TEL AVIV UNIVERSITY

ICOHTEC
International Committee for the History of Technology

IEEE
Advancing Technology for Humanity

HISTORY OF HIGH-TECHNOLOGIES AND THEIR SOCIO-CULTURAL CONTEXTS

The International Committee for the History of Technology (ICOHTEC)
42nd Annual meeting,
IEEE-HISTELCON 4th meeting

BOOK OF ABSTRACTS

The Lester and Sally Entin Faculty of Humanities
Cohn Institute for the History and Philosophy of Science and Ideas

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Welcome to Tel Aviv

On behalf of the local organizing committee for the 2015 joint meeting of ICOHTEC – IEEE-HISTELCON, it is a pleasure to welcome you – participants at the meeting to the city and university of Tel Aviv. As the range of talks at the conference show, the main theme of the meeting - the History of High-Technologies and their Socio-Cultural Contexts, stimulates many interesting subject of scholarly research. As always with ICOHTEC meetings, the subjects at the conference go beyond this theme to many other issues in the history of technology. With more that a hundred participants from twenty-five countries, with diverse backgrounds in history and engineering the conference offers a wide range of perspectives, approaches and methods. We hope that you will find the stimulating, and use the formal and informal opportunities for intellectual exchange. The social programme, including a tour to the desalination plant and archaeological site and a Jazz evening will provide such opportunities. We hope you will enjoy the conference and your time in Israel!

Yoel Bergman and Shaul Katzir

The Conference is hosted by the Cohn Institute for the History and Philosophy of Science and Ideas, the Lester and Sally Entin Faculty of Humanities, Tel Aviv University.

We are grateful for the support of:

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Overview Programme ICOHTEC – HISTELCON 2015

	09:30-11:00	11:00-11:30	11:30-13:00	13:00-14:30	
Sun 16th					
Mon 17th	**A.** Encoding/ decoding – the communication of technological invention **(R. 278)** **B.** social history of military technology (1) **(R. 277)**	**Coffee break**	**A.** Environment, climate and communication information **(R. 278)** **B.** Soc. Hist. military tech (2) **(R. 277)** **C.** Inventing, producing and popularizing **(R. 279)**	**Lunch break**	
Tue 18th	**A.** Digitalization,computers, energy & its cultural impact **(R. 278)** **B.** Soc. Hist. military tech (4) **(R. 277)** **C.** Labour-power shifting perspectives **(R. 279)** **D.** Regional history studies I – Japan **(R. 280)**	**Coffee break**	**Plenary session:** computar meets human **(R. 282)**	**Group 1: 13:00-19:00: Lunch and a tour** **Group 2: 13:00-14:00: lunch 14:00-19:00: tour**	
Wed 19th	**Keynote lecture:** Turing machine to Turing's computer **(Hall 144)**	**Coffee break**	**A.** medical technology & measuring equipment **(R. 278)** **B.** Soc. Hist. military tech (5) **(R. 277)** **C.** Different approaches to innovation **(R. 279)** **D.** Regional studies II – Europe **(R. 280)** **E.** Human factors in the history of technology **(R. 305)**	**Lunch break**	
	09:15-11:00		11:30- 13:15		
Thu 20th	**A.** Universality in computational theory **(R. 278)** **B.** Conceptuali-zing modernity in architecture **(R. 279)** **C.** The history of israeli hi-tech **(histelcon)**	**Coffee break**	**A.** evolution of air pollution: valley of Mexico **(R. 278)** **B.** Making music, drawing art works, creating new environments **(R. 279)** **C.** The history of israeli hi-tech **(histelcon)**	**Lunch break**	

	14:30-16:00	16:00 -16:30	16:30-18:00	19:00-21:00
		Registration		18:15 **Kranzberg lecture** **(Hall 144)**; reception
	Plenary session: alternative concepts of mobility **(R. 282)**	**Coffee break**	**A.** Knowledge, creativity & engineering **(R. 278)** **B.** Soc. Hist. military tech **(R. 277)** **C.** Develop-ment of oil & gas techno-logies **(R. 279)**	
	Tour			
	A. Structured invention & inno-vation **(R. 278)** **B.** Soc. Hist. military tech (6) **(R. 277)** **C.** Innovation in the wake of war **(R. 279)** **D.** High techno-logy in Infra-structure **(R. 280)** **E.** History of computing & related components **(R. 220)** **F.** History of telecom **(R. 305)**	**Coffee break**	16:30-17:30 **Daumas prize** winner's session **(R. 282)** 17:45-18:45 **Icohtec prize** for young scholars **(R. 282)**	**Jazz night** at the cymbalista jewish heritage center, Tel Aviv university
	14:30-17:00	17:00-18:00		19:30-22:00
	A. Icohtec general assembly (R. 279) **B.** The history of israeli hi-tech **(histelcon)**	**Cocktail offered by IEEE Israel section**		**Gala dinner –** **Goshen resteraunt:** 37,nachalat binyamin street, tel aviv.

All sessions will be held at the Gilman Building, Tel Aviv University.

Sunday, 16th August 2015

18.15–22.00

Opening Ceremony followed by Kranzberg Lecture and Reception (Hall 144)

Greetings

Moderator: Shaul Katzir (Tel Aviv University)

Timo Myllyntaus (President of ICOHTEC)

Yaron Oz (Rector of Tel Aviv University)

Yoel Bergmann (Chair of the Local Organizing Committee)

Martin Bastiaans (Past Director – IEEE Region 8)

Christopher Neumaier (Chair of the Program Committee)

Kranzberg Lecture

Robert Fox (University of Oxford)
Mentality or Circumstance? The Dilemmas of Science-Based Industry in France, 1870–1920

Monday, 17th August 2015

09.30–11.00

A Session: Encoding and Decoding – the Communication of Technological Invention (Room 278)

Chair: Maria Elvira Callapez (CIUHCT-FCUL) 18

Elena Helerea (Transilvania University of Brasov) 18
Dragomir Hurmuzescu (1865–1954) – Promoter of High-Communication Technique in Romania

Omer Keynan (Bar Ilan University/ Tel Aviv University) 18
Therapeutic Dimension in Virtual Discourse

Boaz Miller (The Hebrew University of Jerusalem/Bar Ilan University) / Stav Kaufman / Ehud Lamm (Tel Aviv University) 19
From Market-Basket Analysis to Individual Profiling: Big Data, Association Rules, and Privacy, 1989–2001 19

B Session: Tenth Annual ICOHTEC Symposium on the Social History of Military Technology (1) (Room 277)

Organizer: Bart Hacker (Smithsonian Institution); Co-Organizer: Ciro Paoletti (Italian Commission of Military History) 19

Sandy Kuttler (Independent scholar, Israel) / Hadas Marcus (Tel Aviv University) 19
The Sling: An Overlooked "Poor Man's Weapon"

11.00–11.30 Coffee Break

11.30–13.00

A **Session: Environment: Climate Change and the Communication of Information (Room 278)**

B **Session: Tenth Annual ICOHTEC Symposium on the Social History of Military Technology (2) (Room 277)**

C **Session: Inventing, Producing, and Popularizing High Tech (Room 279)**

13.00–14.30 Lunch Break

14.30–16.00

Plenary Session: Alternative Concepts of Mobility (Room 282)

16.00–16.30 Coffee Break

16.30–18.00

A Session: Knowledge, Creativity & Engineering (Room 278)

B Session: Tenth Annual ICOHTEC Symposium on the Social History of Military Technology (3) (Room 277)

C Session: Development of Oil and Gas Technologies for Improving the Economic and Political Situation of Countries and Regions (Room 279)

Organizer: Eldar Movsumzade (Ufa State Petroleum Technological University)
Chair: Christopher Neumaier (Centre for Contemporary History Potsdam) 28

Eldar Movsumzade / Olga Poletaeva (Ufa State Petroleum Technological University) 28
The Influence of the Political and Economic Situation on the Development of Alternative Sources of Hydrocarbons

Boris Mastobaev (Ufa State Petroleum Technical University) 29
Development of Techniques and Technologies of Ensuring Stable Operation of Oil Pipelines

Rim Teregulov (Ufa State Petroleum Technical University) 29
The Liquefied Natural Gas (LNG) Market in the Perspective of the Present and Future World Gas Supply

Pavel Revel-Muroz (JSC «TRANSNEFT») 30
Development of Energy Saving Technologies in Oil Pipeline Transportation

Tuesday, 18th August 2015

09.30–11.00

A Session: Digitalization, Computers, Energy and Its Cultural Impact on Humans (Room 278)

Chair: Maria Luisa Sousa (CIUHCT-FCT/UNL-NOVA) 30

Galit Wellner (Ben Gurion University of the Negev) 30
The Cellular Age: History of the Cellphone as a Memory Prosthesis

Mathias Mutz (RWTH Aachen University) 31
The Computer as Time Machine. Changing Concepts of the Computer and its Effect on Time-Keeping Since the 1960s

Robert Belot (Université de Technologie de Belfort-Montbéliard) 31
The Atom as a Utopia and a Theophany for France After the Second World War

B Session: Tenth Annual ICOHTEC Symposium on the Social History of Military Technology (4) (Room 277)

Organizer: Bart Hacker (Smithsonian Institution); Co-Organizer: Ciro Paoletti (Italian Commission of Military History) 32

Philipp Aumann (Peenemünde Historical Technical Museum, Germany) 32
Vision and Tradition: Rocket Development as a Cultural Revolution in the History of German Armaments

Brian E. Crim (Lynchburg College, Virginia) 32
From Peenemünde to Huntsville: German Specialists and the Culture of Cold War Science

Vasily Borisov (Russian Academy of Science, Moscow) 33
Russian Electronics between the Military-Industrial Complex and the Market

C Session: Labour-Power: Shifting Perspectives (Room 279)

Chair: Elena Helerea (Transilvania University of Brasov) 33

Eike-Christian Heine (Universität Stuttgart) 33
Shovel Work: The Production Process of Earthwork and the Body of the Navvy in the 19th Century

Marina Cionca (Transilvania University of Brasov) 34
Losing Skilled Labor in the Strive for New Technologies. A Case Study

Liliia Zemnukhova (Russian Academy of Sciences; European University at St. Petersburg) 34
When Professional Community Changes the Rules: the Case of the Russian IT Sphere

D Regional History Studies I—Japan (HISTELCON) (Room 280)

Chair: Michael Geselowitz (IEEE History Center) 35

Michael Geselowitz (IEEE History Center) / Jacob Baal-Schem (IEEE Region 8/Israel Section) 35
Welcome to HISTELCON 2015

Isao Shirakawa (University of Hyogo) 35
History of Japan's First Commercial Hydroelectric Generation at Keage Power Station

Isao Shirakawa (University of Hyogo) 36
History of Development of the Map-Based Automotive Navigation System 'Honda Electro Gyrocator'

11.00–11.30 Coffee Break

11.30–13.00

Plenary Session: Computer Meets Human (Room 282)

Chair: Dick van Lente (Erasmus University Rotterdam) 36

Janine Noack (Centre for Contemporary History Potsdam) 36
The Role of Cold War Computer Technology in East and West German Militaries (1960s–1980s)

Julie Wosk (State University of New York, Maritime College) 37
Female Robots and Androids: Changing Technologies and Cultural Views

Matthias Heymann / Dania Achermann (Aarhus University 37
When High Tech Meets Science: How the Computer Challenged Climatologists

13.00–14.00: Lunch Break

13.00/14.00–19.00

Tour – Sorek Desalination Plant and caves at "Bet Guvrin" National Park

First group leaves at 13:00, second group leaves at 14:00)

Wednesday, 19th August 2015

09.30–11.00

Keynote Lecture

11.00–11.30 Coffee Break

11.30–13.00

A Session: Designs on Medical Technology and Measuring Equipment Coupled with Its Application

B Session: Tenth Annual ICOHTEC Symposium on the Social History of Military Technology (5)

C Session: Different Approaches to Innovation

D Regional Studies II—Europe (HISTELCON)

E Human Factors in the History of Technology (HISTELCON)

13.00–14.30 Coffee Break

14.30–16.00

A Session: Structured Invention and Structuring Innovation

F History of Telecom (HISTELCON)

16.00–16.30 Coffee Break

16.30-17:30

Daumas Prize Winner's Session

Stefan Krebs: Dial Gauge Versus Senses 1-0: German Car Mechanics and the Introduction of New Diagnostic Equipment, 1950–1980 (Technology & Culture, April 2014)

Chair: Susan Schmidt Horning (St. John's University, NYC)

Hans Joachim Braun (Helmut Schmidt Universität Hamburg)

Christopher Neumaier (Centre for Contemporary History Potsdam)

17.45-18.45

ICOHTEC Prize for Young Scholars

Karena Kalmbach, Meanings of a Disaster: The Contested 'Truth' about Chernobyl. British and French Chernobyl Debates and the Transnationality of Arguments and Actors (dissertation completed in September 2014 at the European University Institute, Florence)

Chair: David Zimmerman (University of Victoria)

Mogens Rüdiger (Aalborg University Denmark)

Noah Efron (Bar Ilan University)

Karen Kalmbach (FU Berlin)

19.00–21.00 Jazz Night at the Cymbalista Jewish Heritage Center, Tel Aviv University Campus

Thursday, 20th August 2015

09.15–11.00

A **Session: Universality in Computational Theory (Room 278)**

Organizer/Chair: Arie John Mor-Wurm (Achva Academic College) 58

Arie John Mor-Wurm (Achva Academic College) 58
Universality in Leibniz Theory

Oded Koren (Shenkar - Engineering. Design. Art) 59
From Charles Babbage's Analytical Engine to Turing's Imitation Game

Boaz Tamir (Bar Ilan University) 59
Universal Circuits in Classical and Modern Computers

Israel Belfer (Ben-Gurion University of the Negev) 59
From Mathesis Universalis to Universal Information

B **Session: Conceptualizing Modernity in Architecture (Room 279)**

Chair: Slawomir Lotysz (Polish Academy of Sciences) 60

Piotr Marciniak (Poznan University of Technology) 60
In Pursuit of Modernity: Architecture and Computers in Communist Poland (1945–1989)

Agnieszka Rumież (Poznan University of Technology) 60
How to Tame Mathematical Methods in Architectural Design

Bartha Biborka (Transilvania University of Brasov) 61
Integration of Vernacular Concepts in the Development of Romanian High-Tech Rural Communities

Victoria V. Cotorobai / Liviu-Alexandru Sofonea (Technical University Gheorghe Asachi from Iasi) 61
High Tech & Paradigm Shift in Buildings Areas

C **The History of Israeli Hi-Tech from a Personal Perspective 1955–2015: The Origins (HISTELCON)**

Chair: Arie Braunstein (Tel-Aviv University) – IEEE Israel Past Chair

Jacob Baal-Schem (Tel-Aviv University): Enablers of Israel Technology

Raya Leviathan (Tel Aviv University): The WEIZAC: First Israeli Computer

Joseph Shapira (Comm&Sens): The Development of EMC Systems

Elisha Yanay (Association of Electronics & Software Industries): Motorola Israel: An industrial pioneer

11.00–11.30 Coffee Break

11.30–13.15

A Session: Presence and Evolution of Air Pollution Damage on Vegetation in the Valley of Mexico: Historical Summary (Room 278)

B Session: Making Music, Drawing Art Works, Creating New Environments (Room 279)

C The History of Israeli Hi-Tech from a Personal Perspective 1955–2015: The Origins: Achievements (HISTELCON)

13.15–14.30 Lunch Break

14.30–17.00

A **ICOHTEC General Assembly (Room 279)**

B **The History of Israeli Hi-Tech from a Personal Perspective 1955–2015: Homage to Founders – Presentation of Certificates and Lectures of Recipients (HISTELCON)**
Moderator: Peli Peled

17.00–18.00 Cocktail Offered by IEEE Israel Section

19.30–22.00 Gala Dinner

Monday, 17th August 2015

09.30–11.00

A Session: Encoding and Decoding – the Communication of Technological Invention (Room 278)

Chair: Maria Elvira Callapez (CIUHCT-FCUL)

Elena Helerea (Transilvania University of Brasov)

Dragomir Hurmuzescu (1865–1954) – Promoter of High-Communication Technique in Romania

A history of High-Technology is, first of all, a history of the people who laid the bases of the scientific knowledge in the world and society, and who developed ever more advanced instruments, with a view to supporting life on Earth. A sequence in the history of advanced technologies, which revolutionized the economic, politic and socio-cultural systems in Romania, resides in the development of the radio communications, in the years 1924-1928, when the radio transceiver systems, as well as the new models of radio devices, with vacuum tubes, were launched on the market- cheaper and capable to ensure a more faithful reception. The paper analyzes the development conditions of the radio broadcasting in Romania, as well as the contributions brought thereto, by one of the most important personalities, namely D. Hurmuzescu (1865-1954)- professor, researcher and founder of the Romanian Electrotechnics School. Dragomir Hurmuzescu's merits in introducing and developing radio broadcasting, in Romania, are linked to the establishment of the first radio broadcasting section at the Electrotechnical Institute, within the University of Bucharest. In 1925, under Dragomir Hurmuzescu's guidance, the first radio receiver is built and put into operation, which enables listening to public broadcasts. The paper discusses the investigation sources- documents in the National Archives, in the Archives of the Romanian Academy, in magazines of that time, under titles, such as: "What shall we expect from the year to come" (January 1st, 1931), or "Opinions on the development Program of the Romanian radio broadcasts" (June 21st, 1931). The paper also describes the authors' contribution in designing and implementing the site promoting this pioneer of radiotechnics and new technologies, who is celebrated, this year, on the occasion of 150 years since his birth.

Omer Keynan (Bar Ilan University/ Tel Aviv University)

Therapeutic Dimension in Virtual Discourse

Subjects who disclose their feelings, thoughts and memories of serious personal events often post accounts of these events on blogs and social media sites. Examples of disclosure issues include domestic violence and rape. This paper is about the discourse of which these subjects are involved. I was interested in exploring what emanates from the discourse initiated by the exposed subjects. To do so, I conducted in-depth interviews with subjects who posted about serious personal events. Additionally, I analyzed posts utilizing both text and film-based mediums, in both Hebrew and English. My research suggests that internet disclosure is a process that consists of three major steps: 1. generating the motivation to be exposed, by the posts, to internet surfers. 2. Writing and distributing posts concerning the event, on blogs and social media sites. 3. Interaction between the exposed subject and the internet community- responses from Internet surfers about the posts, and the act of processing the responses by the subject. I argue that statements made by the interviewees reflect a therapeutic discourse, one which frames the process of internet disclosure as a means of releasing or coping with difficult feelings and experiences. The thesis demonstrates that with the emergence of virtual communities, there has been a concomitant expansion of therapeutic discourse interpersonal space to cyberspace. Therapeutic discourse exists beyond face-to-face meetings and non-verbal interactions.

Boaz Miller (The Hebrew University of Jerusalem/Bar Ilan University) / Stav Kaufman / Ehud Lamm (Tel Aviv University)

From Market-Basket Analysis to Individual Profiling: Big Data, Association Rules, and Privacy, 1989–2001

The data-mining technology of association-rules or market-basket analysis algorithms is used in commerce for profiling a customer, inferring unknown properties of her, or predicting her behavior, potentially raising ethical concerns. Yet when researchers at IBM first introduced association rules in 1993, this was in the context of traditional retailing. They did not engage with the algorithms' potential for profiling. Only subsequent scientific literature addressed profiling, but ethical issues, specifically about privacy, were initially neither addressed nor seen as requiring technical or algorithmic solutions. Although the currently prevailing view that algorithms may best handle privacy preservation emerged in the mid 1990's by some of the same actors, it has no trace in the early association-rules literature. In explaining this puzzling historical narrative, we introduce an approach for intellectual history of algorithms. We classify conceptualizations of computational problems and their respective solutions into three spheres, varying in their generality level and professional context. We argue that scientists have maneuvering room deciding which elements of a problem belong to which sphere. Drawing on this methodology and interviews with the practitioners, we show that while profiling motivated association-rules algorithms development, profiling and privacy protection were never conceptualized as part of the generalized problem category. This suggests that the technology affected the emerging notion of privacy while at the same time technological developments responded to this conceptualization. This illustrates how intellectual history of algorithms can reveal contingent social, institutional, and intellectual forces in the evolution of computer technologies and their surrounding socio-technical practices.

