centered, participatory learning [13, 43]. Students are also assigned to create a digital journal using online tools. In the case of History, the purpose of journal writing is to provide a space where students can connect their personal experiences and opinions to the concepts and events they are studying in the classroom. Teachers evaluate the journals based on criteria such as effort, thoughtfulness, completion, creativity, curiosity, and making connections between the past and the present [13, 44]. All the aforementioned free technology tools enable the groups of students to work together to complete their tasks. They have the advantage that anyone can contribute anytime, anywhere. Thus collaborative skills, skills in negotiation and organization, critical writing skills, and a sense of responsibility and ownership are developed. This way students are helped to reach Bloom's higher order skills: knowledge, comprehension, application, analysis, synthesis, and evaluation [13].

3. CONCLUSION

The evaluation of the learning process and results takes place in the end with the evaluative reports from the participants about the achievement of the lesson's objectives and the success of the activities (based on how well the students have incorporated the concepts discussed in class). Teachers evaluate students' understanding of the content; ability to relate and analyze primary and secondary sources; ability to situate the sources and their messages within the context of the historical events; ability to determine the central ideas or information of a primary or secondary source and provide an accurate summary that makes clear the relationships among the key details and ideas; ability to evaluate various explanations for actions or events; ability to determine the meaning of words and images as they are used in sources. Also teachers check for the: clarity with which the argument is presented; ability of the students to cite specific examples to support their analysis; active participation of all students (as group members and individually) [13].

4. REFERENCES

- [1] Levstik, L. S. and Barton, K. 2001. *Doing history: Investigating with children in elementary and middle schools*. Mahwah, NJ: Lawrence Erlbaum Ass. (246-261).
- [2] Peck, C. 2005. Introduction to the Special Edition of Canadian Social Studies: New Approaches to Teaching History. *Canadian Social Studies*. 39, 2 (Winter. 2005), Special Issue: *New Approaches to Teaching History*.
- [3] Vakaloudi, A.D. and Dagdilelis, V. 2016. The Transformation of History Teaching Methods in Secondary Education Through the Use of Information and Communication Technology (ICT). *International Journal of Historical Learning, Teaching and Research*. 13, 2 (Spring-Summer. 2016), 150-174; 151-152, 166.
- [4] Vakaloudi, A.D. 2003. *Teaching and Learning with Information and Communication Technologies – Theory and Practice*. Patakis, Athens. In Greek.
- [5] Engeström, Y. 1987. *Learning by expanding an activity-theoretical approach to developmental research*. Orienta-Konsultit, Helsinki.
- [6] Duffy, T.M. and Cunningham, D.J. 1996. Constructivism: Implications for the design and delivery of instruction. In D.H. Jonassen (Ed.), *Educational communications and technology* (pp. 170-199). Simon and Schuster Macmillan, New York, NY.
- [7] Poole, B.J. 1997. *Education for an information age. Teaching in the computerized classroom*. McGraw Hill, Boston.
- [8] Minami, M., Morikawa, H., and Aoyama, T. 2004. The Design of Naming-Based Service Composition System for Ubiquitous Computing Applications. In *Proceedings of the 2004 International Symposium on Applications and the Internet Workshops (SAINTW'04)* (pp. 304–312). IEEE Computer Society, Washington, DC.
- [9] Wu, H.K., Lee, S.W.Y., Chang, H.Y., and Liang, J.C. 2013. Current status, opportunities and challenges of augmented reality in education. *Computers & Education*. 62, 41–49.
- [10] Wu, P.H., Hwang, G.J., and Chai, W.H. 2013. An expert system-based context-aware ubiquitous learning approach for conducting science learning activities. *Journal of Educational Technology & Society*. 16, 4 (October. 2013), 217-230.
- [11] Hwang, G.J., Hung, P.H., Chen, N.S., and Liu, G.Z. 2014. Mindtool-Assisted In-Field Learning (MAIL): An advanced ubiquitous learning project in Taiwan. *Educational Technology & Society*. 17, 2, 4–16.
- [12] Hwang, G.-J. 2014. Definition, framework and research issues of smart learning environments – a context-aware ubiquitous learning perspective. *Smart Learning Environments*. 1, 4 (November. 2014). DOI = <https://slejournal.springeropen.com/articles/10.1186/s40561-014-0004-5>
- [13] Vakaloudi, A. D. 2020. Concepts of Propaganda: Educating Responsible Citizens by Integrating Multiple Intelligences and Learning Styles Into a Smart Learning Environment. In R. Zheng (Ed.), *Examining Multiple Intelligences and Digital Technologies for Enhanced Learning Opportunities* (pp. 184-214). IGI Global, Hershey, PA. DOI = 10.4018/978-1-7998-0249-5.ch010
- [14] Sutherland, R., Armstrong, V., Barnes, S., Brawn, R., Breeze, N., Gall, M., Matthewman, S., Olivero, F., Taylor, A., Triggs, P., Wishart, J., and John, P.† 2004. Transforming teaching and learning: embedding ICT into everyday classroom practices. *Journal of Computer Assisted Learning*. 20, 413–425.
- [15] Winters, N., Walker, K., and Rousos, D. 2005. Facilitating Learning in an Intelligent Environment. In *the IEE International Workshop on Intelligent Environments* (pp. 74-79; 74). Institute of Electrical Engineers, London.
- [16] Mikulecký, P. 2012. Smart Environments for Smart Learning. In *Proceedings of 9th International Scientific Conference on Distance Learning in Applied Informatics* (pp. 213-222; 217). Divai.
- [17] Vakaloudi, A.D. 2016. *The Teaching of History with the Use of Information and Communication Technologies*. K. & M. Ant. Stamoulis, Thessaloniki (152). In Greek.
- [18] Ashby, R. and Lee, P. 1987. Discussing the evidence. *Teaching History*. 48, 13-17.

- [19] Limón, M. 2002. Conceptual Change in History. In M. Limón and S. Mason (Eds.), *Reconsidering Conceptual Change: Issues in Theory and Practice* (pp. 259-289). Kluwer Academic Publishers, Dordrecht.
- [20] Tally, B. and Goldenberg, L.B. 2005. Fostering Historical Thinking with Digitized Primary Sources. *Journal of Research on Technology in Education*. 38, 1, 1-21; 1.
- [21] Smith, N. 2010. *The History Teacher's Handbook*. Continuum Intern. Publishing Group, New York, NY, 94-95.
- [22] Vakaloudi, A.D. and Dagdilelis, V. 2013. Differentiation in the teaching of Social Sciences with the development of Information and Communication Technologies. In *Proceedings of the 3rd International Conference on Cognitronics, The Science about the Human Being in the Digital World, a subconference of the 16th International Multiconference Information Society 2013* (vol. A, pp. 476-479; 476-478). (Ljubljana, October. 07 – 08, 2013).
- [23] Price, J.K. 2015. Transforming learning for the smart learning environment: lessons learned from the Intel education initiatives. *Smart Learning Environments*. 2, 16, 1-16; 4, 5, 13.
- [24] Kennah, M.R. 2016. *The Use of ICT in the Teaching and Learning Process in Secondary Schools: A Case Study of Two Cameroonian schools* (Master's Thesis). University of Jyväskylä.
- [25] Kearneya, M., Schucka, S., Burdenb, K., and Aubussona, P. 2012. Viewing mobile learning from a pedagogical perspective. *Research in Learning Technology*. 20. DOI = <https://files.eric.ed.gov/fulltext/EJ973806.pdf>
- [26] Sharples, M., Arnedillo-Sánchez, I., Milrad, M., and Vavoula, G. 2009. Mobile Learning. In S. Ludvigsen, N. Balacheff, T. de Jong, A. Lazonder, and S. Barnes (Eds.), *Technology-enhanced learning: Principles and products* (pp. 233-249). Springer, Dordrecht.
- [27] Park, Y. 2011. A Pedagogical Framework for Mobile Learning: Categorizing Educational Applications of Mobile Technologies into Four Types. *International Review of Research in Open and Distance Learning*. 12, 2 (February. 2011), 78-102; 78-79.
- [28] Lazar, S. 2011. *Teaching History Through Inquiry*. Education Week Teacher (November. 2011). DOI = http://www.edweek.org/tm/articles/2011/10/31/tln_lazar.html
- [29] Endacott, J. and Brooks, S. 2013. An Updated Theoretical and Practical Model for Promoting Historical Empathy. *Social Studies Research and Practice*. 8, 1 (Spring. 2013), 41-58.
- [30] Vakaloudi, A.D. 2017. From the holocaust to recent mass murders and refugees. What does history teach us?. *International Journal of Historical Learning, Teaching and Research*. 14, 2 (Spring-Summer. 2017), 119-149; 120-121.
- [31] Krajcik, J.S., Blumenfeld, P.C., Marx, R.W., and Soloway, E. 1994. A collaborative model for helping middle grade teachers learn project-based instruction. *The Elementary School Journal*. 94, 5, 483-497.
- [32] Thomas, J. 2000. *A Review of the Research on Project-Based Learning*. The Autodesk Foundation, San Rafael, California (1, 3).
- [33] Krajcik, J.S. and Blumenfeld, P.C. 2006. Project-based learning. In R.K. Sawyer (Ed.), *The Cambridge handbook of the learning sciences* (pp. 317–334). Cambridge, New York.