B Session: Tenth Annual ICOHTEC Symposium on the Social History of Military Technology (1) (Room 277)

Organizer: Bart Hacker (Smithsonian Institution); Co-Organizer: Ciro Paoletti (Italian Commission of Military History)

Sandy Kuttler (Independent scholar, Israel) / Hadas Marcus (Tel Aviv University)

The Sling: An Overlooked “Poor Man’s Weapon”

The humble sling—one of the earliest known weapons—originated around 10,000 BC. This apparently simple, handmade means of defense, relatively uncomplicated and inexpensive to create, yet requiring great skill in its successful operation, has been largely overlooked as a component of warfare that was ubiquitous for centuries throughout much of the world. Thelow-tech sling was suffused with great social and historical significance that went far beyond military purposes, including non-lethal functions to protect civilians and the flocks of shepherds, from antiquity until today. This primitive device has garnered a timeless, emotionally-laden status with symbolic, heroic, political and strategic connotations on both sides of the Middle East conflict. A name such as *David’s Sling*, a new technology meant to reinforce the second tier of Israel's theater missile defense system, echoes the biblical account of David’s audacious slaying of the gargantuan Goliath, armed with only a primitive hand weapon, thus defying the odds against him. The aim of this paper is to review previous literature based on archeological, ethnographic and military evidence re-examining the various social aspects of the sling in Israel and other areas of the Middle East, in both ancient and modern times. We will also discuss the various forms and uses of stone and sling technological design (ranging from Wadi Rabah to the Palestinian territories today) and their social implications in warfare.

David Zimmerman (University of Victoria)

Technological Determinism and Military History: A Post-Industrial Revolution Perspective

Debunking military technological determinism has become a small industry undertaken by ancient, medieval, and early modern military historians. The withering intellectual cannon fire of historians such as Kelly DeVries, John Lynn, Jeremy Black, and Bernard Bacharach, among others, have breached the walls of even the most formidable theses that placed technology as the central causal factor in military history. Among the hypotheses breached and sacked by the anti-determinists are: Lynne White's argument that the invention stirrup led to the dominance of the knight; Geoffrey Parkers' postulation of an early modern Military Revolution caused by the development of the *Trace Italienne* fortress; and, Robert Drew's theory that the catastrophic collapse of Aegean societies at the end of the Bronze Age was caused by people wielding new types of iron swords and javelins to outmatch war chariots. Yet, with all these great sweeping deterministic theories ground into nothing more than intellectual dust, how are we to understand the role of technology in war? What are we to make of the rapid and seemingly decisive technology change that has occurred since the end of Napoleonic wars. What is left from the wreckage of anti-determinism is that there no clear picture of the role played by technology either in war or the development of military institutions and there relationships with civil society. My paper will challenge the pre-modern anti-determinists, and present new post-industrial approaches to the study of war and technology.

11.30–13.00

A Session: Environment: Climate Change and the Communication of Information (Room 278)

Chair: Galit Wellner (Ben Gurion University of the Negev)

Anthony Nicholas Stranges (Texas A&M)

Guy Callendar and Gilbert Plass, Pioneering Proponents of Global Warming

The history of global warming falls into three time periods. Period one, 1800-1900, saw the introduction of a changing atmosphere-changing climate theory. In period two, 1900-1940s, the scientific community lost interest in the changing atmosphere-changing climate theory. Period three, 1950s-2000s, witnessed a revival of interest in the changing atmosphere-changing climate theory and a recognition that carbon dioxide (CO2) emissions contributed to global warming. Guy Callendar (1898-1964), a steam engineer and amateur meteorologist in England, and Gilbert Plass (1920-2004), an American physicist, represent the transition from the 1900-1940s denial period to the 1950s-2000s period that acknowledged the reality of global warming. Callendar believed humans caused global warming, and beginning in 1938 he provided experimental evidence from global temperature readings that showed the connection between an increasing atmospheric temperature and the increasing consumption of coal. He used the new instrumentation of infrared spectroscopy to establish the presence of methane and water vapor as greenhouse gases. Plass took the next step. His infrared spectroscopic investigations and computer modeling proved the independent effect of water vapor and carbon dioxide on global warming. Plass published remarkable predictions in the 1950s about future atmospheric temperature increases resulting from increasing CO2 concentrations and showed that contrary to prevailing scientific opinion the oceans would not absorb all the human- generated fossil fuel emissions. Together Callendar's and Plass's revitalization of global warming research paved the way for the next group of investigators that included Roger Revelle, Charles Keeling, and James Hansen.

Petter Wulff (Swedish Defence Research Agency)

Climate Change – a Role for History?

In the majestic work Global Crisis: War, Climate Change & Catastrophe in the Seventeenth Century historian Geoffrey Parker describes the era of "the little ice age". He tells a dismal tale of droughts, frosts and floods in various parts of the world that left millions to suffer. Many starved to death, others perished in the revolts and revolutions accompanying the adverse weather. America, Europe, Russia and China- all were hit by weather extremes, and they may have taken a toll of as much as a third of the world's population. Backed up by such drastic demographic facts, Parker points to the parallel with the situation today. He sees a critical choice "either to invest now to prepare for inevitable natural disasters or instead wait to pay the far higher costs of inaction". It is a bold statement of an historian wishing history to be of practical help. How then could history help politicians find a path of climate resilience? Beyond showing the high cost of a wait-and-see attitude, Parker also points to a positive example. Japan was exceptional in having a considerable population increase during the years of general demographic catastrophe. This is of great interest as is his indication that it had something to do with technology. History of Technology should, in other words, be of special interest in this context. My presentation will discuss in what ways its perspective on the past may be a guide to a climate-resilient future.

Hadas Marcus (Tel Aviv University)

Ecocinema: Portraying Technological Encroachment and Alienation from Nature

Global events have led to the dissemination of urgent messages linked to rampant environmental degradation; in particular, loss of habitat, climate change and toxic pollution as a result of the widespread encroachment of technology threaten the future survival of all species. This frightening realization "a crucial prerequisite to instigating awareness and promoting sustainable lifestyles" has permeated contemporary arts and media. The aim of this paper is to explore feelings of solastalgia (Albrecht), or the grief experienced over altered environments, through ecocinema, films with ominous environmental messages. Dazzling scenes of pristine wilderness and thriving ecosystems have been largely superseded by alarming representations of anthropogenic (human caused) damage to nature. Activist films focus on many disturbing topics related to the destruction of the environment which play a vital role in political debates and in motivating audiences. Edward Burtynsky's Manufactured Landscapes depicted nightmarish scenes of dehumanized, heavily contaminated industrial zones, and Al Gore's grim An Inconvenient Truth terrified audiences with predictions of global warming, followed by a spate of other films that have further promulgated fear to instigate effective action. In Trashed, aristocratic Jeremy Irons narrates from a mammoth garbage heap as he embarks on a heartbreaking expedition, and Earthlings shocked viewers with gruesome images of factory farms, mechanized slaughterhouses and animal torture. Does ecocinema merely sell tickets for sinister entertainment, or is it a catalyst for real social transformation and political change? We will explore why popular ecological "disaster films", meant to elicit a potent emotional response, have become a burgeoning industry.

B Session: Tenth Annual ICOHTEC Symposium on the Social History of Military Technology (2) (Room 277)

Organizer: Bart Hacker (Smithsonian Institution); Co-Organizer: Ciro Paoletti (Italian Commission of Military History)

Seymour E. Goodman (Georgia Tech)

Absorbing Information Technologies into the Field Armies of the American Civil War

By the time of the American Civil War, there were many forms of information technologies available for use in large-scale field armies that were either not available or not extensively used in the Napoleonic Wars. Among these were five types of telegraph, including two that used electrical transmission, and several forms of optical technologies and paper-based media. Some of these technologies were quickly or gradually effectively absorbed into the field operations and logistics of the armies and the daily lives of a sizable fraction of the soldiers throughout the ranks. Others were not. They all required substantial forms of enabling and supporting infrastructures. Explanations will be sought from the ways American society had changed as the industrial revolution progressed in the decades before the war, the interfaces between the technologies and their human and organizational users, and from the network externalities that surrounded the field armies.

Ciro Paoletti (Italian Commission of Military History)

A Problem of Weight and Speed: Italian Bombing from Airships to Airplanes, 1911–1916

In 1908 the first Italian military airship flew. In 1911–1912 airships were used in Libya as bombers. They proved useful, which induced Army and the Navy general staffs toward planning extensive use of airships as bombers. This required substantial ground facilities, but their speed, good payload, and long-range operability rendered airships a major asset in wartime. No surprise that in 1915 Italy foresaw a wide use of airships, especially against Austrian naval bases on the eastern Adriatic coast. But early experience demonstrated airships to be much more vulnerable than expected, especially to antiaircraft gunnery. At the same time, air engineer Gianni Caproni, supported by Col. Giulio Douhet, successfully tested an airplane designed as a bomber. When used in war, the Caproni biplanes, and later their improved tri-plane versions, were outstanding successes—faster than airships and comparable in payload, but requiring much less ground facilities and much cheaper in cost, men, fuel, and materials. They were also operationally more flexible than airships and better able to evade antiaircraft fire or enemy fighters. During World War I, Caproni bombers were sold to the Italian, French, US, and British Air Corps. They were the most used widely Allied bomber (1,100 aircraft made between 1915 and 1918), a milestone along the route from airships to airplanes, and a significant step in the history of flight in Italy.

C Session: Inventing, Producing, and Popularizing High Tech (Room 279)

Chair: Slawomir Lotysz (Polish Academy of Sciences)

Dick van Lente (Erasmus University Rotterdam)

The Philips Electronics Company as a Popularizer of High Tech

The Philips electronics firm in Eindhoven, which had started in 1891 as a producer of light bulbs, had by the end of WWII diversified into Xray machinery and radio receivers, and kept turning out more new products, e.g. television receivers and recording and transmission technology, military communication,

and its great pride, the CD, to name but a few. At the core of this technological creativity was the famous Natlab, or laboratory of physical research, which had started in 1914 and employed very gifted scientists. In its advertising at the general consumer after WWII, Philips emphasized its high tech profile, which fit well into the widespread imagery of reconstruction and modernity. Together with KLM airlines and the large polder and dam construction projects, Philips became a symbol of Dutch technological prowess. It also became a very visible propagandist for this technological modernism, both via its well-designed consumer products such as tv and transistor radio sets, shavers and UV lamps, and through its widely spread advertisements. the most impressive expression of this technological optimism was the futurist, flying saucer-shaped exhibition building, called Evoluon, which opened in 1966 on the occasion of the firm's 75th anniversary. It featured a wide range of hands-on exhibits of the latest electronic technology aimed at the general public. At this time the tide of technological optimism was beginning to turn, and one of Philips' aims was to counteract the rising technological pessimism. The paper analyses and contextualizes the thinking behind the design of this building and its public reception, using the Philips Company Archives as a major source.

Wolfgang König (TU Berlin)

On the Co-Construction of Technology and Culture: The Condom’s Difficult Path to Become a High-Tech Product

In my opinion, it is problematic to reserve the term "High-Tech" to electronic devices. It makes more sense using it for products which fulfill ambitious, complex and sometimes contradictory requirements. The main contradictory demands with the condom are that it should be safe for protection but also thin for enabling sensation. The rubber condom was invented in the middle of the 19th century but it did need until the 1980s when it became a high-tech product in that sense. The most important developments of this high-tech condom were: - the dipping process of manufacturing, - automated conveyor systems of production, - the replacement of the rubber by the latex condom, - individual testing of each item, - standards for guaranteeing quality. My paper's main thesis is that these quality elements were developed rather late because of a couple of cultural and social obstacles like - the acceptance of the usage for extramarital intercourse, birth control, and in the context of prostitution, - the legal and juridical treatment of particularly the condom's promotion, - the condom industry's structure. The interrelation between the condom's technological development and the cultural and social context will be demonstrated by the example of Germany since 1900 respectively the Federal Republic. In my opinion, the paper would fit into the subthemes 1. High Technology as a Time- and Place-Bound Concept, and also in 2. Inner Momentum of Technological and Scientific Developments vs. the Impact of Social and Cultural Forces.

Shaul Katzir (Tel Aviv University)

Differences Between Commercial and Academic Drawings in Research Notebooks

In this talk I will show that styles and connected uses of notebooks' drawings differed between researchers working in commercial versus academic settings in early 20th century physical science and engineering. For the latter, drawings served mainly for personal reference: for future use in repeating or modifying the setting and in analyzing and publishing the results. Industrial researchers used drawing for these aims but beyond that, they employed drawing to present their work for colleagues and to secure their claims for patents. It became a potentially public record. Academic scientists also worked on inventions, but they did not share the same practices of defending their patentable ideas with their colleagues who worked in commercial environment. Consequently industrial researchers put more efforts in producing clear neat drawing, which also provided more details about the experimental setting, and its various stages than independent academic scientists, who provided fewer, less detailed and more sketchy drawing, yet these

better reveal failures and modifications. The talk will be drawn on examples from research and development on piezoelectricity and electronics between 1915 and 1930. I use the notebooks of the academic scientists Ernest Rutherford and Walter Cady, related respectively to methods of submarine detection and of crystal frequency control. I compare them to the notebooks of researchers working at AT&T's research branch on related problems. I regard the talk as an opportunity to collect examples from other periods and areas that may support or undermine my claim.

14.30–16.00

Plenary Session: Alternative Concepts of Mobility (Room 282)

Chair: Timo Myllyntaus (University of Turku)

Daniel Uziel (Haifa University/Ben Gurion University)

The Aviation Industry of the Third Reich as a High-Tech Industry

The aviation industry of the Third Reich not only produced advanced technology products. It also represented social and corporate modernism. The spirit of modernism prevailing in this branch set it apart from the rest of the German industry and turned it into a predecessor of the contemporary high-tech industry. This paper will discuss two main aspects of this modernity. 1) The self-image of this branch as an industrial elite determined to a large extent the working environment and working relations in most aviation-related firms. For instance, most of the new aircraft and aero-engine factories constructed in Germany from the mid-1930s were state of the art complexes. They included recreation facilities, sport facilities and modern cafeterias. Employment contracts offered the workers dental care, healthcare, affordable modern housing and other amenities typical of today's high-tech industry. In this respect the aviation industry represented the ideals of the Nazi regime regarding technological and industrial modernism. 2) The aviation industry and the Nazi state made huge investment in R&D of new aviation technologies. This unique characteristic resulted in a large number of advance aviation technologies developed by firm-based R&D teams. These developments benefited also from the close cooperation between firms and state or university owned R&D institutes. This paper is based on extensive research of firm files, official documents and Allied technology intelligence reports. It also places the topic in the current discourse of modernism and social engineering in Nazi Germany.

Maria Elvira Callapez (CIUHCT-FCUL) / Maria Luisa Sousa (CIUHCT-FCT/UNL-NOVA)

Disciplining the Poor's Mobilities during Portuguese Dictatorship Discourses on Professional Drivers and on Pedestrians (1930s–1950s)

This paper addresses the production of discourses on the mobility practices of the poor people as a form social control during the first two decades of the Portuguese dictatorship Estado Novo (1930s-50s). On the one hand, we analyze specifically the production of discourses on professional motorists and pedestrians by elite automobile clubs (like the Automobile Club of Portugal) and their private motorists, as a way of disciplining street's use. On the other hand, we focus on the discourse by the public health concerned organizations (like the Portuguese League for Social Prophylaxis) about bear feet pedestrians as a way of preventing diseases, namely tetanus. Both speeches built under safety discourses (some supported by educational campaigns) were not neutral, but produced norms, prescriptions on adequate behaviors and power relations. These discourses had a reflex at two levels: the level of regulation and the level of representations. At the level of regulation, we include the regulation of circulation, like the highway codes, or municipal laws for the mandatory use of shoes. Those who broke the law had the consequent penalty. At the level of representations, we consider the promotion of social order as well as the improvement of the country's public image (by hiding poverty) for nationals and foreign tourists fostered by the dictatorship.

These disciplining discourses were part of larger processes, such as: the legitimation of the Portuguese dictatorship indoors and outdoors, the growth of foreign tourism as an important economic income, the redefinition of the street as a thoroughfare (i.e. for high speed vehicles) and the consequent increase of road accidents (being pedestrians the main victims). Many of them were bare feet and as a result new synthetic materials, like rubber and plastics, were introduced for manufacturing cheap shoes for the poor people. This paper aims at showing that the disciplining and moralization discourses on both the bodies of professional motorists and pedestrians, as well as the control of their social behavior were either part and shaped by these larger processes.

Christopher Neumaier (Centre for Contemporary History Potsdam)

At the Crossroads: the Cultural Perception of Cars and its U-Turn in Europe and the USA, 1970s–1980s

In 1965, BMW coined the slogan "Aus Freude am Fahren". Pleasure while driving was crucial to a positive cultural perception of cars. By the mid-1970s, the automobile was suddenly situated in a different socio-cultural context, influenced by the energy crisis and the debate on environmental pollution. This initiated a turn towards a new perception of cars. Advertising hence focused on safety, efficiency, and quality albeit differences remained between Europe and the USA. For instance, performance as an assessment criterion of quality did not vanish entirely but was more pronounced in the USA. Moreover, it returned to the center of car advertising after the energy crises of the 1970s. Thus, indicating a U-turn from the path taken in the early 1970s. My paper analyses these changing cultural perceptions of cars in Europe and the USA between the 1970s and 1980s, addressing several key questions: What factors- such as the energy crises and the debate on environmental pollution, initiated the turn? How were they linked to the time-specific socio-cultural context and how did they contribute to a shift in the cultural perception of cars? In what respect did the perceptions in Europe and the US differ? What caused the U-turn after the 1970s? Answering these questions, my paper will contribute to our general understanding of the perception of cars and how it was linked to the socio-cultural contexts of the 1970s and 1980s and defines today's cars. I will draw on a wide range of sources such as material from automakers, governments as well as engineers and media reports from Europe, with a particular focus on Germany and the USA.

16.30–18.00

A Session: Knowledge, Creativity & Engineering (Room 278)

Chair: Maria Luisa Sousa (CIUHCT-FCT/UNL-NOVA)

Hans Joachim Braun (Helmut Schmidt Universität Hamburg)

Modeling Invention: Cognitive Science, Invention, and Engineering Design

Although there is ample research on cognitive science and creative processes in the sciences and the arts, cognitive scientists have neglected creativity in engineering. In recent years, however, researchers such as Dean K. Simonton, Robert W. Weisberg and Subrata Dasgupta have investigated this topic. The controversy between Simonton, advocating the neo-Darwinian creativity model of blind variation and selective retention, and Weisberg, arguing in favor of a "structuralist" view of creativity seeing great engineering achievements as an outcome of expertise and "normal creativity", is of particular interest. I will analyze those contributions and try to answer the question about their uses for a better understanding of historical and present processes of engineering creativity. My thesis is that they offer challenging approaches and explanations but that their value for shedding light on historical cases of eminent engineering creativity is distinctly limited. More promising are collaborations between psychologists and historians of technology such as Michael E. Gorman and Bernhard Carlson, who offer finely grained and analytically rewarding

case studies of Edison or Bell`s inventive processes. During the last years, Nancy J. Nersessian and collaborators have developed an intriguing cognitive-socio-cultural account of designing and building a novel lab-on-a chip in bioengineering, combining anthropological methods of participant observation with interviews and artifact analysis in a lab. Taking the recent discussions about embodiment and embeddedness into account, approaches like this, which can only be applied to recent developments, can breach the gap between cognitive and socio-cultural research.

Avner Molcho Molcho (NYU)

Israel's Shift Towards Knowledge-Based Industries

In 1968, the Israeli Council for Research and Development has conducted a survey on the "Aspects of the Development of Science-Based Industries in Israel." The final report begins with stating the survey's goal: "Numerous articles and studies have appeared recently describing Israel as a suitable country for the development of science-based industries." The report's main findings are that while "there are only a handful science-based plants in Israel," the prospects of developing this industry are very promising, due above all to "an abundant supply of technological and scientific manpower of high caliber." In that same year, a series of governmental and academic committees have all reached a similar conclusion: while Israel's industrial sector is lacking in quantity and quality, the supply of highly trained scientific manpower, along with some other supporting social and cultural conditions, provides the country with a good chance in succeeding in a nascent industry- electronics in general and computers in particular. In this paper I argue that this shift towards knowledge-based industries, which turned out to be a crucial step for Israel's economy, is not so much a case of a long evolution (industrial or ideological) but rather a result of a sudden realization that a fortunate series of unintended conditions made Israel suitable for what turned out to be one of the most important trends in modern industrialization. In a time when knowledge became for the first time the main key in technological progress, Israel was well suited to join this new trend.