- [34] Helle, L., Tynjälä, P., and Olkinuora, E. 2006. Project-based learning in post-secondary education – theory, practice and rubber sling shots. *Higher Education*. 51, 287–314; 288.
- [35] Sullivan, S. 2007. Media and Persuasion: Techniques, Forms, and Construction. In M. Christel and S. Sullivan (Eds.), *Lesson Plans for Creating Media-Rich Classrooms* (pp. 173-176). NCTE, Urbana, IL.
- [36] Graham, C.R. and Dziuban, C. 2005. Blended Learning Environments. *Encyclopedia of distance learning*. DOI = https://www.researchgate.net/profile/Charles_Graham2/publication/267774009_Blended_Learning_Environments/links/54d522c30cf246475806fd8f.pdf
- [37] Fomichov, V.A. and Fomichova, O.S. 2017. The Student-Self Oriented Learning Model as a Paradigm for Supporting and Developing Emotional Intelligence and Creativity. In *Proc. of the 20th International Multiconference INFORMATION SOCIETY - IS 2017, Volume D. Kognitonika/Cognitronics. Uredila / Edited by Vladimir A. Fomichov, Olga S. Fomichova. 9.-13. oktober 2017/ 9th - 13th October 2017, Ljubljana, Slovenia*. Ljubljana : Jozef Stefan Institute, 2017. P. 11-16.
- [38] Fomichov, V.A. and Fomichova, O.S. 2019. The Student-Self Oriented Learning Model as an Effective Paradigm for Education in Knowledge Society. *Informatica. An Intern. Journal of Computing and Informatics*. 43, 1, 95-107.
- [39] Kinshuk, Chen, N.-S., Cheng, I.-L., and Chew, S.W. 2016. Evolution Is not Enough: Revolutionizing Current Learning Environments to Smart Learning Environments. *International Journal of Artificial Intelligence in Education*. 26, 2, 561-581.
- [40] Tang, B.C. 2005. Designing interactive e-learning activities to engage learners - A simple classification. In P. Kommers and G. Richards (Eds.), *Proceedings of ED-MEDIA 2005-World Conference on Educational Multimedia, Hypermedia & Telecommunications* (pp. 4092-4097). Association for the Advancement of Computing in Education (AACE), Montreal, Canada.
- [41] Elgort, I., Smith, A.G., and Toland, J. 2008. Is wiki an effective platform for group course work?. *Australasian J. of Educational Technology*. 24, 2, 195-210; 197-199.
- [42] Kurt, S. 2017. Wikis in Education: How Wikis are Being Used in the Classroom. *Educational Technology*. (September. 2017).
- [43] Farmer, B., Yue, A., and Brooks, C. 2008. Using blogging for higher order learning in large cohort university teaching: A case study. *Australasian Journal of Educational Technology*. 24, 2, 123-136; 124.
- [44] Journals in a Facing History Classroom. *Facing History and Ourselves*. N.D. DOI = <https://www.facinghistory.org/resource-library/teaching-strategies/journals-facing-history-classroom>

Indeks avtorjev / Author index

Brusić Teo	33
Catalfamo Elide	7
Christofidou Angela	11
Dhaini Mahdi	19
Fakhereldine Amin	19
Fomichov Vladimir A.	15
Fomichova Olga S.	15
Hamdan Sleiman	19
Haraty Ramzi A.	19
Jaber Mohammad	19
Jadžińska Monika	26
Karolina Ovijač	45
Kim Joonho	29
Krivec Jana	45
Liverić Dijana	33
Micarelli Rita	37
Oksala Tarkko	41
Panev Ida	50
Pizziolo Giorgio	37
Sertić Martina	54
Šupica Žaklina	33
Vakaloudi Anastasia D.	58

**IS
20
19**

Konferenca / Conference

Uredila / Edited by

**Kognitonika /
International Conference on Cognitonics**

Vladimir A. Fomichov, Olga S. Fomichova