Timo Myllyntaus (University of Turku)

Learning by Experience: Reconsidering the Horndal Effect on Productivity

In 1959 Walt Rostow published his development theory in an article The Stages of Economic Growth. He claimed that economies develop through five stages from primitive society to the age of high mass consumption. The decisive stage in this sequence was "Take off" when urbanization increases, industrialization proceeds and technological breakthrough occurs. This step depends on three components, of which "The rate of productive investment should rise from approximately 5% to over 10% of national income or net national product" is the most important. Rostow's theory provided one of the major historical models of economic growth for almost two decades in the middle of the Cold War period. The importance of productive capital investments both to industry and agriculture became a mantra among economists, industrialists and politicians. It was claimed that the best way to promote economic growth is to make capital investments in the production of raw materials and goods. Although Rostow's small book was introduced as a textbook in dozens of universities around the world, several contemporary scholars criticized openly his theory. For example, the Swedish economist Erik Filip Lundgren challenged Rostow's viewpoints in his book Productivity and Rate of Return where he examines the importance of capital formation for economic development. He claimed that in certain industries, production per worker can increase as a result of "pure productivity". In his studies, he had found out that in the small steelworks of Horndal in Sweden, productivity on average rose by 2 percent per year between 1935 and 1950 although significant capital investments were neglected. As a result, this kind of increase in labour productivity was labeled the Horndal effect and has since been examined in the economics profession under the term learning by doing. During its time, Lundberg's findings raised a lot of discussion. Kenneth Arrow argued that the sustained productivity growth at Horndal could "only be imputed to learning from experience". A decade later, Paul

David published his analysis on a comparable phenomenon in a cotton mill in Lowell, Massachusetts, USA, in 1835-1856. Since the late 1970s, economists have admitted that production per man can increase without inputs to new machinery and studied more carefully what factors have been behind this kind of rise in the labour productivity. They suggested that better results were achieved by minor adjustments to the capital equipment, the introduction of organizational change, social factors and improved management-worker relations or a switch to more experienced workers. In the 21st century, the Horndal effect has not been forgotten although the viewpoint has been redirected toward studying the productivity of ageing workers. This paper re-evaluate the Horndal effect's role as a counter theory to mainstream economics and doctrines of industrial management studies. This theory attempts to prove that investments in brand new machinery and the recruitment of young workforce are not the only effective methods to increase production per worker but in certain industries and medium long timespans, steady growth can also be achieved by relying old machinery and ageing but experienced workforce. The key thing is to find out how widely the Horndal effect can be benefitted in advanced economies and whether it can serious compete with the common current practices of the producing industries. Will "learning by doing" ever challenge the investments of new productive machinery or the continuous introduction of young greenhorn workforce?

B Session: Tenth Annual ICOHTEC Symposium on the Social History of Military Technology (3) (Room 277)

Organizer: Bart Hacker (Smithsonian Institution); Co-Organizer: Ciro Paoletti (Italian Commission of Military History)

Anna Turza (University of Rzeszow, Poland)

For the Country, for Their Rights: Polish Women in Military Training before World War Two

Quite early after the Great War, the understanding that the next military conflict more likely would turn into a total war was widespread, and pushed the nations toward preparations on a total scale, which also engaged training women. In interwar Poland, particularly after coup d'etat in 1926, there was a strong drive to prepare citizens for future war. A number of paramilitary organizations were formed, such as Military Preparation for Railway Workers (KPW), and Military Preparation for Post Workers (PPW). Female workers were included in special sections. Women could also join Military Preparation for Women (PWK), founded in 1928 by Brig.-Gen. Maria Wittekówna, the first such officer in the Polish Army. The training programs of all three organizations were similar, and might include general physical training, archery, or horse riding. Participation in such organizations as PWK opened the door for Polish women not only to master new skills, but also to realize professional careers and personal ambitions. The PWK, although designed as a military organization, helped Polish women in their fight for civil rights and equal positions in society. I argue that PWK contributed even more than other women's movements in inter-bellum Poland specifically devoted to advancing women's rights, such as Women's League, because PWK enjoyed the full support of government and military circles, very powerful in pre-1939 Poland.

Francesco Gerali (University of Western Australia)

Squeezing Coal to Fill the Tank. The German Scientific Endeavor for Synthetic Fuel Production between the Two Wars

Oil shaped fuel production policy in Germany between 1918 and 1941. The emergence of the *oil society* accelerated Germany's decline as a great power. Blockade would block Germany from overseas oil in wartime, while shortage of foreign exchange made accumulating large stockpiles impossible. The Third Reich based part of its oil supply on limited domestic crude oil production and imports from Romania. But the greater quantity of petroleum and derivates production was expected from processing coal. German

technologists and scientists were called to project and implement an ambitious and unprecedented process of strategic alchemy that would transform Germany's abundant supplies of coal into oil and refined products to feed army and industry.
The victory underwritten by synthetic fuels would allow the Third Reich to occupy the oilfields of the Caucasus and the Middle East, putting Germany on solid economic foundations. But the system faltered after the defeat of France, when Germany found itself responsible for meeting Europe's, not merely its own, energy requirements. The need for fresh sources of oil was a major factor in compelling the Third Reich to invade the Soviet Union in June 1941.The failure of the Russian campaign and then the lost Romanian oil fields left only the synthetic fuels that sustained the German war effort to the bitter end.

Yoel Bergman (Associate Researcher at the Cohn Institute, Tel Aviv University/ Independent Scholar)

Closing US Gaps in Propellant Production for Rockets, at the Beginning of WWII

US development of short range rockets began shortly before Pearl Harbor and large scale production in 1942. The rockets engines were solid propellant tubes with diameters and lengths greater than gunpowder grains. Britain had already used the fairly new "solvent less" process for producing rocket tubes. The ingredients, mainly nitroglycerine and nitrocellulose, were mixed and processed into thin sheets without the aid of solvents, and then dry-extruded to tubes. In the older "solvent" process, volatile solvents were added to aid mixing, and later dried out from the extruded product. But drying distorted the shape of thick tubes. The US lagged behind in the solvent less process, but in a lucky bit of timing, the army during 1939-1940 established solvent less facilities to produce thin sheets for mortar propellants. Shortly before Pearl Harbor, the navy tested dry-extrusion of thick tubes and began large scale extrusion by August 1942. Army dry-extrusion proceeded slowly and large scale extrusion began only on September 1943. The decisions before and during the WWII and their implications exemplify a recurring dilemma in R&D& technology strategies, on which alternative technology to advance. The sources for the current research include a US army report at the end of WWII and a retrospective1990 review on WWII ordnance planning.

C Session: Development of Oil and Gas Technologies for Improving the Economic and Political Situation of Countries and Regions (Room 279)

Organizer: Eldar Movsumzade (Ufa State Petroleum Technological University)
Chair: Christopher Neumaier (Centre for Contemporary History Potsdam)

Eldar Movsumzade / Olga Poletaeva (Ufa State Petroleum Technological University)

The Influence of the Political and Economic Situation on the Development of Alternative Sources of Hydrocarbons

Fuel and energy complex is the basis of the economy and security of any country. This is a complex inter-industry system of extraction and production fuels and energy, their transportation, distribution and use. FEC continually evolving and increasing its capacity to provide ever-increasing needs of society. During political and economic crises it becomes necessary to attract new resources and, accordingly, the creation of new high-efficiencies technologies for their production, processing, transportation and storage. Activities of the specialists aimed at searching and developing new fields of natural resources (oil, natural and associated gas, coal, shale oil, etc.), increase in the rate of their production, development of the processing and transport of energy resources. Development of small fields and deposits with abnormal properties and composition of oil and gas becomes cost-effective. In the processing involved passing gas, the synthesis gas obtained during the processing of industrial waste. Oil refineries and petrochemical companies improve technological processes for full use of raw materials. In our section we present reports about development

of oil and gas technologies and their impact on the economic and political situation and the development of regions. List of abstracts: 1. The influence of the political and economic situation on the development of alternative source of hydrocarbons. 2. Development of techniques and technologies of ensuring stable operation of oil pipelines. 3. Liquefied natural gas (LNG) market in the perspective of the present and future world gas supply. 4. Development of energy saving technologies in oil pipeline transportation. 5. European experience of processing of acid tars to the secondary fuel. 6. Unique Ancient Oil from Azerbaijan.

Boris Mastobaev (Ufa State Petroleum Technical University)

Development of Techniques and Technologies of Ensuring Stable Operation of Oil Pipelines

Development of pipeline transportation of oil and petroleum products could not be able without implementation of new progressive techniques and technologies that increase efficiency and reliability of oil pipelines.
During operation, asphalt resinous paraffin deposits are emerging on the inner surface of the pipeline which impact on efficiency and reliability exploitation of pipelines (capacity decreasing, pressure increasing, lack of reliable diagnostic information).
There are no typical techniques and technologies in the scantily explored direction of offshore pipelines cleaning. Despite the presence of a large number of papers on this subject, the process of cleaning of inner surface of pipelines has not been adequately studied. The current state of problem solution in cleaning of oil pipelines can not accurately predict the formation of asphalt resinous paraffin deposits and select the most effective methods of cleaning depending on the characteristics of pipelines and crude oil.
This paper is dedicated to complex analysis of technologies and techniques in cleaning of oil pipelines of asphalt resinous paraffin deposits and other sediments. Study of existing technology and technical measures purification during pipeline operation at all stages is of considerable practical interest and is relevant to the development of new methods for removing asphalt resinous paraffin deposits, as well as forecasting their formation.

Rim Teregulov (Ufa State Petroleum Technical University)

The Liquefied Natural Gas (LNG) Market in the Perspective of the Present and Future World Gas Supply

As the energy industry changing there is always a need in mostly flexible energy transportation technology usage. LNG production system is exactly that type of technology. And although the largest gas volumes still being delivered by the pipelines in some cases LNG transport appears to be more favorable.
Natural gas liquefaction experiments started by the end of the 19th century. The fact that LNG could be transported on the big distances by LNG-tankers was proved in 1959. Nowadays LNG cargoes routinely run between Atlantic and pacific regions.
In the early 1990-ties LNG trading was mostly «from spot to spot» beside dry dock maintenance. There were almost no «spot» sales except for the need to monetize instantly appearing gas volumes. Some contracts were made by the fixed prices what changed in the year 1991 when LNG price was linked to the oil and oil products prices.
IEA expects that in the year 2030 global demand in the fossil fuels will grow by 50% relatively to the present time (assuming 70% of the energy will be consumed by the developing and newly industrialized countries, especially China).
LNG industry deserted an important place in the world energy space and almost likely will keep its position in the foreseeable future. And after solution of some engineering challenges (dealing with possible complexities of finding reachable offshore gas and realization of floating LNG projects) LNG market will be more and more tempting for the energy industry players.

Pavel Revel-Muroz (JSC «TRANSNEFT»)

Development of Energy Saving Technologies in Oil Pipeline Transportation

Based on historical analysis of energy use in the JSC “Transneft” has been designed program of energy conservation and energy efficiency of JSC "Transneft". The main type of energy consumed is electricity, whose share in the overall energy balance is 82%.
Historically, all measures of energy saving in oil pipelines are divided into organizational and technical.
Technical measures include energy efficiency measures in the following areas of energy conservation:
- Optimization of process oil pumping,
- Energy efficiency in electrical equipment,
- Optimization of process oil storage,
- Energy saving in thermal power generation systems,
- Energy savings in heating and water systems,
- Energy efficiency in the operation of motor vehicles.

Energy saving in electrical equipment is 6% of the total capacity. It could be reached by replacing the exhaust motors, by use motors with higher efficiency, by introduction of modern digital excitation controllers of synchronous motors, by replacement exhaust transformers, by use transformers with lower losses and by replacing light bulbs to energy saving lamps.
Energy saving in heat supply systems is 3% of the total capacity in response to the reconstruction of boilers, modernization and replacement of boiler equipment, out commissioning work, replacement of thermal insulation plates based on mineral wool to a more efficient polyurethane foam insulation, retrofitting devices commercial and technical accounting of fuel energy and water resources.
Saving of fuel and energy resources in tons of conventional fuel in each year of the Program of energy saving compared to the previous year will be 1.8% in 2015.

Tuesday, 18th August 2015

09.30–11.00

A Session: Digitalization, Computers, Energy and Its Cultural Impact on Humans (Room 278)

Chair: Maria Luisa Sousa (CIUHCT-FCT/UNL-NOVA)

Galit Wellner (Ben Gurion University of the Negev)

The Cellular Age: History of the Cellphone as a Memory Prosthesis

Today it becomes evident that the cellphone has changed the way we experience the world. For example, the urge to take pictures of a dish ordered in a restaurant, of an exhibit in the museum or of myself on the way to school (aka selfie). Our memories are externalized and kept safe from oblivion. Nothing is forgotten. I can remember who participated in the New Year party at work three years ago; I can remember where I walked when on a trip to Berlin. It is now a matter of access to a certain organization of data and search capabilities. The cellphone has become an extension of our memory. It is our memory prosthesis. The first part of the paper provides a short genealogy of the cellphone, evolving from "talking heads", through texting and later multimedia applications, to today's "sensory exploration". These historical variations are analyzed through the lens of memory prosthesis that functions as a common denominator across the variations. in the second part, the effects of memory prosthesis are examined from three points-of-view: The utopian perspective as provided by Ray Kurzweil's Singularity (2005) is qualified as hyped; the dystopian approach of Nicholas Carr's The Shallows (2011) is criticized for overlooking the benefits; lastly post phenomenology emerges as neither utopian or dystopian, but as a study of how technologies

like the cellphone mediate a worldview for us and how they change our being-in-the-world (Ihde 1990, 2009; Verbeek 2005).

Mathias Mutz (RWTH Aachen University)

The Computer as Time Machine. Changing Concepts of the Computer and its Effect on Time-Keeping Since the 1960s

In chronobiology, a zeitgeber is an external cue that entrains an organism's biological rhythm to the environment. In the last decades, computers have become such an emitter of time that changed individual and collective use and perception of time. The paper evaluates the role of computers for the social construction of time by looking at technical and sociological literature from the 1960s to 90s and the expectations for the future presented there. From the beginning, the temporal effects of computers have been compared to those of modern clocks, highlighting their revolutionary character. Here, the history of computing illustrates conflicting and changing concepts of time- while the growing use of computers led the path for a new synchronization of society. As a new medium of time-keeping computers did not only allow for high-speed operations and unprecedented accuracy, but also for a new flexibility in linking different activities. Discourses on the future of computer time focused on acceleration and alienation as well as autonomy and individualization. Identifying key elements of these debates, the paper argues that past ideas of technology and time are crucial to understand the rise of present temporal practices. Computers did not produce time by themselves, but they introduced new concepts like "time sharing" or "ubiquitous computing" that became part of a long-term process of social adaptation. Computers as time machines, thus, exemplify how technology depends on cultural models to evolve. Although time-keeping may not be its most important effect, it highlights the overall scope of the computer revolution.

Robert Belot (Université de Technologie de Belfort-Montbéliard)

The Atom as a Utopia and a Theophany for France After the Second World War

France, today a world leader in the nuclear industry, has always had a special relationship with the atom. At the leading edge of atomic research in the first half of the nineteenth century, the country was responsible for several Nobel prizes in the field, and French physicists have a tradition of political engagement, as was seen at the time of the Popular Front (1936). Many of them joined the ranks of the Resistance to the Vichy regime and the Nazis, while others sought exile in England, the USA or Canada to take part in the Allied war effort. It was no coincidence that Frederic Joliot-Curie, Nobel prizewinner in 1935 with his wife, inventor of nuclear fission and active member of the French Resistance close to the Communist party, was the man who signed France up to nuclear power after the Second World War by creating the Atomic Energy Commission (1945). The conditions were right. Unlike the USA, where guilt at having produced and dropped the first atomic bomb on Hiroshima and Nagasaki led to a crisis of conscience among researchers, France seemed unaware of the drama. The country was sensitive above all to the benefits nuclear power could provide. Based on research carried out for a forthcoming book, I would like to draw attention to three aspects: -the broad consensus that emerged around the benefits (geopolitical, social, economic) of atomic energy -the belief in its power to transform the French energy landscape -the faith in its rapid industrial deployment. Control of the atom was seen as an ideal and unhoped-for means for France to recover its power and independence after the trauma of defeat in 1940 and the shame of German occupation. This was not merely an "energy transition". It was a Damascene conversion, a revolution, a revelation. It had all the ingredients of a utopian ideal, but a "realistic" utopia. In this revealed "mystery" and this promised "power", there were all the elements of a theophany. Through the atom, man could reclaim possession of himself and of nature, France could be reconciled with itself and science and technology could regain their demiurgic potential. The "liberation" (as Joliot called it) of the atom was the flipside of the Liberation of France.

B Session: Tenth Annual ICOHTEC Symposium on the Social History of Military Technology (4) (Room 277)

Organizer: Bart Hacker (Smithsonian Institution); Co-Organizer: Ciro Paoletti (Italian Commission of Military History)

Philipp Aumann (Peenemünde Historical Technical Museum, Germany)

Vision and Tradition: Rocket Development as a Cultural Revolution in the History of German Armaments

Until the 1920s, weaponry was optimized incrementally with the objective of keeping one step ahead of foreign countries. Now military elites became increasingly visionary and developed the idea of a revolutionary new weapon system: the rocket, later called "V 2." The military rocket program became the final level of weapon system escalation beyond all boundaries. Peenemünde, the place of this rocket program, embodied this new type of military technology and mentality and became the largest research, development and testing center in Europe. This fundamental turn in the history of military technology stemmed not from military logic, but from a new public mentality. Military decision makers were influenced by a common euphoria which considered technological progress as a secular promise of salvation and rocketry as the most important technological revolution of the 20th century. Translated into military contexts, faith in science and technology meant seeking a weapon so powerful as to exceed all foreign technology now and forever. This paper integrates the history of the Peenemünde testing range and the Nazi rocket program into a broader social context of a military-industrial-academic complex, and it adds a perspective of cultural history to what has been up to now a purely descriptive historiography of German rocketry.

Brian E. Crim (Lynchburg College, Virginia)

From Peenemünde to Huntsville: German Specialists and the Culture of Cold War Science

Project Paperclip and its successor programs brought approximately 1500 German and Austrian scientists, engineers, and other specialists to the United States for what government officials termed "long-term exploitation" by the military services and related industries. While the controversial aspects of Paperclip are infamous and well-documented, namely the inclusion of ardent Nazis and accused war criminals in the program, the diverse ways in which specialists were integrated into the nascent military-industrial complex is relatively unexplored, especially in light of recently declassified documents. This paper examines the debates between the competing services, civilian agencies, and prominent companies like General Electric and the aerospace industry over the proper use of German specialists in national security state. As the United States struggled to formulate a strategy to confront the Soviet Union during the immediate postwar period, German specialists contributed their technical expertise and volunteered often specious predictions concerning Soviet capabilities and intentions. Moreover, figures like Wernher von Braun, the embodiment of the military's faith in the "Great German Inventive Mind", publicly lobbied for additional resources and privileges on behalf of his Paperclip colleagues. Consequently, German specialists played a significant role in defining the agenda for military research and development during the early Cold War. Sources consulted include foreign scientific case files, FBI personnel files, and CIA reports declassified as part of the National Archives' Nazi War Crimes and Japanese Imperial Government Records Interagency Working Group.

Vasily Borisov (Russian Academy of Science, Moscow)

Russian Electronics between the Military-Industrial Complex and the Market

This paper reports on some special features of the development of electronics in Russia that answers Prof. Loran Graham, author *Lonely Ideas*, question: Why, having picked up a desirable gadget in an electronics store, you never find a label "Made in Russia"? Such a label was unlikely between the 1920s and 1950s, when electronics in Russia was forming with the technical assistance of French and American firms. It might have been more likely from the 1960s to the 1980s, when the Soviet electronic industry could meet the needs of all the strategically important branches of economy and its capacities were comparable with the U.S. Russians were pioneers in the development of lasers and semiconductor hetero structures (Zh. Alferov), etc. But the industry had aimed mainly at producing advanced technology for military purposes. Manufacturing of electronic products for civil purposes was limited by resource constraints and the policy of limited use of military technologies in civil industries.
Collapse of the USSR in the 1990s and transition to a market economy coincided with radical global technological transformations in electronic industry, which required immense private and government investment. The military conversion program launched in 1992 failed to bring a significant effect and Russia became dependent on electronic import. It is possible to conclude that the attitude of the State to production of military and civil electronics significantly differed during the past decades.

C Session: Labour-Power: Shifting Perspectives (Room 279)

Chair: Elena Helerea (Transilvania University of Brasov)

Eike-Christian Heine (Universität Stuttgart)

Shovel Work: The Production Process of Earthwork and the Body of the Navvy in the 19th Century

One major challenge on infrastructure projects is until today the production of a plane surface. This makes the movement of large quantities of earth necessary. Until the 20th century muscular strength played the most important part when constructing cuts and embankments on canal, road and railroad projects, and only gradually mechanical power became dominant. Also due to a lack of sources Jurgen Kock's evaluation from 1990 is still valid, that relatively little is known about earth workers, even though in the 1870s more people worked on railroad construction than in Germany's coal and steel industries. My contribution to the 2015 ICOHTEC conference focuses on the production process of earth work and the body of the navies in the 19th century in Britain and Germany. A few autobiographies allow, in combination with engineering handbooks and the contemporary social political discourse, to reconstruct the production process and the self-perception of the workers. I will focus on four topics. When remembering accord work in their autobiographies, the body becomes central. How the work put strain on the body, how it wore out and was endangered through chipping, shoveling and carting becomes clear. The body also was central for the self-staging of the workers; next to an emphasis on power and dexterity the constant threat for bodily health are expressed. On the country site the housing and feeding of hundreds or even thousands of workers became a problem. Finally the role of alcohol for the production process is analyzed. Alcohol played a central role in the culture of the navies, it produced dependency to the contractor who provided it, it distracted from a monotonous life and once again shows the vulnerability of the body.

Marina Cionca (Transilvania University of Brasov)

Losing Skilled Labor in the Strive for New Technologies. A Case Study

The geographical area known as Transylvania, surrounded by the Carpathian Mountains, once part of the Austrian-Hungarian Empire, is a better-known part of Romania, due to its natural, cultural and economic assets. One of the assets, in the 19th and 20th century, up to the 1980s, was the success of highly skilled craftsmanship, for example in the field of carpentry and furniture manufacturing. This social-economic asset was particularly visible in counties like Mures, Harghita, Covasna, Brasov, Sibiu a.o., where furniture with important value-adding joinery and decoration was produced and this kind of work was highly respected, becoming part of the local cultural identity. The case discussed in this paper refers to the social, cultural and identity crisis generated in an economically active smaller town of Transylvania, due mainly to the building of a High-Tech furniture factory in the 1990s. The case of the town of Codlea is a typical post-1989 Romanian failure story and the decisive cause of its failure was the collapse of its traditional industrial profile, meaning furniture manufacturing, chemical dyestuff, agricultural machinery and tools, hothouse flowers growing. In November 1990 the old Magura furniture factory, with a local tradition of more than a century became a state-owned joint-stock company. Soon the factory went bankrupt and a Swedish high-tech automatic line for processing and assembling simple melamine-faced chipboard shelves was installed, for which no special wood-working skills were required. Most of the wood workers lost their jobs. Ultimately the new factory was closed. In many towns of Transylvania the economic process was more or less the same. The effect can be seen nowadays on a nation-wide scale: the almost complete loss of wood-working skills and also the loss of interest in higher education related to the wood-engineering profile. Oscillating between side-effect and cause are the low wages in the wood-working industry, including furniture manufacturing, generating again a dramatic lack of respect for this profession.

Liliia Zemnukhova (Russian Academy of Sciences; European University at St. Petersburg)

When Professional Community Changes the Rules: the Case of the Russian IT Sphere

The development of high-technologies in Russia went through different stages during the last few decades, ranging from total Soviet secrecy during the war and post-war periods with leading role of state and academia to active industrial initiatives to build innovative environment and to train skilled professionals. The talk discloses the context change and the main features of engineering in Soviet and post-Soviet Russia on the case of Information Technology (IT) sphere. I will show how professional community managed to overcome economic, political and cultural factors and continues to develop IT sphere. IT is probably the most fast-moving area in technological development and bears the major contradiction between academy and industry: while the demand for IT at the labor market increases, the rate of changes and innovations in this sphere exceeds adaptability of the education system. However, heritage of the Soviet engineering school as a fundamental education system conditioned emergence and reproduction of technical specialists resulted in tradition of self-organization in the context of system crisis, be it economic failure, political instability, or mass emigration. The talk is based on the interviews with IT professionals as well as analysis of history and cases in IT-education, and practices of knowledge and skills translation.

D Regional History Studies I—Japan (HISTELCON) (Room 280)

Chair: Michael Geselowitz (IEEE History Center)

Michael Geselowitz (IEEE History Center) / Jacob Baal-Schem (IEEE Region 8/Israel Section)

Welcome to HISTELCON 2015

Isao Shirakawa (University of Hyogo)

History of Japan's First Commercial Hydroelectric Generation at Keage Power Station

1. Historical Background of the Birth of the Keage Power Station

Following the relocation of Japan's capital to Tokyo in 1869, Kyoto City, which had served as the capital of Japan for more than a millennium, suffered a drastic decline with its population dropping from 350,000 to 250,000. Thus, the local government of Kyoto launched the 'Lake Biwa Canal Project' in 1881, which envisioned channeling water from Japan's largest lake, Lake Biwa, to Kyoto, with the aim of restoring Kyoto's prosperity.

The original objective of this project was to use the water of Lake Biwa for waterway transportation, water turbines, drinking, irrigation, and fire-fighting, but midway through the construction work, it was also decided to use the water for hydroelectric power generation, based on the investigation of the hydroelectric plant just started in Aspen, Colorado, USA. This visionary decision to revise the project to include power generation, gave birth to the Keage Power Station, Japan's first commercial hydroelectric plant, as described below.

2. History of Power Generation at the Keage Power Station

From June 1891 to May 1897, a variety of advanced DC- and AC-generators were installed one after another in the Keage Power Station, achieving a total capacity of 1,760 kW through the water intake of 6.9 m^3/s from the Lake Biwa Canal.

Specifically, the installation of these DC/AC-generators was executed as follows:

In June 1891, two Edison 80 kW DC-generators were first installed in the Keage Power Station to supply power to the inclined equipment built in the station.

In 1891 and 1894, a Thomson-Houston 75 kW and three GE 60 kW single-phase AC-generators, each operating at 125 Hz, were installed to meet the growing power demand for electric lights.

In 1894 and 1895, two Stanley 60/80 kW and a Tokyo-Shibaura 60 kW 2-phase AC-generators, each operating at 133 Hz, were installed to meet the power demand for such industries as cotton spinning, textile production, etc. However, these 2-phase AC-generators soon became obsolete, resulting in the introduction of 3-phase AC-generators, as described below in (5).

In 1895, two GE multipolar DC-generators were installed to supply power to the Kyoto Electric Railway Company, which operated Japan's first streetcars, running 6.4 km between Shiokoji (Kyoto Station) and FushimiAburakake.

In 1896 and 1897, four Siemens 80 kW 50 Hz and two GE 100/150 kW 60 Hz 3-phase AC-generators were installed to meet the rising power demand for spinning, weaving, tobacco, metal foil working, and other industries. Thus, the Keage Power Station embarked on 3-phase AC-power generation, contributing to the development of AC-power industries.

It should be added here that with the widespread use of motors, as well as with the growing necessity of long-distance transmission capability, 3-phase AC-generators soon dominated the power system market, and eventually the Keage Power Station pioneered the start-up of 3-phase AC-power generation, paving the way for the modernization of Japan.

Isao Shirakawa (University of Hyogo)

History of Development of the Map-Based Automotive Navigation System 'Honda Electro Gyrocator'

With the rapid advances in automotive technology and roadway environment, the motorization in Japan achieved drastic progress in the 1970's. However, in those days there was still a hard reality that the automobile could not exert its potential of convenience to the full extent, due to traffic congestions caused by the drastic increase in motor traffic as well as by the sharp rise in personal mobility. Accordingly, the Japanese government launched the project 'Comprehensive Automobile Traffic Control System' in 1973, with the aim of equipping a moving vehicle with an innovative function to provide dynamic route guidance on its on-board display with reference to the actual traffic situation.
This project envisioned constructing a regional-scale navigation system provided with hardware capabilities of transmitting the information on the present location and destination of each moving vehicle from its on-board antenna to the center computer via loop antennas embedded in major crossroads, and Visualizing the optimal destination path of a moving vehicle on its on-board display with reference to traffic conditions. However, such a large-scale system necessitated a vast range of too peculiar functions to be implemented for practical use, and moreover it was useless in any area without such an infrastructure. Thus, at that time the automotive navigation technology was barely able to provide a moving vehicle with a routing ability to indicate its destination direction with the use of a magnetic compass.
Honda therefore determined to develop a completely self-contained navigation system, with the intention to equip a moving vehicle with a navigational function to visualize its traveled course including the present location on its on-board CRT (Cathode Ray Tube) display, without relying on any external installation like a radio station. To realize such a function, the most fundamental issue was how to display the present location of a moving vehicle on CRT screen. Thus, even prior to the advent of GPS (Global Positioning System), Honda tried to display the traveled course of a moving vehicle on its on-board CRT screen, referring to the idea inspired by inertial navigation systems which had so far been developed for airplanes. Specifically, Honda first developed an elaborate procedure for seeking positioning data on the location of a moving vehicle by detecting its moving distance and direction by means of the 'mileage' and 'gas-rate gyro' sensors, respectively. Then, with the use of positioning data derived by applying this procedure to a sequence of moved locations of a vehicle, Honda devised a sophisticated mechanism to display on its on-board CRT screen its traveled course including the present location. Subsequently, Honda managed to devise a man-machine processing scheme to overlay on the traveled course displayed on CRT screen a set of those transparent road-map sheets, which were prepared in advance so that the driver could view the present location over a transparent road-map. Eventually, this processing scheme was successfully evolved into the map-based automotive navigation system 'Honda Electric Gyrocator', which was released in 1981 for the first time in the world.

11.30–13.00

Plenary Session: Computer Meets Human (Room 282)

Chair: Dick van Lente (Erasmus University Rotterdam)

Janine Noack (Centre for Contemporary History Potsdam)

The Role of Cold War Computer Technology in East and West German Militaries (1960s–1980s)

Digital computers are a fundamental part of today's military defense. During the Cold War, these computers were first implemented in strategic operations, administration and training. This paper deals with the role of computer technology in both the National People's Army (NVA) and the Bundeswehr in context of the Cold War. Expectations relating to the implementation of computer technology will be compared to its

actual application. The paper takes into account the social, technical and structural changes that occurred in both militaries through computers. To deal with both the NVA and the Bundeswehr is especially crucial because of the direct confrontation line between the NATO and the Warsaw Treaty in Germany. First findings show that the system of alliances has a significant influence of both the implementation of computers and the connected ideological construct within in the Cold War discourse, where Computers became a metaphor to demonstrate military dominance and strength. The paper focuses on first results, as well as the presentation of my source base and methods. The analysis is based on sources I obtained in the German National Archive in Freiburg, the company archives of Siemens and IBM, oral history findings and official publications. Methodologically, I aim to connect to research in a wider context of the "social history of computing" in order to place the history of computing in German militaries in its social, cultural and political context using a discourse analytical approach.

Julie Wosk (State University of New York, Maritime College)

Female Robots and Androids: Changing Technologies and Cultural Views

Electronic robots today are being developed for a wide variety of industrial, domestic, medical, and military uses. Female androids and robots, however, have a particular fascination for they have been shaped not only by changing technologies but also changing attitudes toward women themselves. Engineers, automaton manufacturers, filmmakers, and photographers have long been fascinated by the idea of artificial females that come alive. Their creations have ranged from early hydraulic and steam-powered female wine servers to the sexy homemakers in The Stepford Wives to today's female robots that look so real they can easily fool the eye. This talk focuses specifically on today's electronic female robots and androids, and places them in a cultural context seeing them as part of a long history of male fantasies about creating the perfect female. The presentation will draw on research gleaned from my new book My Fair Ladies: Female Robots, Androids, and Other Artificial Eves. It will include historical examples from ancient Mesopotamia and Greece, eighteenth and nineteenth-century Switzerland and France, and also simulated females in today's robotics, video games, and films.

Matthias Heymann / Dania Achermann (Aarhus University

When High Tech Meets Science: How the Computer Challenged Climatologists

The postwar era has seen a computer and information revolution with tremendous impact on scientific practice, directions and cultural roles. The atmospheric sciences are a particularly important case. In this paper we focus on the emergence of climate modeling as a predominant research approach in the climate sciences. Computer based climate models and climate simulation have not only introduced new practices in climate sciences but also changed its direction and the very meaning and understanding of the term climate. In our paper we will deal with questions like the following: How did climate modeling and simulation fit to traditional approaches in the climate sciences and how was it appropriated? How did traditional climatologists respond to the challenge of computer models and simulation? Which conflicts and negotiations did the appropriation or intrusion of computer based science in climatology cause? Which social and political contexts influenced the rise of climate modeling as a predominant research tool? The technology of computer simulation offered not only tremendous research opportunities, it also involved shifting research interests, new epistemic standards and changed social roles of climate science which were controversial. Traditional climatologists observed these changes with skepticism and feared the marginalization of their established approaches, while others were more open towards the new tools and tried to incorporate the new ideas. In our paper we will investigate these questions based on historical research about leading climatologists in the USA, UK, Germany and Sweden.

Wednesday, 19th August 2015

09.30–11.00

Keynote Lecture

Leo Corry (Tel Aviv University)

From the Universal Turing Machine to Turing's Analog Computer: The Fatherhood of the Modern Computer Revisited

In the recent historiography of the electronic computer, it has been increasingly common to draw a straight line naturally leading from what is now called the "Universal Turing Machine" (UTM) to the "modern computer". The former refers to an abstract mathematical idea introduced in 1936 by Alan Turing in a landmark paper entitled "On Computable Numbers, with and Application to the Entscheidungsproblem". The latter typically refers to one or more of the large-scale calculating machines that were either planned or actually built after World War II, and which had in common four defining technical characteristics. They were (1) electronic (as opposed to electromechanical), (2) digital (as opposed to analog), (3) multi-purpose (as opposed to "special purpose"), and, most importantly, (4) stored-program (as opposed to non-programmable, or, programmable but by more primitive means such as rewiring or using punched paper strips). The stress on this seemingly unproblematic—for some, even unavoidable—connection, and on the essentially unsurprising transition from the abstract idea to the concrete machine, is at the basis of the recurring reference to Turing as the "Father of the Modern Computer".
In this talk I want to call into question some of the basic assumptions behind the above described view. I will do this by focusing on Turing's work before joining in 1939 the Government Code and Cypher School (GC&CS) at Bletchley Park. It seems quite obvious to state that his wartime work had a far-reaching impact on the development of Turing's ideas on automatized computing. Still, I think that it makes sense to spell out in greater detail the meaning of this impact by taking a closer look at his earlier work while ignoring, inasmuch as possible, his later work on computing machines. In particular, I will analyze the historical context of Turing's early involvement with the Riemann conjecture and his plan for constructing, in 1939, an analog machine for calculating the zeros of the the zeta-function in the critical line. More generally, I will analyze Turing's interest in fundamental questions within the classical disciplines of mathematical analysis and number theory independently of the question of the UTM.

11.30–13.00

A Session: Designs on Medical Technology and Measuring Equipment Coupled with Its Application

Chair: Dick van Lente (Erasmus University Rotterdam)

Slawomir Lotysz (Polish Academy of Sciences)

"We Need to Think of What Exactly We Need to Plan": Designing Pharmaceutical Consumption in Poland's Centrally Controlled Economy, 1945–1989

For four and a half decades of communist rule in Poland, the domestic pharmaceutical market had been a scene of political and ideological struggle. Shortly after the war, when the need for medications among the nation exhausted by war was at peak, the government seemed to be more concerned about the process of nationalization of domestic pharmaceutical industry than about reconstruction of its production capacity. The quote "We need to think of what exactly we need to plan", taken from one of the meetings held at the Department of Planning in the Ministry of Industry and Trade, is an exemplification of the communists'

determination in applying the rules of centrally controlled economy in every aspect of social life, including qualitative and quantitative demand for drugs, which is almost unpredictable considering changing patterns of human morbidity. Using mainly the governmental documents, this paper suggests, that nationalized pharmaceutical companies, being poorly managed and vulnerable to ideological determinants, were neither innovative nor flexible to meet the changing domestic demand for medicaments. This fact, along with the state's irrational and inconsequent drug policy, caused an almost permanent shortage in drug supplies for patients: ironic for a socialist system in which universal and free health care was a basic principle. In the conclusions, the article argues that in the early post-war period, ideological considerations played too much of a role in reconstruction of Polish pharmaceutical industry and the revolutionary fervor overshadowed the most important goal- the benefit of the patient.

Miroslaw Andrzej Sikora (The Institute of National Remembrance, Katowice)

Pro Publico Bono? Intelligence in Service of Pharmaceutical Industry in People's Republic of Poland in 1973–1989

The studies on the history of intelligence service in People's Republic of Poland were rather focusing on international policy-making, military-affairs and intimidation of dissidents as well. Whereas respectively little attention was being paid to spying on science and technology in western countries. This paper is meant to redress that imbalance of our knowledge about the clandestine operations. Examined sources involve documents of former communist intelligence service and records of various state agencies and ministries as well. The author hypothesizes that scientific-technical intelligence (STI) caused measurable financial benefits to the Polish state treasury. Moreover numerous successes of the illegal undertakings contributed significantly to the growth of the living standards of whole Polish society. Because of the very wide spectrum of tasks passed on to STI by R&D-institutions, author decided to choose the field of unquestionable social nature, which is medical care along with pharmaceutical industry to bolster major thesis. The primary objective in this paper was to define particular areas of technological advances within pharmaceutical industry, - as antibiotics, heart medicines, vaccines or vitamins, - in which the Polish government could take advantage of the intelligence in order to supply or improve scientific and production potential. Second relevant intention was to quantify the effects of intelligence work, by comparing the trade-value of technological solutions acquired on the "black market" with the domestic expenditures on R&D. Due to the fragmentary nature of this paper this quantification was an approximate and selective one. However it managed to deliver a very general sense of proportion of the Polish outlay in the sector of pharmaceutical chemistry on the one hand, and outline savings resulting from the intelligence assistance on the other. STI stimulated by its actions - depending on time or branch of medicine - up to 10-15% of the pharmaceutical market in Poland.

Catalin Nicolae Mihai (Transilvania University of Brasov)

Electrical Measuring Equipment Development in Romania

The new metering technologies have been developed since the expansion of electric networks early 1900-1910. Expanding the system of production and power distribution by a growing number of consumers has imposed the development of equipment used both for energy metering and for monitoring the parameters of electrical power. This paper focuses on the history of instruments for the measurement of electrical power in Romania. The first measurement systems have been imported by companies such as Lohmaier, Siemens and Weston and were installed at hydro power plants built in Romania since 1888. They allowed the recording of voltage and current. Only in the years 1983 - 1985, there is established the base for the creation of an information system for the automated metering electricity consumption in Romania. In 1986 appears the first electricity meter with pulse transmission. In 2010, following the development of the process information systems and coordination with SCADA programming environments, there are introduced

systems such as Advanced Metering Infrastructure, thus appearing the first stage for the development of Smart Metering. The concept of Smart Metering according to IEC is the technology of recording usage from metering devices and providing communication and/or control path extending from electric power utility to current-using equipment. This new technology has been implemented by the electricity company "SC FDEE Electrica Distributie Transilvania Sud SA", starting with 2014, by conducting three pilot systems from different companies producing smart meters. The paper analyzes documentary sources - archives, scientific articles and monographs in the field.

B Session: Tenth Annual ICOHTEC Symposium on the Social History of Military Technology (5)

Organizer: Bart Hacker (Smithsonian Institution); Co-Organizer: Ciro Paoletti (Italian Commission of Military History)

Richard A. Ruth (US Naval Academy, Maryland)

The Secret of Seeing Charlie in the Dark: The Starlight Scope, Techno-Anxiety, and the Spectral Mediation of the Enemy in the Vietnam War

In 1965 the United States military committed its first combat troops to South Vietnam. It sent along with them a recently developed technological marvel that allowed the troops to see their guerrilla enemy in the dark. The GIs called these wonder devices “starlight scopes” because they amplified ambient light, mostly from starlight, moonlight, and sky glow. Along with this heavy piece of machinery—one of the first models weighed more than thirty pounds—American soldiers bore the anxiety of protecting a technology that the U.S. military’s enemies had not yet acquired. Each soldier responsible for his unit’s scope was expected to destroy it before allowing it to fall into Viet Cong hands. Americans also developed a view of the enemy mediated by the ghostly images that appeared to them through the scope’s viewfinder. Their descriptions of the Viet Cong, in appearance and essence, were a manifestation of the highly pixilated forms of greens, grays, and blacks that the scope conjured in the jungle darkness. By using contemporary sources, recently declassified documents, and memoirs, I examine the starlight scop’s introduction into service, the culture of anxiety it provoked, and the significant (and unexamined) role it played in furthering the popular image of the Vietnamese guerrillas as spectral beings who occupied and fought from an otherworldly realm.

Olufikayo Kunle Oyelade (University of Ibadan, Nigeria)

The Nigerian Civil War and the Socio cultural Context of the ‘Ogbunigwe’ Missile

Nigeria-Biafra War, or the Nigerian Civil War, lasted for about 30 months. Scholars have asserted that indigenous Biafran scientists and engineers developed some sophisticated weapons, which sustained the supposed weaker Biafran State. The famous missile, “Ogbunigwe”, was one of the scientific and technological innovations that sustained the Biafran Organization of Freedom Fighters (BOFF) during the war. This paper investigates the meaning, origin, historical and socio-cultural context of Ogbunigwe. The study relies on the concept of Adaptive Ingenuity. Research design is exploratory, while data collection is in progress, using historical and qualitative methods. Thirty in-depth interviews in all, including 15 with Nigerian military engineers and soldiers who engaged in the war and another 15 with former Biafran soldiers and military engineers bring insight into the social context of Ogbunigwe. Preliminary investigation reveals that most of the weapons used during the war were developed by the Research and Production Group (RAP) of BOFF. Scientists, engineers, and skilled technicians were driven by necessity; because of the blockade, Biafra could not import the weapons and munitions needed to prosecute the war. People faced with desperate situations adapt by creating ways of overcoming their challenge. “Ogbunigwe” was an indigenous high technology achieved by the defunct Biafran State. More than five decades after Ogbunigwe’s successful use, there is no record that Nigeria State has been able to produce such missile.

Virginie Wanyaka Bonguen Oyongmen (Université de Yaoundé I, Cameroon)

L'Armee Camerounaise et les Nouvelles Technologies de l'Information et de la Communication

The Cameroonian army is the body of the state that has experienced tremendous upheavals of its creation to date. In its hunt against Cameroonian nationalist after independence, it was already using technical equipment which enabled the synergy between the operations conducted along the triangle formed this country. With the evolution of military technology, the Cameroonian army is not standing still and little from its resources to deal with inters or intra -state attacks.
This study we are conducting following some traceability because it will allow different readers to get a concrete idea of the Cameroonian army that some army deal in area in reference to recent events in its northern part . Our approach is based on rigorous observation coupled with a synthetic analysis on the contribution and role of ICT in the Cameroonian army. An army that knows and has adapted to this development to address threats in real time hanging over its territory.

C Session: Different Approaches to Innovation

Chair: Timo Myllyntaus (University of Turku)

Jürgen Poesche / Ilkka Kauranen (Aalto University)

Complex and Recursive Recombination: Legitimization of Technology and Technological Innovation in the Occident from Antiquity to 1789

The paper presents a new concept termed "Complex and Recursive Recombination" that provides a powerful explanatory and predictive tool for the comprehension of technological change in society. The novelty of the tool is in its ability to operationalize the legitimization of technology and technological innovation based on the societally accepted interpretation of the relevant branch of the appropriate societal tradition at a given point in time. Four case studies spanning an exceptionally long time period, i.e., from the Roman Empire to the fall of the French Ancient Regime in 1789, are analyzed with the new concept of Complex and Recursive Recombination. In the case of the High Middle Ages, the focus is on the role played by the roots of the Occidental Tradition, i.e., the Greco-Roman Heritage and Occidental Christianity, in the (re-) absorption of Greco-Roman science and technology. In the case of the French Ancient Regime, the focus is on the intra-societal tensions caused by two competing legitimizations of technology and technological innovation, i.e., chemical engineering- and natural resources-based technology on the one hand and mechanical engineering- and manufacturing-based technology on the other hand. Whereas these two cases demonstrate broadly speaking constructive aspects of the legitimization of technology and technological innovation in the Occidental Tradition, the following two cases demonstrate its destructive aspects. In the case of the Aztec Empire, Occident delegitimized significant parts of Aztec technology because it was not congruent with the roots of the Occidental Tradition and thus the societally accepted interpretation of the Romanic Branch of the Occidental Tradition in the 16th century. In the case of the Chinese Empire, the interest in Chinese products reached back into the time of the Roman Empire thus legitimizing the importation of, e.g., Chinese silk into the Occident. However, the society-based legitimization raised obstacles to the legitimization needed for the absorption of much of Chinese engineering in the Occidenrt. The case studies demonstrate that the concept of Complex and Recursive Recombination offers new ways to interpret the emergence of high technology of its day.

Irina Gouzevitch/ Dmitri Gouzevitch (Ecole des Hautes Etudes en Sciences Sociales, Paris)

The High-Tech in the 18th century: Compound Steam Engine by a Spanish French-Trained Engineer Made in England for the Cuban Sugar Industry

In 1791, because of the revolt of slaves, French Haiti lost its dominant position in the sugar industry, and Cuba tried to intercept it. In order to perform the sugar-cane processing, it was decided to use a steam engine. In 1794 two Cuban planters, Casa Montalvo and Arango, went for this purpose to England. They first approached Watt and Bolton, but the negotiations failed. Then they contacted Betancourt, Spanish engineer who stayed in England, co-operated with William Reynolds, accepted the command and already in autumn 1794 designed the machinery. All work took place secretly, for infringed both the rights of Watt and Bolton and the protectionist laws of England. Two engines made at Reynolds' workshop were secretly transported to Bristol waiting to be charged on the military ships. However, because of the war, only one steam engine could be delivered to Cuba in 1796 where it was assembled and worked for several months Humid climate and insufficient fuel (palm leaves instead of wood or coal) resulted in stopping it. Complex analysis of sources (demonstration drawing of the engine reproduced after a picture stored in La Havana; a description of the machine by Betancourt; documents from Cuban and British archives) along with the specificity of Reynolds' workshop production (compounds, beginning with Hornblower's machine), led the authors to conclude that Betancourt invented and produced the two-cylinders compound machine based of that of double action of Watt ten years before the compound steam engine of high pressure patented by Woolf in 1804.

Dikla Bytner (Tel Aviv University)

The History of Modern Technology and the History of Modern Invention

We usually conceive contemporary high-technology as one of the most impressive products of modern techno-science, as well as one of the major engines of further techno-scientific innovation. Techno-scientific innovation, in turn, is itself considered one of the most significant forces of growth and prosperity in modern western civilization. These conceptions are evident in countless national and international efforts to cultivate the conditions allowing constant innovation: from high-tech "hothouses" nourishing techno-scientific innovation to international administration of patent laws ensuring recognition and reward for innovation. A key concept in these efforts is the concept of "invention": invention relates both to the processes and to the products of innovation. Inventions solve problems, they open possibilities to do what was previously impossible, or very difficult. At the same time, making invention constantly possible is itself a problem which western modern techno-science and societies strive to solve, since constant innovation is considered a key solution to various economic, social and cultural problems. In my presentation, I will trace the origins of these modern conceptions of techno-scientific invention and innovation, and their place in modern western culture, to early modern European discourse concerning science. I will focus on Leibniz's techno-scientific inventions, where we can find not only novelty, but also an effort to find the techno-scientific and socio-political apparatuses which can make constant innovation possible. Looking into the origins of these present day trends may allow us to reconsider their techno-scientific and socio-cultural significance today.

D Regional Studies II—Europe (HISTELCON)

Chair: Jacob Baal-Schem (IEEE Region 8/Israel Section)

John Vardalas / Michael Geselowitz (IEEE History Center)

The Trireme—High-Tech Weapon of the Ancient European Seas

Sometime in 481, as the Persian king Xerxes gathered a vast invasion force in western Anatolia, the assembly in Athens debated the proper military response. Themistocles alone argued for the need to use sea power. The Oracle's pronouncement that "a wall of wood alone shall be uncaptured, a boon to you and your children" was a clear reference to their ships' hulls, he argued, and not to some ancient fence around the acropolis. He won the argument that day and Athens bet everything on her fleet, eventually securing a great victory at nearby Salamis (in October 480 BCE). Without control of the sea, Xerxes cut the size of his land force, charged a subordinate with continuing the war, and personally returned to Asia. Although the fighting continued for another year, the lesson was not lost on the first historian of western literature, Herodotus of Halicarnassus. For him, Athens and her new fleet of warships--called triremes--saved Greece. The technological key to victory, then, lay in the trireme, a fearful weapon, which Athens was able to use to great effect, not only against Xerxes, but also in the decades to follow. With it, the Athenians forged an Empire and a flowering of culture that still amaze us.
This paper explores what is known of the origins, engineering, and role in world history of the trireme, with special attention played the student research done as part of a pioneering class on engineering history at the Stevens Institute of technology.

Péter Kádár (Óbuda University)

Metro Line No. 1 (Budapest, Hungary)

In the second half of the XIXth century Budapest became a metropolis. Huge infrastructural investments formed the city into the present tourist-luring townscape. In 1896 was celebrated the 1000 year statehood and the mayor’s office wanted to raise the glare of the feast with an up-to-date technical solution. Up to that time in the city were used horse carts, horse tramway, electric tramway, etc. The new elegant avenue rimmed with palaces was built from the center to the city park where a millennia world fair was organized. For the establishment of the fast and posh connection an idea was formed to push the line underground. In 1894 a tender was made for realization of the first continental underground electric tramline. (The first metro line of the world was established in London in 1863 with steam traction) The construction was realized in 21 months. The 6 m wide, 2,65 deep and 3,km long tunnel was constructed by the local entrepreneur *Robert Wünsch*. A lot of steel and concrete was built in the stations were tiled artistic by tiles of factory *Zsolnay*. At the final open-air section was constructed the first Hungarian steel-concrete bridge too that can be visited on its original location. The train track, carriages and 350 V DC traction system was produced by *Siemens & Halske Co.* The paper deals in detail with the electrical solutions.
The Budapest metro line No. 1 is in operation since its inauguration, the 120 year anniversary will be held in 2016. The most famous passenger of the opening ceremony was *Kaiser Franz-Josef*. Some modifications and extensions are made during the century but the original artistic stations are used today too. Since 1975 in a no-used tunnel part operates the underground tram museum with tree original wagon. Budapest has nowadays 4 metro lines, the last one was opened in 2014 The historic metro line No.1. (called yellow line after the color of the carriages) is in well shape, acts important part of the urban traffic. More than 300 trips transport the 10 to 35 thousands passengers daily between the 12 stations. 8 of them are in original form. The Budapest metro line No.1 is part of the World heritage since 2002 with the avenue above it called “*Andrássy*”.

German Sharygin / Liudmila Sharygina (Tomsk State University of Control Systems and Radio electronics)

Siberian Electronic and Cultural Progress in the East Russia During the Last Century

Siberia and the Far East - a vast geographical area in the centre of Russia, which became a part of Russia in XVI – XVII-th centuries. The square is 12.6 million km^2 (about 74 % of the whole territory). Population 26 million.

Siberia is reach of **resources;** it has 85 % of lead and platinum, 80 % of coal and molybdenum, 71 % of nickel, 69 % of copper, 44 % of silver and 40 % of gold.

In the XIX – XX centuries it is possible to mark out three periods influenced more the development of Siberia.

The first period is "the golden fever" of 1819-1861 years. During this period there was extracted 570 tons of gold. It was the period of private mining industry flourishing and accumulation of Siberian owners' money, making bases for the Siberian cities grow and their cultural development. By the end of the XIX century there lived 50 000 people in Tomsk, the same number in Irkutsk, 20 000 each in Tyumen, Barnaul and in the cities of million population to-day Omsk and Krasnoyarsk. The centre of the region with the square 847 million km^2 and population of 2 million people was Tomsk founded in 1604.

The second period covers the end of the XIX century and the beginning of the XX. In 1878 in Tomsk there was founded the first Russian university east from the Volga. To-day at this university there are 23 000 students, 800 postgraduates and PhDs. According to the QS Quacquarelli Symonds version the University is among the ten first universities of Russia. 1891 year was the beginning of the railway Moscow-Vladivostok 9288 km long. In ten years, in 1901 started the regular railway traffic. This second on the Earth long railway, built in a very short time, became a strong stimulus of Siberian cities industrial and cultural development. At the place of the village Krivoshchekovo with population in 1893 685 people has grown the nowadays capital of the Siberia Novosibirsk with population of 1.5 million people.

The third period was influenced by the Second World War. In 1941-1942 more than 500 plants (mainly of defense production) were moved to Siberia from the European part of Russia. Siberia accepted 1 million people - workers, specialists and their families. Equipment and the staff of research institutes, cultural and museum objects, theatre groups were moved to Siberia from Moscow, Leningrad, west and south of the European parts of Russia, Ukraine and Belorussia. There were also moved high schools from Moscow, Leningrad, Voronezh, Ukraine. There was no return - the industry stayed in Siberia also after the War. All this influenced the development of science and culture of the eastern regions of the country.

Rino Rocchelli / Antonio Savini (University of Pavia)

The History of Electronics Reviewed Through the Study of the Life and Activities of the FIVRE-Marelli Company in Pavia

The study of the almost 70 years of existence (1932-2000) of the FIVRE-Marelli company in Pavia (Italy) gives the opportunity of reviewing important steps of the evolution of electronic technology and manufacturing in Italy/Europe, starting from electronic components for radio and television receivers to electronic control units for cars.

The paper illustrates the development of the continuous mission of the company, i.e “developing and producing high-technology components to be applied to systems produced by the holding Magneti Marelli company”. The company was the leader in Italy and among the most important competitors in Europe in its field of activity, sometimes adopting mature technologies and other times developing innovating components of emerging technologies.

The changes that occurred in these 70 years observed, were basically driven by changes in market and business strategy to which the company responded developing and using the most sophisticated technologies available at the time.

The study points out the evolution of technologies and products, the dynamics of work organization, from manual intensive to capital intensive, and, consequently the dynamics of workplaces as well as the impact of, and on, society of the new technologies.
The analysis includes the high-technologies acquired and exploited positively and also examines some cases of failure happened in the search for new frontiers of innovative technologies. In particular, the development is discussed of semiconductor technology (germanium diodes and transistors), initiated very early at the beginning of 1954 but never actually sent to production and later on, in 1961, dismissed.

E Human Factors in the History of Technology (HISTELCON)

Chair: Antonio Savini (University of Pavia)

Massimo Guarnieri (University of Padua)

The Rise of Light

This year 2015 is celebrating two important anniversaries, which are related each other. It is the 150th anniversary of the publication of Maxwell's electromagnetic theory and it has been appointed UNESCO's "International Year of Light and Light-Based Technologies". The latter has not been designated after Maxwell, but rather after a much older seminal research work, developed one thousand year ago by Iraqi polymath and philosopher Ibn al-Haytham (أبو علي،الحسنبنالحسنبنالهيثم), Latinized as Alhazen), at a time when Muslim science was at its climax. Around 1015 Ibn al-Haytham developed seminal researches on optics and vision, besides studying astronomy, mathematics, meteorology, and exploring the scientific method five centuries before Galileo Galilei. Alhazen's Book of Optics had a deep influence on western science and technology after the printing by Friedrich Risner in 1572 of a Latin translation made by an unknown scholar in the 12th-13th century. In modern western world optics had a boost at the time of the scientific revolution, with the inventions of the telescope and the microscope. Later on, seminal theories on light were proposed by Isaac Newton, who discovered the spectrum of sunlight (1666) and developed an accepted corpuscular theory. These researches led him to invent the reflecting telescope in 1668 and to publish his findings in *Opticks* (1704). Building on Galileo's discovery of the Jupiter's satellites (Galilean Moons), in 1676 Danish astronomer Ole Christensen Rœmer was the first to estimate the speed of light by observing the eclipses of Io, Jupiter's innermost satellite, that he evaluated in 227,000km/s. Dutch physicist Christiaan Huygens, opposing Newton's theory, in 1678 began to develop the first wave (elastic) theory on the propagation of the light, estimating its speed212,000 km/s.
The nineteenth century science and technology allowed much better evaluation of this speed. After Faraday's discovery in 1845 of the effect dubbed after him, namely the rotation of polarized light passing through a magnetic field, two French scientists, Armand Fizeau and Jean Foucault, in 1849–62 made independent and consistent mechanic-optical measurements of the speed of light, that they indicated in300,400 km/s and 298.000 km/s, respectively. At the same time other experiences confirmed its wave nature .As soon as 1857, Gustav Kirchhoff observed that electric and magnetic quantities were related by a parameter that was consistent with the speed of light in physical size and numerical value. It was at this time that James Maxwell came out with his groundbreaking theory (1962), including the deduction that electromagnetic waves travel at the speed of light, and published it in 1865. Consistent results were achieved in 1967 by Ludvig Lorenz**.** The way was open to those achievements that would eventually lead the electromagnetic technologies to full maturity.
The paper will describe the long evolution of our knowledge of light that has promoted major discoveries in modern science and technology.

Branimir Jovanovic (Nikola Tesla Museum)

Nikola Tesla and the problem of Human Energy

Nikola Tesla, Serbian – American inventor, is one of of the most prominent electrical engineers and inventors at the end of XIX and beginning of XX century. He is most known as inventor of induction motor but in 1880s and 1890s he had a number of succesfull patents in the fields of transmission of electrical energy and wireless telegraphy. The global significance of his innovations induced Tesla early to reflect on the global problems of humankind.

After the discovery of the resonance frequency of the planet Earth in 1899, he tried to realize system of global wireless transmission of signals and power. At that time he envisioned a revolution in all spheres of human life which would be yielded by his and similar innovations of global character. In 1900 he wrote and published the study "Problem of increasing of human energy" – in which he exposed some of the problems humankind would face in the near future and suggested specific solutions.

After the rejection of the leading American financiers to further invest in his project, which seemed to be too ambitious and unrealizable, Tesla started to think more critically about the trends of contemporary development in the world and raised a series of prognoses about the consequence that the prescribed trends were generating. This was the time of 1920s and 1930s when he spoke about the need to:

Preserve energy resources; Search for new, renewable and alternative energy sources; Strive for a more modest development with less consumption; Aspire a culture oriented to universal mankind values, true education and true culture; Weigh towards the poor life habits change as to reach an even development of all people.

On a personal, social and civilizational level, Tesla saw three main problems that must be addressed in order to achieve stable growth conditions. These problems are: social, moral and spiritual.

We live in times when the importance of solving the social problems of humankind, regardless of whether it is raising the good living comfort of minorities or the problem of poverty of the majority, is emphasized. We also live in times of great moral crisis of humankind, especially of those people who manage the movement of the world today. And finally, we live in times of refined materialism and neglected spiritual values.

Tesla also insisted that the developed part of the world had already reached a satisfactory high level of comfort and security of existence, and that humanity should now turn to planting such habits of all people that would bring advantages of civilization to all men equally. The value of Tesla as an authentic and early thinker of global problems of humankind is unknown to the broader public and even undiscovered and unrecognized among experts.

Nathan Brewer / Michael Geselowitz (IEEE History Center)

The Engineering & Technology History Network (ETHN)

When engineering emerged in the modern period, it was viewed as a single field involving the designing, making and using of artifacts (from as small as a needle to as large as a bridge) for the use of people. What distinguished modern engineering from earlier technology was the conscious and intentional reliance on science to provide the information needed for invention. With rapid rise of both science and technology, each expanded in numerous, increasingly specialized disciplines that could barely communicate with one another. The attempts to preserve and promote the history and social context of these various disciplines were likewise fractionalized.

For some years the IEEE History Center has operated on behalf of IEEE the IEEE Global History Network (GHN), a wiki-based website dedicated to preserving and making known the history of IEEE's areas of interest, that is, the sciences and technologies that derive from electricity, electronics, computing, and information.

Interestingly, in the contemporary “high-tech” world, the engineering disciplines are re-converging. For example, biomedical engineering fields such as prosthetics involve, at a minimum, electrical, mechanical and chemical engineering.
Therefore in 2014, with a grant from the United Engineering Foundation, the IEEE History Center partnered with the major American “Founding Engineering Societies” (AIChE, AIME, ASCE, ASME), along with SPE and SWE to develop a new site, the Engineering & Technology History Wiki (ETHW). Built on the infrastructure of the GHN, the ETHW presents a united face to a public interested in the origins of their completely technologized world.
This paper describes how the ETHW came to be and its initial impact on presenting the history of “high-tech.” It also describes its relationship to REACH (“Raising Engineering Awareness/Appreciation through the Conduit of History”), the IEEE History Center’s pre-university educational program.

Hiroshi Suzuki (Japan University of Economics)

Japanese Innovation History from ‘One Step on Electro Technology’

1. Introduction: The Institute of Electrical Engineers of Japan (IEEJ), which in 2008 celebrated its 120th anniversary since being founded, established the honor of “One Step on Electro Technology– Look Back to the Future–." This system unveils and respects electrical technologies in Japan that are not well known to society, but which have contributed greatly to social life. The Institute has already made honorable recognition of 52 technologies through March 2015.
The honor of the "One Step on Electro Technology," of course, contributes to wider notification of the history of Japan's electric technology development and the societal background to the general public. It is also extremely important to create the goals of new science and technology from ideas of the past.
As described in this paper, summarizing "One Step on Electro Technology" of all 52 technologies that have been honored in the past, the authors will discuss upcoming features of Japan's innovation.
2. "One Step on Electro Technology" and innovation: "One Step on Electro Technology" candidates are nominated from the general public including IEEJ membership, irrespective of self appointment, several dozen applicants have been submitted every year. The final election committee consists of successive past IEEJ Chairmen. It tasks selecting candidates to subordinate organizations, which consist of IEEJ members covering all electric and electronics fields. These lection is conducted strictly under confidential conditions.
In the "One Step on Electro Technology," the award categories are in subjects of "things," "location," "matter," and "persons." Development of each should be done in the electric field and more than 25 years prior.
3. Study of selected honors: First, when the honor projects that have been recognized among these eight years were classified by category, results show that about half of the honored projects were "things," followed by honored projects as "matter" and “persons.”
Secondly, analysis of the number of honored projects by era reveals that just after the Meiji Restoration, several foreign professors and Japanese engineers were recognized because many electrical engineers had been developed through the efforts of foreign teachers in the early days of the Meiji Restoration. During the Meiji through Taisho eras (1912–1926), the number of the honors was very few. Entering into the 1920s, the honor number increased before World War II. During the war (1939–1946) the number of honored projects decreased. Since 1950, a number of outstanding electric technologies have been developed, reflecting the support of Japanese reconstruction after the war.
4. Conclusions: From the discussion presented above, to support the growth of the Japanese economy and to achieve a good life for its people, Japan did not rely on other countries’ proprietary technology, but vigorously developed efforts in this field. Japan concentrated on manufacturing to improve mass production. As in "One Step on Electro Technology," creating innovation in accordance with the era in the future, Japan's electrical technologies are increasingly expected to open up future development.

14.30–16.00

A Session: Structured Invention and Structuring Innovation

Chair: Irina Gouzevitch (Ecole des Hautes Etudes en Sciences Sociales, Paris)

Peter Koval (Humboldt University Berlin)

Obstacle Design and the Historiography of Technology

In a general sense an obstacle could be understood as "thing that blocks one's way or prevents or hinders progress" (OED). Those "blocking things" aren't out of scope of the historiography of technology- even they can lead to failures they are not to be confused with them. Usually they are studied to learn more about "the way" and "the progress" whether it's technology or (its) history. A closer look at the obstacles reveals two basic historiographic patterns. Either they are known, at least to some extent, and act as a challenge or as a vanishing point of the progress, or they aren't really predictable beforehand, they emerge "on the way" and often change the progress direction. In both cases they are somewhat "external" to the technology, either they are just there as the Alps for the Gotthard tunnel or they dynamically shape the way like market fluctuations, changing legislations or user needs in case of high technologies. Drawing on the (chrono-) topological definition of the obstacle and the dialectics of obstacle and teleology I would like to present and discuss an experimental conceptualization of a "positive obstacle". An obstacle may not be a telos of technology but it can be made productive as an "epistemic obstacle" (Bachelard) in the historiography of technology.

Eduardo Perez- Molina (TCB-UPM)

The Role of Patent Citations as a Historical Footprint of Technology

This talk discloses the characteristics of the body of patent citations highlighting some interesting features over bibliographic references in non-patent (technical) literature, and the special role that they could play as a historical footprint of technology. Three main features of prior-art patent citations are identified, namely who produce the citations -the patent examiner in place of the author-, why they are cited -the evaluation of novelty and non-obviousness- and the fact that every patent publication is classified in a universal scheme containing the whole spectrum of possible technologies, together with some auxiliary features such as universal identifier, absence of self citations or homogeneity of bibliographic sources. All these features make of patent citations a unique collection within the body of bibliographic references. The list of patent documents referenced in a patent by the patent examiner forms a link between the patent application and the prior-in-time available technology. Both concepts - novelty and non-obviousness - point to time and conceptual proximity, which seem fundamental in the study of history and technology. The list of prior-art citations for a set of patents forming a specific technology, together with their classification information, once processed by computer, form a historical footprint of the specific technology. Such a footprint has some limits and constrains but can be useful to identify the origins, evolution and main players -inventors and companies- of the specific technology.

Eufrosina Otlacan (CRIFST, Romanian Committee for History of Science and Technics)

About Theoretical Hydrodynamics and Professor Victor Valcovici (1885–1970)

Any high-technology started with theoretical and mathematical models especially. That is why it is important to study the history of mathematical models also. The paper speaks about a creator of mathematical models for hydrodynamics. Romanian Professor Victor Valcovici entered the world of scientific and technical inheritance with his doctoral thesis presented at the University of Gottingen in Germany, on July 30, 1913.

The title of this thesis was "Über diskontinuerliche Flüssigkeitsbewegungen mit zwei freien Strahlen" (On the continuous fluid movements with two free dimensions). The advisor was the outstanding scientist Ludwig Prandtl. Professor Prandtl himself, using the idea of this work, modified his wind tunnel at the University of Gottingen. Valcovici's ulterior scientific and experimental works have lead to the construction of wind tunnels at the universities in Paris and Bucharest and were used in the aeronautics industry. The method Valcovici-Birckoff and surfaces Bernoulli-Valcovici, are used in the study of the supersonic movements. From a large list of subjects studied by Victor Valcovici, with important scientific and applicable results, we could name a few here : the equilibrium of a rigid solid over an elastic surface, the movement of a rigid solid into a viscous fluid, the rocket theory, the theory of Bernoulli surfaces for barotropic fluids, the column buckling. Victor Valcovici has written books on general mechanics, mechanics of perfect fluids, elasticity theory, strength of materials, and elaborated an original and interesting theory about the formation of the Earth. Member of the Romanian Academy since 1936, Professor Victor Valcovici has had an exceptional activity in the frame of the Polytechnic School of Timisoara and University of Bucharest.

B Session: Tenth Annual ICOHTEC Symposium on the Social History of Military Technology (6)

Organizer: Bart Hacker (Smithsonian Institution); Co-Organizer: Ciro Paoletti (Italian Commission of Military History)

Paul J. Hoffman (US Air Command and Staff College, Alabama)

Explaining Organizational Variation in Suicide Attacks, 2004–2013

Despite the growing number in suicide attacks around the world in the last 14 years, studies of the phenomenon remained focused on theories that identify causal factors that contribute to the likelihood of suicide attacks. This paper explores these attacks from a different perspective. Rather than investigating *why* groups use suicide attacks, it instead focuses on the empirical question of *what* they attack, and whether these attack patterns change over time. This paper conducts a longitudinal study in terrorist innovation using the suicide bomb as a type of deadly military innovation.

I use the Global Terrorism Database (GTD) for country-specific attack data from 2001 to 2013 to identify terrorist groups and suicide attack targets by country. I choice of case studies: Boko Haram (Nigeria, 2010-2013), ISIL and its forerunners (Iraq, 2004–2013), ISIL and ANF (Syria, 2011–2013), and the Tehrek-e-Taliban-Pakistan/TTP (Pakistan, 2007-2013).GTD empirical data shows how hardware and ideas change or persist over time. Rogers's innovation-decision process suggests ways to model how specific groups adopt suicide attacks as a deadly innovation and modify their hardware, employment ideas and doctrine, and organizational structures to achieve their desired effects and outcomes. I also explore the role of cognitive biases in innovation diffusion and adaptation processes. Initial analysis suggests that suicide attacks are not a singular form of terrorist violence; significant differences exist between groups both in how suicide attacks are employed and in what targets they attack.

Paul J. Springer (US Air Command and Staff College, Alabama)

War by Remote Control: The Strategic Costs of Drone Warfare in the Twenty-First Century

Unmanned and remotely-piloted weapon systems have come to dominate the American public's concept of warfare, so-called drone strikes having become one of this century's most ubiquitous and visible means of military attack. Unfortunately, American political leaders have developed an unrealistic and irrational understanding of the utility of these platforms, increasingly seeing them less as military technology and more as instrument of international relations.

Drones have sparked significant controversy, in part because of their use outside designated combat zones, with little legislative or judicial oversight. Belief that they can be carried out with impunity ignores the history of human conflict. When armed forces can strike opposing combatants, they tend to confine most of their violence to such targets. When they have no ability to inflict casualties against uniformed military personnel, though, they tend to seek alternate means of tactical effect, to include attacks on civilians.
This paper examines the moral and legal quandaries created by the increasing use of remotely-piloted aircraft, particularly in operations other than conventional warfare.American political leadership mistakenly views these weapons as a means to engage in conflict without human cost or legal accountability, but the ramifications of such uses are much larger than the immediate effects upon the battlefield. While these weapons offer a significant tactical advantage to U.S. forces, their negative strategic effects outweigh any gains they might offer, particularly in irregular conflicts.

Krzysztof Kubiak (University of Jan Kochanowski, Poland)

The Western Core of NATO: Between High Technology Armies and Post-Heroic Societies

The writers who address the issue of challenges faced by the North Atlantic Alliance usually treat the subject in a "technical" way. Discussing the provisions of subsequent summits of the organization they specify the needs articulated then, simultaneously suggesting that meeting them will be identical to preparing NATO to face what future brings. The issue of further existence of the structure, rooted explicitly in the times of the cold war, and the structural challenges faced in the conditions of the principal change in the global security organization is quite rarely a topic of a public dispute. It is the writer's intention to prompt such an exchange of opinions, based on the assumption that the North Atlantic Alliance finds itself in its crucial phase and that within the nearest years it will be clear whether it will remain an civil-military alliance that is effective and capable of effective action to build security in its surroundings, or, whether it is another "discussion box", which, as a matter of fact, owns military instruments, but is not able to use them by any way.

C Session: Innovation in the Wake of War

Chair: Yoel Bergman (Associate Researcher at the Cohn Institute, Tel Aviv University / Independent Scholar)

Anthony Travis (The Hebrew University, Jerusalem)

Capturing Nitrogen with Electrochemistry and High-Pressure Chemistry: New Chemical Technologies in the Early 20th Century

Compounds of nitrogen are essential as fertilizers and in the manufacture of explosives. During 1900 and 1913 three novel industrial processes for capturing atmospheric nitrogen for use as fertilizer were developed in Norway and Germany: electrothermal production of nitric oxide (Birkeland- Eyde) and calcium Cyanamid (Frank-Caro process); and synthesis of ammonia from its elements by the high-pressure process of BASF (Haber-Bosch process). With the outbreak of war in 1914, these processes were exploited in the manufacture of munitions, particularly in Germany, which from December of that year was denied access to nitrates from South America. The long stalemate on the Western Front stimulated technical improvement and massive expansion of synthetic nitrogen processes, as well as major developments in the production from ammonia of nitric acid by catalytic oxidation. The Haber-Bosch process inaugurated a new era in industrial chemistry, based on high-pressure, high-temperature catalyzed processes, including the growth of a key sector: synthetic nitrogen products as fertilizers. During the 1920s it stimulated major developments in rival high-pressure ammonia processes, particularly in Italy and France.

Louise Karlskov Skyggebjerg (The Danish Museum of Science and Technology)

World War I and Cross- Country Transfer of High Technologies

In the years surrounding World War I the truck, the airplane and the radio were quite new technologies - the high technologies of their time. The paper explores the impact of the war on the development and cross-country transfer of these technologies, and discusses on this background the popular assumption that the general effect of war on the development and use of new technologies is stimulation. The war meant improvements of key parts like vacuum tubes, increased production of for example trucks, and more experienced users as young men used these technologies as part of their military duties. On the other hand, it also meant difficulties for the international exchange of information among inventors and developers, and focus on military requirements rather than civilian purposes. As an example, the amateur use of radio was banned in many countries during the war, which may have delayed the use of radio for broadcasting. The paper uses Denmark as a case, especially two cases of transfer of "surplus" wartime technologies from the belligerent countries to Denmark after the war, the F.F.49c seaplane used by the German Marine for reconnaissance, and the Mack truck, which came in large numbers to the battlefields in France with the American and British Armies. These wartime technologies were transformed and used for civilian transport purposes after the war. The paper is dealing with the conference subtheme cross-country transfer of high technology.

Emily Brock (Max Planck Institute for the History of Science, Berlin)

The Development of Marine Grade Plywood and the Environmental Impact of World War II Naval Small Craft

This paper focuses on the cultural and environmental history of plywood manufacturing, in relation to the widespread adoption of marine-plywood for American naval use during World War II. By the mid-1930s, plywood manufacture was well-established in the United States, but the product itself was not considered appropriate for high-end needs. Manufacturers of wood products had found plywood glues unstable and the plywood itself neither durable nor consistent in quality. During World War II, however, the American military insisted that companies use newly advanced, marine-grade plywood to build small landing craft for the Navy. For a military worried about domestic wood shortages, plywood usage made existing supplies last longer. After initial resistance, boat building companies found the new military grade plywood could produce light and durable boats. By war's end, the companies had redesigned boat hulls around the new materials, which could be curved in ways boards could not. Upon renewing their leisure-craft manufacturing postwar retained the plywood designs. This paper argues for the importance of the military role in pioneering the material and enforcing the shift. More to the point, the wartime military role had far-reaching implications for worldwide patterns of postwar wood use. I trace the historical arc of relationship between commercially-logged tropical trees in Southeast Asia and elsewhere in the developing world, through the establishment of subsidized plywood-making facilities by postwar international development agencies like USAID and the United Nations.

D Session: High Technology in Long-Term Perspective and Cultural Practice– Lessons from the History of Infrastructure

Organizer: Andreas Marklund (The Danish Post & Tele Museum)
Chair: Mogens Rüdiger (Aalborg University Denmark)

The purpose of this session is to discuss how insights and analytical tools from current research on the history of infrastructure can be used to deepen our understanding of the broader historical and societal impact of high-technology. We will argue for an approach in which high-technologies are analyzed as historically contingent networks of human actors, material objects and cultural beliefs instead of being

treated as isolated technologies or scientific artefacts with ingenious inventors. Paper #1 will probe the subject from a general theoretical and historiographical perspective, drawing on conclusions from the editing of an interdisciplinary research volume on infrastructure history. The following papers are more applied and deal with particular technologies and methodologies: #2 analyses cold war telecommunications from the point of view of security studies, whereas #3 brings in spatial studies for a critical assessment of the nation-building potential of 19th-century railroad technology.

Andreas Marklund (The Danish Post & Tele Museum)

Historicizing Infrastructure after the Material Turn

Research within the humanities for the past ten years has been affected by an epistemic re-orientation from text to things, as focus is shifting from discourse and representations to the materiality of the past. This development has proved rewarding for the historiography of infrastructure, as the research field has been infused with a wide array of new tools, methodologies and theoretical approaches. The history of infrastructure is no longer a province for historians specialized in science and technology, but is gradually being integrated into mainstream history as well as anthropology and cultural studies.

The paper will discuss how this historiographical development can be used to extract tools for a better understanding of high-technology as a "time- and place-bound concept", i.e. subtheme #1 of the ICOHTEC CFP. Particular attention will be given to the issue of social practice and human agency vs. technological determinism. Cultural research after the material turn highlights the complex webs of interaction between human actors and material (technological) objects as crucial for the historical processes, and I will argue that this is a fruitful vantage point for explorations into the societal impact of high-technologies in various contexts.

The paper takes its point of departure in a coming research volume on current tendencies in the history of infrastructure – a book consisting of original research by 11 scholars from all across the globe, who joined forces at an interdisciplinary conference in September 2014 organized by the Danish Post & Tele Museum and Aalborg University.

Sanne Aagaard Jensen (The Danish Post &Tele Museum, University of Copenhagen)

Securing the Alliance With Infrastructure and Technology: Infrastructure Programs and Communications Security on the NATO Agenda in the1950s

In 1951, NATO launched its first so-called common infrastructure program. In order to rearm Western Europe and build-up a reliable defence alliance, the military infrastructure in the member countries had to be restored, extended and interconnected. This entailed development and application of high-technologies within many different areas. The paper delves into the infrastructure planning in NATO in the 1950s with a particular focus on telecommunications. A prospective new war was expected to be fought on own territory, and therefore an operative and secure communication system was needed – a system that could function even in the most critical situation; after a potential nuclear attack.

By examining the work carried out by the spate of committees and working groups set up within NATO in the 1950s, the paper will map the complex of problems related to the task of building a secure communication infrastructure: high-technological development, forced standardization, financial negotiations, policymaking and involvement of civilian telecommunications experts. Drawing on the field of critical security studies, the paper will address questions as to how security is created, and how this process can be studied. A strict focus on discourse has been dominating within security studies, but in the recent years a material turn has become visible. The paper will address the material dimension of security in the NATO infrastructure programs and discuss the role of security issues in the history of high-technologies.

Zef Segal (Ben- Gurion University/ the Hebrew University)

The mid-19th century annihilation of space: The railway infrastructure delimitation of territorial identities in 19th century Germany

Railways, as the most revolutionary nineteenth-century hi-tech development, transformed society dramatically by giving the opportunity for spatial movement to the masses. The technological innovation broke down the "tyranny of distances" with respect to the shaping of economic, cultural, social and political connections. As a result, it has long been seen as part of the nineteenth-century nationalization process. Unlike other political modes of nationalization, its significance lied in its practical usage. Therefore, the territorial coverage of railway infrastructure correlates with its importance in the creation of modern national societies. However, most research on the topic had focused on the general appearance of railways, such as uniforms, architecture and technology, and not on the actual spatial deployment. Using spatial analysis and defining the topological characteristics of the infrastructure suggests a new understanding of the complex relationship between technological innovations and territorialization. Not a subordinate one, conforming blindly to a regimented national plan, but rather an independent route, relying on social and geographic connections. This type of analysis focuses on the territories left out, the gaps created, and the consequences caused by it. In this sense, it does not just connect people, but also disconnects them.
Deconstructing the railway network of independent German states, such as Bavaria, Saxony, Hanover, Wurttemberg and Baden, prior to the German unification of 1871, explains the different futures for internal integration of these states. Moreover, this spatial- infrastructural analysis depicts a Germany, which is much less connected and united than the history of German unification usually acknowledges.

E History of Computing and Related Components(HISTELCON)

Chair: Michael Geselowitz (IEEE History Center)

Zvonko Bencic (University of Zagreb)

The First Remote Recording of Gramophone Records in Europe (Zagreb, 1927)

The study of acoustic waves in Croatia began with the arrival of Vinko Dvořák at the Faculty of Philosophy of the Franz Joseph I Royal University of Zagreb in 1875. Vinko Dvořák had attained his PhD in philosophy two years earlier, with physics marked as his speciality, at the University of Prague under the mentorship of Ernst Mach. Peter Salcher, professor of physics and mechanics at the Maritime Academy in Rijeka, under the instructions of Ernst Mach, photographed the shock waves which occur from the movement of a bullet through the air at a speed greater than the speed of sound in 1886/1887.
Vinko Dvořák is also known for his experiments and the apparatus he used to try to demonstrate the mechanical action of sound waves. Perhaps his best-known experiment, by which he tried to show the gathering of dust particles in nodes of sound waves in a Kundt's pipe, which is known as Dvořák-Rayleigh's circulation. His best-known apparatus were his acoustic motors and the acoustic radiometer.
In this way a scientific base was formed in Zagreb and in 1926, in an alliance between the Zagreb pencil factory, Penkala, and the English company Edison Bell, a gramophone and gramophone record factory was founded, under the name Edison Bell Penkala. In 1927 experts from that factory undertook the first remote recording of a gramophone record in continental Europe, using a telephone line. This was the third recording in the world, after the recordings in the New York Metropolitan opera house and in London's Covent Garden.
This article also describes and explains the apparatus with which Vinko Dvořák demonstrated the mechanical effects of sound. It also describes the technical recording methods used, from the microphone in Zagreb Cathedral, to the gramophone record cutting machine in a studio about 500 m away. The recording arrangement developed Paul Voigt, electrical engineer from Edison Bell company who spent the second half of 1927 in Zagreb.

Valery V. Shilov / Sergey A. Silantiev (MATI – Russian State Technological University)

Logical Machines: Predecessors of Modern Intellectual Technologies

The scientific discussions on the theme «can the machine think?» (i.e. on the possibility of creation of artificial intelligence) began in 1950s when after the development of first electronic computers Alan Turing published his paper «Computing Machinery and Intelligence» (1950; later this paper was published under the title «Can the Machine think?»). Philosophical (and quasi-philosophical!) discussions on these problems reached their peak in 1960-1970s. But in fact when at the end of 1970s the program of 5th generation computer design was announced in Japan (so called «Japanese challenge») and appropriate programs in USSR and USA began the main aspect of these discussions was the necessity of computer «intellectualization». It meant not only the extending of application fields where computer can solve various tasks effectively but also the rising of the level of communication between computer and a man (even up to the level of natural language).

Despite the failure of Japanese project the progress achieved from that time exceeded all the most optimistic expectations. Nowadays computers are used almost in all spheres of human activity. So the computer intellectualization became matter of topical interest today. That's why it is very interesting and edifying to know the history of machines carrying out various kinds of intellectual human work. These machines include mechanical computing devices (adding machines, arithmometers etc.), mechanical automata which can draw, write and play music, mechanical speech generators and even automata for writing poetry.

Among such devices those which are designated for solving the problems in the field of formal logic − logical machines − present the particular interest. The history of mechanical, electrical and relay logical machines began by the works of famous Catalan philosopher and mystic Raymund Lull (the end of XIII century) and ended with the design of first universal electronic computers which could solve the similar problems. Actually logical machines could be considered as very simple and primitive model of the thinking process. In this article we give the review of logical machines built before the beginning of computer era. In contrast to the classic book of Martin Gardner «Logic machines and diagrams» (1958) our paper includes descriptions of all known logical machines. Some of them (e.g. devices of Alfred Smee) Gardner described only briefly and some («virtual» logical machine of Jonathan Swift, Round Demonstrator of Earl Stanhope, *machines intellectueles* of Semion Korsakov, logical machines of Pavel Khruschev and Aleksandr Schukarev) did not mention at all.

The centuries-old development of logical machines is very interesting page of both computer technology and logic history. In fact, logical machines cannot be called the ancestors of modern computers but our analysis allows us to state for surely that these devices were the very first predecessors of contemporary intellectual informational technologies.

Haruo Okuda (Shonan Institute of Technology)

Vicissitude of Magnetic Tape Data Storage: Comparison with Video Tape Recording

Magnetic tape storage was originally developed for audio recording before World War II. Video tape recorders (VTRs) also developed after a long time for recording wide-band video signals, and they came into widespread professional and consumer use. We previously described the changes in VTR scanning systems at HISTELCON 2010. We showed that Japan made substantial contributions to the development of helical scanning systems. In this paper, the history and outlook of magnetic tape data storage for external computer memory are discussed and it is compared with VTRs.

Magnetic tape storage began to be used for computer data recording in the early 1950s before the advent of VTRs. Tape storage was initially used as external memory for mainframes. Easy handling systems where the tape was contained in a cartridge appeared in the 1980s, and these systems were used in midrange office computers and mini computers. In addition, various tape storage systems were developed for small office computers and workstations, including Quarter Inch Cartridges (QICs), single reel cartridges containing

half-inch magnetic tape, tape cassettes based on broadcast-use digital VTRs, and cassettes based on 8-mm VTR and 4-mm DAT.
Early on, linear scanning systems were used for tape data storage, although helical scanning systems similar to VTRs were subsequently adopted because they could record large amounts of data at high speed. Japanese manufacturers proposed many helical scanning systems for data storage. Among them, small cassette storages containing 8- or 4-mm tape was used also for personal computers. However, many competing removable storage mediums appeared in the 1990s, including magneto-optical discs, large-capacity flexible magnetic disks, and removable hard disks. In particular, the compact disc (CD), which is a 120-mm-diameter digital optical disc that was developed for recording music, was adopted for storing computer data. Subsequently, DVDs and Blue-Ray discs appeared, providing a remarkable increase in capacity compared with CDs. In the 2000s, magnetic tape data storage surpassed by the new storage systems and the market of tape storage for personal use declined rapidly.
The only tape storage system that was introduced after 2000 was Linear Tape Open (LTO) that adopted the linear scanning system with half-inch tape. LTO used for not only midrange computers but also high-end computers. They were superior in capacity, transfer rate, and cost per volume to other storage systems. LTO has progressively incorporated various new technologies.
Tape storage technology will continue to provide indispensable stable storage for applications such as cloud computing and long-term archiving. In contrast to VTRs, the advantages of helical scanning with complicated mechanism are not essential for data storage, which has reduced the contribution of Japanese industry to the storage technology.

Antonio Savini / G.G. Savini (University of Pavia)

Short History of 3D Printing, a Technological Revolution Just Started

The advent of computers just after the second world war fostered the second industrial revolution. In the field of manufacturing the result was the possibility of replacing hand-controlled processes with computer-aided or numerically-controlled ones. In the 1980s a new way of industrial manufacturing, which traditionally was subtractive manufacturing, was proposed, the so called additive manufacturing, where 3D objects were produced by adding layers of materials starting from nothing instead of removing useless material from a whole block. This way of manufacturing was also called 3D printing with reference to a similar technology used in inkjet printers. Charles Hull is considered the godfather of this technology after his patent of 1986. Since then it is reported that over 30 000 patents about 3D printing have been published just in the U.S. Over the years various additive technologies have been propoposed from photopolimerization to fusion deposition up to bioprinting recently. At the same time veveral open-source slicer programmes have been produced and made available on the web. Since in the past few years most of patents have expired, nowadays the cost of a desktop 3D printer is more than 20 times less than in the past. Therefore probably we are at the beginning of a revolution in manufacturing processes, as has been recognized in 2013 also by the President of the U.S.
The paper reviews the brief history of 3D printing, also through the analysis of patents, and points out the possible impact on society of this new revolutionary technology which may soon change our way of manufacturing but also of working, pèlaying and living.

F History of Telecom (HISTELCON)

Chair: Jacob Baal-Schem (IEEE Region 8/Israel Section)

O. V. Makhrovskiy (Bonch- Bruevich Saint-Petersburg State University of Telecommunications)

The 120th Anniversary of the Invention of Radio by A. S. Popov: From Telegraph Apparatus to Future Communications Technologies

Aleksandr Stepanovich Popov was born in the North Urals on March 16, 1859. He was the son of a village priest.

For some years he had been studying at the seminary in Perm and then went to the University of St. Petersburg. In his student days he worked as a mechanic at one of the first electric power plants in St. Petersburg which was producing electric lights for Nevsky prospect.

After graduating from the University in 1882, A.S. Popov remained there as a post-graduate at the Physics Department. A year later he became a lecturer in Physics and Electrical Engineering in Kronstadt.

By this time he had already won recognition among specialists as an authority in this field.

In 1894 Aleksandr Popov, Russian radio pioneer built his first practical radio receiver, which contained improvements to the coherer tube.

On May, 7th, 1895 Popov has demonstrated the world's first radio-receiving set created by him at the convention of the Russian Physical and Chemical Society in St. Petersburg and conducted the first radio session (the first public demonstration of the electromagnetic telegraph). This day went down in history as “Radio Day” and being celebrated in Russian Federation**.**

Thus the first wireless (radio) receiving set was created.

Then Popov on March 24, 1896 demonstrated the transmission and reception of a radiogram consisting of two words: “Heinrich Hertz” over a distance of 250 meters. On that day the radio-telegraphy was convened from an abstract theoretical problem into a real fact.

By his invention Popov made a priceless contribution to the development of world science.

Nearly at the same time an Italian inventor G. Marconi, who moved to Great Britain in 1896, got an English patent on using electromagnetic waves for communication without wires. As A.S. Popov had not yet patented his invention by that time, the world considered Marconi to be the inventor of radio. But in our country it is A.S. Popov who we by right call an inventor of radio.

In 1897 an active part in promoting the A. S. Popov invention took French engineer E., Ducrete (Ducretet 1844—1915). A. S. Popov and E., Ducrete created in 1899, "POPOFF - DUKRETET" company (with the assistance of the French and Russian governments) and began produce the equipment of serial marine radio. In all time of existence of the company "POPOFF - DUKRETET" (1899 - 1904) was released 25 sets of ship radio stations on joint A. S. Popov and E. Ducrete developments.

A.S. Popov did not live to see the great impact of his invention to the social, political, economic, scientific, and military life in all over the world.

Popov's invention laid the foundation for further inventions and improvements in the field of radio engineering. Since that time scientists in all cauntries have been developing the modern systems of radiotelegraphy, radioastronomy, broadcasting, television, radiolocation, radiometeorology and other branches of radioelectronics.

Radio has now become a popular medium of portable entertainment. In 21st century, technological advancements have given birth to Internet radio. Satellite radio is also recent development in the field.

Radio occupies one of the leading places among the greatest achievements of modern Communications Technologies.

Nina Borisova (A. S. Popov Central Museum of Communication)

Beginning of Soviet Broadcasting and First Soviet Radar Projects as Example of State Influence on Innovations

High technologies develop successfully in those countries that create the conditions encouraging innovation perception: innovative climate and innovative culture. These are influenced by many welfare factors. Innovative process in the Soviet Union (unlike in some other countries) has never been based on entrepreneurship spirit (as in the USA) or on the management culture (as in Japan). In the Soviet Union the main factor was the state direct participation in managing domestic science and technologies.

The report will discuss results of the research on identifying advantages and disadvantages of the state participation in the initial stage of development of broadcasting and radar in the Soviet Union in the 1920s-30s.

Presenting innovations in three phases – conception (idea), construction (idea implementation) and marketing (bringing a product to the consumer) – is a foundation of any research. Our research was carried out using general scientific principles, including systemacity and historicism. Along with the information from the archival sources, this paper features the data received from the published memoirs of the developers and of the radio-electronic branch managers.

On the positive side, the conclusions are as follows. The idea of the state to use broadcasting in political purposes led to a phenomenal development of domestic broadcasting technologies and to dissemination of culture in the huge territory of semiliterate Russia. On the negative side, this is what marked the start of the strategy of foreign help and assimilation.

The conclusions concerning the first Soviet radar projects are as follows. Submission of innovative process to the military purposes by the state can only be effective if a number of accompanying conditions is observed. Violation of these conditions can lead to wrong assessment of innovative results, as in the case of the Cavity Magnetron known as Alekseev-Malyarov magnetron in the world (Featured in a publication in Russia in 1940 and in a republication in the US «Proceedings of the IRE» in 1944).

Al MacRae/ A. Michael Noll (Bell Labs, retired)

Bell Laboratories, Incorporated: 1925– 1984— New Jersey's Innovation Factory

A long time ago, long before there was a Silicon Valley and long before California was famed as the innovation and technology State, there was a New Jersey with an innovation factory operated by Thomas Alva Edison. But New Jersey then became the home of a second innovation factory – Bell Telephone Laboratories, Incorporated (also known as Bell Labs).

Bell Labs was formed in 1925 from the engineering department of the Western Electric Company – the manufacturing unit of AT&T's Bell System. In 1941, Bell Labs moved to Murray Hill, New Jersey, and in 1962 expanded to a second large building in Holmdel, New Jersey.

Much of today's information age and digital era came from inventions and discoveries made at Bell Labs. Four recent IEEE Milestones honor these discoveries by the scientists and engineers of Bell Labs.

The period of the 1950s and 1960s is considered by many to the Golden Years of Bell Labs because of the quantity and significance of the many discoveries. Perhaps that period began with the discovery of the point-contact transistor in 1948. But even before then George Stibbitz has built a digital computer to perform arithmetic with complex numbers; Harry Nyquist had observed the relationship between bit rate and bandwidth; and Harry Black had invented negative feedback.

There were many factors that contributed to the uniqueness and accomplishments of Bell Labs, such as: a broad substantive mission; freedom to take long-term chances; excellent support staff; competent management; secure and stable funding.

16.30-17:30

Daumas Prize Winner's Session

Stefan Krebs: Dial Gauge Versus Senses 1-0: German Car Mechanics and the Introduction of New Diagnostic Equipment, 1950–1980 (Technology & Culture, April 2014)
Chair: Susan Schmidt Horning (St. John's University, NYC)
Hans Joachim Braun (Helmut Schmidt Universität, Hamburg)
Christopher Neumaier (Centre for Contemporary History Potsdam)

17.45-18.45

ICOHTEC Prize for Young Scholars

Karena Kalmbach, Meanings of a Disaster: The Contested 'Truth' about Chernobyl. British and French Chernobyl Debates and the Transnationality of Arguments and Actors (dissertation completed in September 2014 at the European University Institute, Florence)

Chair: David Zimmerman (University of Victoria)

Mogens Rüdiger (Aalborg University Denmark)

Noah Efron (Bar Ilan University)

Karen Kalmbach (FU Berlin)

Thursday, 20th August 2015

09.15–11.00

A Session: Universality in Computational Theory (Room 278)

Organizer/Chair: Arie John Mor-Wurm (Achva Academic College)

Arie John Mor-Wurm (Achva Academic College)
Universality in Leibniz Theory

A universal mathematical model for physical reality has been the explicit or unspoken endeavor of science for centuries. From Galileo's Language of Nature to Descarte's Mathesis Universalis - It is an approach to Nature that would describe its complexities and fundamentals on all scales. In this session we discuss the theory of universality in the context of computation. Starting with Leibnitz's great dream of a universal machine (that would combine human and natural logic in his Characteristica Universalis), a prototype of the universal problem solver of Hilbert, which was later implemented by an algorithm of Simon and Newell. Leibnitz partly realized his dream in his universal language of differential calculus. We later discuss the analytical engine of Charles Babbage and the universal Turing machine. Turing was thinking of a universal machine that could simulate any other machine. In what follows we present the notion of universal gates in classical computers, quantum computers and in other models of computation. We conclude with a discussion on Information Theory and 'Information-laden science' (Science imbued with Information processing and communicating terminology), as a unifying and universal language of science. This moment in the history of science brings us back (via communication as well as computation) to Leibnitz's dream.

Oded Koren (Shenkar - Engineering. Design. Art)

From Charles Babbage's Analytical Engine to Turing's Imitation Game

Charles Babbage (1791- 1871) was a remarkable unique pioneer in the domain of designing, creating and building a computation machines during the start of the 19th century. The Difference Engine demonstrated (i.e.: the work on the Difference Engine started at the 20's) the ability to compute large numbers via the help of a machine with no arithmetical mistakes and allowed to reduce arithmetical problems and errors that created losses and difficulties in many fields. I believe that it was only the first step throughout a more generic universal solution (i.e.: the Analytical Engine) on which Charles Babbage started to work on the late 40's (19th century).
The Analytical Engine demonstrates the ability to create a generic use case machine, which can be "programmable" via cards (using the "programmable" punch cards that were used for creating loom).
Charles Babbage's Analytical Engine introduces one of the first real example of a novel universal computation conceptual layers that distinguished between a "hardware" and a "software" for a real universal generic computation use case. Furthermore, the parallel work and articles on the Analytical Engine (e.i.: Ada Lovelace [1815 -1852] translation and notes at 1843 to Federico Luigi Menabrea [1809-1896]) enabled to create interesting thinking on the machine role on our life. This significate work (Ada's notes) was referred back in 1950 [Turing 1950][1], when Allen Truing [1912-1954] presented the Imitation Game and mentioned Babbage Analytical Engine as a universal machine. Turing's work, which is still relevant and highly referred and valuable, is a significant milestone in the progress of the Artificial Intelligence field.

Boaz Tamir (Bar Ilan University)

Universal Circuits in Classical and Modern Computers

Leibnitz, 1640-1716 had a vision of a universal machine, a machine that could 'compute' almost anything, from arithmetic to any logical problem, a machine that could be used to decide any issue. This is his universal machine. He contemplated a machine that has several constituents. The first will produce all atoms of the language concerned. The other will produce all combinations of atoms to form sentences with good syntax –'Ars Combinatoria', a reminder of the Ars Magna by Ramon Llull . Finally, there would be a part that will check the semantics of the language- the 'Calculus Ratiocinator'.
This machine is the precursor of the 'Hilbert machine' of the 20thcentury, a machine that was suggested by D.Hilbert to produce all 'good' (provable) sentences in the language of theories such as geometry. The idea of universal logic machine is also the precursor of the theory of AI.
Leibnitz made one important step in that direction, that is, the language of differential calculus. His dx sign and the $\int$ $\int$ sign became part of the mathematical language we still use.
Moreover, he also invented a contrivance known today as Leibnitz wheel, to make the multiplication of numbers easier to do using Pascal type machines.
Conclusion: Leibnitz dream of universal machine is partly realized today in several modules in AI theory. Leibnitz language of differential calculus is also universal and is part of the general scheme Leibnitz was contemplating. Retrospectively, one can say that the computer age has almost realized Leibnitz dream.

Israel Belfer (Ben-Gurion University of the Negev)

From Mathesis Universalis to Universal Information

Modern Computation and Information theories have had significant impact on science in the 20th century - in theory and application. This influence is tracked through a generalized, Information-laden scientific Style of Reasoning (denoting the Information-theoretical and Computational turn in science) with a focus on the information processing and transfer metaphors tools prevalent in current physics.

Information-Theoretical concepts map out a semantic field encompassing such mathematical physical developments as Black-Hole Thermodynamics (BHTD) and the "Black-Hole War". The treatment of physical systems as information processing systems drives such branches of physics as Quantum Information Theory (QIT). The ubiquitous Informational basis of computation and communication theory and technology brings about a foundational shift in scientific reasoning with deep – potentially problematic as well as intriguing – philosophical ramifications.
Physical models utilizing computation and Informational terms are employed in descriptions of physical reality from the microscopic to the cosmic. The universe as a computational process or an information-coding structure are signifiers of a large scale moment in scientific language. Not only enthusiastic "extreme physics Information" or "digital physics" employ Informational terminology, but a more pervasive shift towards Informational language that includes complex systems and primitive constituents of physical reality framed in a universal language of information.

B Session: Conceptualizing Modernity in Architecture (Room 279)

Chair: Slawomir Lotysz (Polish Academy of Sciences)

Piotr Marciniak (Poznan University of Technology)

In Pursuit of Modernity: Architecture and Computers in Communist Poland (1945–1989)

In the early 1960s, the communist authorities in Poland became aware of the role of electronic computing devices, and of the necessity of research and development in this field. Already in 1958, the XYZ, a prototype of the first mathematical digital device was constructed, whilst in 1959, the state-owned company ELWRO was established, and launched the production of the legendary ODRA computers. With the development of digital integrated circuits in the early 1970s, the first Polish mini computers emerged. These were much smaller and cheaper, and did not require users to be trained professionals. At the same time, Poland also focused on the development of data processing and information technology facilities. In 1964, the ZETO Institute of Electronic Computation Technology was founded and soon became a monopolist in this sector, operating in over twenty Polish cities until the 1990s. Some of its divisions in the bigger towns, were located in newly-erected buildings furnished with infrastructures especially designed to support the work of the high-tech computation systems. The architecture of most of these edifices was a reference to modernist aesthetics and a show-case for the Polish computer industry. In the presentation, I wish to outline the Polish efforts to find new architectural forms and solutions against the development of Polish information technology. I would also like to describe the technologies used in the new architecture, as well as its interrelationship with the latest achievements in computer science and with the political strategy of the communist authorities.

Agnieszka Rumież (Poznan University of Technology)

How to Tame Mathematical Methods in Architectural Design

Mathematical models, which have always been partially incorporated into architectural design, gained reinforced power due to the developments of CAAD and democratization of computer use in architectural domain. Starting from 1990's the widespread incorporation of CAAD among practitioners started to convert the geometrical landscape of architectural forms. As 'analog' architecture tends to be more or less concerned around orthogonal planes and surfaces that are defined by Cartesian coordinates and conic sections, CAAD introduces the use of more complex surfaces and geometries with a needed spontaneity and expected precision. However, approach that has been given to implementation of particular digital tools implied the specific pattern in the preferences of the designers and thus the occurrence or even over-representation of particular forms in architectural objects designed with an assistance of a computer. This

paper aims to present how particular mathematical models were introduced into the architectural domain through CAAD and what enabled some models to be used more often while other still needs to be widely accepted and adopted. On a case study of the ArchiCAD it will be displayed that the time lag between the implementation of some algorithms and its' widely use is very often surprisingly big. The intention is to find, by a comparative analysis, a threshold of usability in a digital tool that enables a designer to work intuitively and effectively with it.

Bartha Biborka (Transilvania University of Brasov)

Integration of Vernacular Concepts in the Development of Romanian High-Tech Rural Communities

The research aims to shed light upon several debates regarding the contemporary design process, such as local identity, rural community, traditional/vernacular/neo-vernacular design, rural strategy (sustainable development, organic growth, community control), through the perspective of high- technologies' impact on a social, cultural, political and economic level. The analysis turned to the possibility of interpretation of Romanian traditional wooden housing as a bioclimatic architecture which exhibits qualities of adaptation to climate and site. In terms of energy saving, contemporary accommodation is committed to adapt to local climatic and topographic conditions, thus providing an example of passive solar architecture. Regarding the merger of the house with its natural surroundings, the research shows that this may be achieved by - the use of land form for its thermal volume; vegetation seen as an element of protection against wind; use of local resources; the use of various volumes adapted to different regions (in the north part of the country houses are more massive); arrangement of windows according to the prevailing winds; enhancement of an aerodynamic roof shape. These principles can provide reference lines in contemporary design; the research and the existing architectural projects providing proof regarding the sustainability of such a neo-vernacular approach. Vernacular dwellings offer a rich source of inspiration for the creative contemporary design process, vernacular features enabling interpretation, which can be apprehended as a series of bioclimatic concepts that can form the basis of a strategy towards a sustainable and harmonious development of a high-tech rural community.

Victoria V. Cotorobai / Liviu-Alexandru Sofonea (Technical University Gheorghe Asachi from Iasi)

High Tech & Paradigm Shift in Buildings Areas

Residential buildings, as well as social, cultural, administrative and commercial, buildings, were unequal and multiple influenced by science and technology development and this, in turn, influenced their evolution, generally spiral with evident jumps, more or less quality. We are currently witnessing a paradigm shift multiple in construction in general and in buildings particular. This paper is concerned some of the key changes in the development of building construction (in their history) with emphasis on the most recent: a) an inventory of these changes determining the area of Romania and Europe; b) gives, after a multi-criteria analysis (technical, social, economical, environmental, energetical, geological, climatic, cultural, ...), the impact of the various high tech integration in buildings in the b1) Human evolution and b2) in socio-economic development, in present and future (likely impact). This includes changes stemming from high tech to: a) architecture (models inspired by bio & nano structures models); b) functional installation systems almost entirely controlled by high tech (BIM systems); c) technologies; d) based on high tech materials (nanostructures for finishing, thermal insulation, acoustic, ..., metamaterials for seismic protection, acoustic, thermal ...); e) design methods using high-tech products; f) the methods of training of professionals in the field; and other. Communication has used various sources to identify changes of paradigm (scientific and technical articles, news articles, stories, anecdotes, myths, ...), which has translated into a language accessible to a wider range of specialists and how non-specialists. The analysis results point to possible negative consequences indiscriminate use of high tech.

C The History of Israeli Hi-Tech from a Personal Perspective 1955–2015: The Origins (HISTELCON)

Chair: Arie Braunstein (Tel-Aviv University) – IEEE Israel Past Chair

Jacob Baal-Schem (Tel-Aviv University): Enablers of Israel Technology

Raya Leviathan (Tel Aviv University): The WEIZAC: First Israeli Computer

Joseph Shapira (Comm&Sens): The Development of EMC Systems

Elisha Yanay (Association of Electronics & Software Industries): Motorola Israel: An industrial pioneer

11.30–13.15

A Session: Presence and Evolution of Air Pollution Damage on Vegetation in the Valley of Mexico: Historical Summary (Room 278)

Organizer/Chair: María de Lourdes de la Isla de Bauer (Colegio de Postgraduados. Teaching and Research in Agricultural Science)

The atmospheric basin, usually designated as the Valley of Mexico, 9,600km^2 in size, comprises the capital of the country and one fifth or the population and produces one fourth of the gross domestic product. Mexico City, the ancient Tenochtitlan, was founded by the Aztecs and since then it has experienced many changes. Perhaps the most important one was the management of the aquatic resources. Thus, prehispanic hydraulic management system included a dike constructed by Nezahualcoyotl, a native king, to control the water flow preventing its entrance into the populated area. The Valley is a region rich in flora with up to 1500 phanerogamic species. It became gradually occupied by man about 10,000 year ago, and it has been calculated that approximately a million was part of the 20 million people of entire Mesoamerica.
At present time, the 25 million inhabitants of the Valley of Mexico have caused tremendous changes, among them the disappearance of native plants. Drastic anthropogenic influences such as urbanization, industrialization and pollution of the whole environment, have had an impact on the vegetation species as *Pinus spp.* and *Abies religiosa*, as shown by diverse studies carried out in the area. Those forested areas most studied in the Valley are the two national parks: "Desierto de los Leones" and "Cumbres del Ajusco", which have suffered accelerated human deforestation, forest decline, as well as the debilitating impact of the air pollutants loads, transported from the city as can be seen mainly in the ravines exposed to the urban area.

María de Lourdes de la Isla de Bauer (Colegio de Postgraduados. Teaching and Research in Agricultural Science)

Detecting the Consequences of Air Pollution in Plants: The Mexico City Area

About the middle of last century the Mexico City area, as a result of anthropogenic disturbances, started to show a decrease of visibility distance and the sensitive people claimed to suffer of certain symptoms such as headache. By 1970 several american scientists were very active using plants as detectors. By then, two types of air pollution had been described "The London type" in which a major component had been identified as SO2 and the "Los Angeles type" due mainly to the transportation by means of vehicles that utilize some form of internal combustion engine and as a result generate the production of photochemical oxidants or precursors, namely ozone (O3), nitrogen oxides (NOx) and peroxyacyl nitrates as PAN.
Due to the lack of scientific equipment to start out, the use of indicator plants was considered as a means to detect the problem. Some american scientists working at the USDA were asked to send some seed of sensitive plants such as certain tobacco varieties. Thereafter, 1971 the tobacco varieties and specially the Bel-W3 were exposed at different districts of the city for two periods a week in a serial expositions

conforming the existence of phytotoxic levels of ozone since the exposed plants developed very clear symptoms already carefully described.
Some other species besides tobacco, were used in these studies like Pinto bean, spinach romaine lettuce and petunia. The published results were so relevant that a governmental instance started a collaborative work.

Abel Quevedo Nolasco (Colegio de Postgraduados. Teaching and Research in Agricultural Science)

Wind Patterns and Ozone Concentrations in Southern Mexico City

Once the occurrence of the oxidant phytotoxic levels was confirmed in the Mexico City area, an attempt was made later on to trace the pathway of the ozone damage into the surrounding forest areas.
In 1990 at the "Desierto de los Leones" forest park (SW Mexico City) a registration of the O3 concentrations began, with the help of the USDA Forest Service, whom borrowed a ozone monitor and equipment to us, in order to record the ozone concentrations to evaluate its effect on the forest trees (*Abies religiosa* and *Pinus hartwegii*). Years before, the ozone damage visible symptoms on pine trees and sacred fir were observed, in both forest species, right there. In 1997 the average ozone concentrations were 0.25 ppm, with maximum values of 0.30 ppm (between 8:00 to 19:00 hours).
However, an important factor of the ozone concentration reached in the Desierto de los Leones park was the behavior of the wind direction. Jáuregui (2000) confirmed the wind direction over the Mexico City Basin, which is from north and northeast to south and southwest at day time, and inverse at night, most of the year.

Claudio Rodriguez Frausto (Instituto Politecnico Nacional)

Ozone Sensitivity and Damage of Evolution in Pine Trees of the Mexican Valley

Ozone damage on mexican pine trees was observed for the first time in 1976, in the Ajusco National Forest Park, southern Mexico City. In 1980 at the same place, the ozone injury in the needles of *Pinus hartwegii* and Pinus *montezumae*, with the help of Miller's evaluation scale for photochemical oxidants, based on needle retention condition, needle length, and branch mortality was assessed. The visible symptoms were chlorotic mottling and banding on the older needles; besides, it was recorded poor needle retention, lower branch mortality and under normal size development of the injured needles.
At the Ajusco Park the already mentioned pine tree species, are apparently damaged by the ozone concentrations reached everyday within the forest. Among them, *P. hartwegii* is the most sensitive, in the category of "severe damage", whereas *P. montezumae* is relatively tolerant, and was designated as "moderate damage" category. A second evaluation 3 years thereafter, showed no variation in the symptoms. In three different forest areas, a third assessment with the Miller's scale, was carried out during 1998 and 1999 on P. *hartwegii*. It was found a "very severe damage" in some trees.
After 30 years research nine pine tree species can be listed, according to their ozone sensitivity from very high to very low as follows: *Pinus hartwegii, P. montezumae, P. montezumae var. lindleyi, P. leiophylla, P. patula, P. teocote, P. rudis, P. pseudostrobus, P. ayacahuite.*

Dionicio Alvarado Rosales (Colegio de Postgraduados. Teaching and Research in Agricultural Science)

Fir Forest Decline and Death at the Desierto de los Leones Park, Distrito Federal

The sacred fir forest, *Abies religiosa* (H.B.K.) Schl. et Cham, in the mexican basin is a highly appreciated and valued resource by the more than 25 million inhabitants of this megalopolis. This forest provides important benefits, among these are the cultural, economic, ecological and aesthetic values; it avoids erosion, and favors oxygen production, water infiltration and water recharge.

A. religiosa decline at the Desierto de los Leones park, located southwest from Mexico City brought attention of the public and scientists since it was reported by the first time. Thus, at the end of the 70s some trees began to show decline symptoms never seen in mexican forests, but similar to the ones present in other forested areas from United States and Europe. Several hypothesis were formulated to explain the syndrome. Ozone was supposed to be a possible cause, even though A. *concolor* in California behaves tolerant to this factor.

The symptoms were an excessive branch mortality and diminished needle retention; however, the generalized symptom was a whitish mottling observed on the needles. Latter, these lesions coalesced and turned reddish-brown, giving to the upper surface of the needles a uniform color; meanwhile, the lower surface did not show the symptoms. In some areas, called "cemeteries", severe damage and massive death of firs was observed, therefore, the visual effects were dramatic. More recent data indicate that the tree mortality is decreasing depending on the location and possibly genetics factors.

B Session: Making Music, Drawing Art Works, Creating New Environments (Room 279)

Chair: Irina Gouzevitch Ecole des Hautes Etudes en Sciences Sociales, Paris)

Sonja Neumann (Deutsches Museum München)

From Electronic Musical Instruments to Lethal Weapons and Back Again – Oskar Vierling (1904–1986) and High-Frequency Technology in 20th Century Germany

On 15th December 1985 the unique "Elektrochord" was ceremoniously transferred to the musical instrument collection of the Deutsches Museum Munich. With its electronically controlled sound features, the Elektrochord, which had been developed in the 1930s mainly by Oskar Vierling, was quite state-of-the-art in due course. That was not at all surprising because in the 1920s Vierling was already an industrious inventor within the scope of modern electronic musical instruments. Furthermore he was a business-minded entrepreneur and- of course- an opportunist. During the Nazi Era Vierling developed more ingenious musical instruments and public address systems for mass events such as the Olympic Games of 1936. From then on his electroacoustical career veered into further lanes: in his own secret environment (Burg Feuerstein) he also invented different kinds of weapon systems on the basis of high-frequency technology as well as encryption tools for the Deutsche Wehrmacht. After WW II Vierling was not only a valuable source of technical know-how for the occupation forces, but he additionally developed the wiretap system of the precursor organization of the German secret service in the 1950/60s. Based on the biographical narrative of Oskar Vierling the paper will discuss how high-technology was able to switch between different kinds of applications. In this respect it is crucial to analyze how the utilisation strategies of high-technology assimilates into diverse political systems with their different economical and socio-cultural contexts.

Susan Schmidt Horning (St. John's University, NYC)

Yesterday's High Tech Is Tomorrow's Retro Tech: The Changing Fortunes of the Material Culture of Music-Making

Nostalgia for the past is alive and well in the music industry. Ever since the rise of digital recording and reproduction technologies in the late 1970s, professional engineers and audiophiles alike have debated the relative superiority of analog over digital sound quality, the so-called warm vs. cold sound. Accompanying this debate was an increasing appreciation for older recording devices, vintage electronic musical instruments, and increasingly obsolete listening formats, a reverence that went beyond valuing the music that was played, captured, and reproduced by those technologies. As the market for vintage equipment exploded, companies began producing "knock-offs" reproductions of classic equipment, ranging from 1920s-era

radio-phonograph units that incorporate cassette and CD players along with AM/FM radios and turntables, to a range of professional microphones designed to look like the classic RCA and Neumann/Telefunken mics of the 1930s-50s and immortalized by singers like Frank Sinatra. Most recently, a resurgence in the popularity of vinyl records has led indie and major artists alike to simultaneously release their product in all formats, and retailers from specialty shops to big box stores like Target are stocking vinyl and record players. This paper explores this phenomenon of retro-technologies associated with musical performance, recording and reproduction, and interrogates the meaning of this trend of looking backward. Is it merely fetishistic or is there a basis in audible or operational superiority? Preliminary research in trade publications and catalogues, semi-professional recording engineers' and musicians' periodicals, popular literature, and studies of nostalgia suggests that these as well as other cultural factors play a part.

Heiko Schmid (Kunsthochschule für Medien Cologne)

Shaping Science-Fiction Universes. The Hidden Relations Between Machine Phantasies and Fine Art

The light-requisit for an electrical stage produced by Laszlo Moholy-Nagy is one of the most influential kinetic art pieces ever produced. This piece was not only meant to be an exhibit but also represented some kind of generator for a series of complex light-effects staged in Moholy-Nagys film "Lichtspiel Schwarz-Weiss-Grau". In this view the piece can not be analyzed as a self-contained artifact. It also was meant to be some kind of machine depicting a (kinetically developed) environment in reach for the human perception and adoption. In my paper I am willing to link kinetic artworks like Moholy-Nagys light-requisit for an electrical stage or Zeros Lichtraum (Hommage a Fontana) with depictions of outer space sceneries presented in science-fiction-movies like Stanley Kubricks "2001. A Space Odyssey" to show the historical influence of this conception. With this comparison I want to highlight, that the concept of kinetic fine art-machines did gain a greater impact on the historic idea of technology and space than is agreed on today. I am claiming for example that Kubrick was not only making use of op art pieces to produce certain light-effects for his famous film. He was besides adopting the mentioned artistic functionality of kinetic artworks to illustrate the working mode and function of a hyperspace piercing alien machine. In my view there is a content-layer in kinetic art, that is depicting artworks as utopic, world re-shaping machines, which obviously was attractive for the sci-fi-genre. To elaborate on my previous example: especially Kubrik was not only using the aesthetics of kinetic art pieces, he also was adapting their utopian content-layers to depict the functionality of his alien hyperspace machine. Therefore directors like Kubrick and Robert Zemeckis (Contact) on whose works I will concentrate my analysis were not really depicting conceptions of outer space in their movies, but images of a universe opened up by artistic machine, thereby also anticipating the aesthetic and setup of phenomena we in the 80s and 90s learned to know as "cyberspaces".

TEL AVIV UNIVERSITY

UNIVERSITY ADMINISTRATION

Desenberg Wolff Building	U1
Engineering and Maintenance Building	U2
Eric Mitchell Student Center	U3
Itzhak Alfred Guttmann Administration Building	U4
Machinery Building – North	U5
Planning, Methods and Control Building	U6
Registration Center – Caroline and Joseph S. Gruss Building	U7
Security and Logistics Building	U8
Senate – George S. Wise Senate Building	U9

ACADEMIC UNITS

Animal House	M1
Bob Shapell School of Social Work	S1
Britania – The Cohen-Porter Family United Kingdom Building	F1
Buchmann-Mehta School of Music	A1
Carter – Victor and Adrea Carter Building	T1
Chaim Rosenberg School of Jewish Studies	T2
David Azrieli School of Architecture	A2
David Glasberg Tower for Medical Research	M2
Eitan Berglas School of Economics	S2
Engineering Studies Building	E2
Faculty of Management	G1
Genia Schreiber University Art Gallery	A3
Gilman – Isaac and Rosa Gilman Building of Humanities	T3
Gretl and Fred Raymond Building of Health Professions	M3
I. Meier Segals Garden for Zoological Research	F2
Inge and Harold Hartog Building for Crop Improvement	F3
Jack Green Building of Biotechnology	F4
Louis Calder Jr. Computation Center	X1
Maurice and Gabriela Goldschleger Multidisciplinary Research Building in Engineering and Exact Sciences	E5
Maurice and Gabriela Goldschleger School of Dental Medicine	M4
Mexico Building of the Arts	A4
Michel Kikoine Foundation Art Gallery	A5
Myers – David and Inez Myers Building for the Transgenic Modeling of Human Disease	M7
Naftali – Peretz Naftali Building for Social Sciences	S3
Nicholas and Irene Marsh Building for Dental Medicine	M5
Ornstein – Drs. I. and G. Ornstein Building of Chemistry	X2
Porter School of Environmental Studies EcoBuilding	D1
Sackler School of Medicine	M6
Sara Racine Root Laboratory	F5
Saul Kaplun Building of Mathematics and Space Physics	X3
Schreiber – Wladimir Schreiber Institute of Mathematical Sciences	X4
Moshe Sharett Building of Educational Sciences	T4
Shenkar Chemistry – Arieh and Rivka Shenkar Building of Chemistry	X5
Shenkar Physics – Arieh and Rivka Shenkar Building of Physics and Astronomy	X6
Sherman – Archie Sherman Building of Life Sciences	F6
TAU International	D2
Terry and Lawrence Bessner Building for Zoological Research	F7
Trubowicz Building of Law	W1
W.A. Minkoff Building of Law	W2
Webb – The Max Webb Family School of Languages Building	T5
Wolfson Building of Computer and Software Engineering	E3
Wolfson Building of Electrical Engineering	E1
Wolfson Building of Mechanical Engineering	E4
Yad Avner – Geography Department	T6

POINTS OF INTEREST

Beit Hatfutsot: The Museum of the Jewish People	I1
Broshim Campus Student Dorms (Student City)	I2
Cymbalista Synagogue and Jewish Heritage Center	I3
Einstein Student Dorms	I4
Elite Sports Center	I5
Institute for National Security Studies	I6
Marcelle Gordon University Club (Green House)	I7
TAU Shop	I8
The Steinhardt Museum of Natural History and National Research Center	I9

LIBRARIES

Archeology Library	L1
Azrieli School of Architecture Library Building	L2
Bob Shapell School of Social Work Library	L3
Brender-Moss Library for Social Sciences and Management	L4
Constantiner School of Education Library	L5
David J. Light Law Library	L6
Elias Sourasky Central Library	L7
Geography Library	L8
Gitter-Smolarz Library of Life Sciences and Medicine	L9
Marc L. Grinstein Music Library	L10
Mehlmann Library	L11
Neiman Library of Exact Sciences and Engineering	L12
Wiener Library – The Caroline and Joseph S. Gruss Building	L13

HALLS AND AUDITORIUMS

Abraham Lev Auditorium	H21
Abraham Meerbaum Auditorium	H15
Adolfo and Thelma Fastlicht Auditorium	H13
Alpha Omega – London Lecture Hall	H1
Anwar and Naji Shemesh Auditorium	H2
Argentina Auditorium	H2
Austrian Friends of Tel Aviv University Hall	H3
Bar-Shira Auditorium	H4
Benyamin Yerushalmi Hall (449)	H6
Berger Hall	H6
Bob Shapell School – Halls 01 & 127	H28
Boris and Lena Melamed Auditorium	H18
Claire and Emanuel G. Rosenblatt Auditorium	H27
Clairmont Hall	H9
Claudia Caviezel-Birène Hall	H8
Dan David Building	H2
Dolfi and Lola Ebner Auditoriums	H5
Dr. Dina and Nachum Verlinski Hall (202)	H15
Dr. Sterna Germanis-Kaufman Hall (215)	H15
Drachlis Conference Hall (496)	H6
Edzia and Tanesz Dach Auditorium	H10
Elite Sports Hall	H12
Fabian-Cyril Boisson Auditorium	H7
Haim Auditorium	H17
Harry Triguboff Executive Education Auditorium	H22
Jonas and Blanche Feiner Hall	H14
Kaplun Lecture Hall	H8
Kuky and Sergio Grosskopf Family Foyer	H16
Lecture Hall in Memory of Judy Langer-Gefter (02)	H20
Lion Hall	H22
Lola Litsyn Auditorium	H17
Malka Brender Hall of Justice	H8
Malka Moses Hall	H23
Miriam and Adolfo Smolarz Auditorium	H16
Mordechai Nadivi Hall	H24
Naftali Building – Hall 002	H11
Nicholas and Elizabeth Slezak Auditorium	H15
Ofair Hall	H23
Paul and Mania Pacanowski Lecture Hall	H11
Philip and Zelda Thau Auditorium	H29
Raya and Josef Jaglom Auditorium	H30
Rose and Morris Leigh Auditorium	H3
Rosenberg School – Halls 001& 002	H26
Rudy and Erwin Guttman Lecture Hall	H11
S.E. Hoofien Hall	H8
Sam and Simone Mallah Student Recreation Center	H21
Sara and Felix Dumont Auditorium	H2
Schottlander Hall	H6
Sigma Epsilon Delta Fraternity Auditorium	H1
Silverstone Hall	H25
Targ Auditorium	H9
Venezuela Hall	H11
Yaakov Efter Hall	H11
Yolanda and David Katz Auditorium	H19
Yona Ettinger Hall	H6
Zakheim Family Hall	H8
Zeev Segal Hall (003)	H11
Zobedia and Marcos Leon Holcblat Auditorium	H18

OUTDOORS

Adler Music Street	O14
Albert and Elba Cuenca Boulevard	O18
Albert and Elba Cuenca Entrance Plaza	O41
Albert Einstein Square	O27
Alexander and Antonie Moksel Promenade	O4
Alpha Omega Regency Garden	O2
Bernard Jaskarzec Memorial Garden	O39
Betty Wozniak and Sofia Blake Garden	O23
Botanic Gardens	O30
Bronja and Juma Mandel Square	O33
Dan Bochner Avenue	O8
David and Marlene Snider Family Garden	O17
David and Zipporah Federmann Promenade	O28
De Botton Square	O7
Dr. Marvin Schloss Memorial Garden	O1
Entin Square	O9
Esther Sidi Garden in Memory of the University's Fallen in Israel's Wars	O25
Frankel Avenue	O6
Hanna Doron Memorial Garden	O15
Henry Gildred Promenade	O11
Holocaust and Heroism Square and Avenue donated by David and Fela Shapell	O5
Jacob and Shoshana Schreiber Square	O12
Laura Schwarz-Kipp Square	O16
Levi and Fortuna Eskenazi Sculpture Garden donated by Giulia and Beniamino Matatia	O10
Lowe and Marshall Garden	O32
Meir Ilan Square	O13
Troupeau de Gazelles au nom de Michel Sapon Adopte par la Famille Sapon	O29
Morris and Manja Leigh Avenue	O38
Norman, Evelyn and Irving Feintech Garden	O3
Paula and Menachem Gottesdiener Square	O19
Sam Mallah Palm Tree Garden	O31
Samuel Merenfeld Garden	O40
Sarita and Noel Wertheim Senate Plaza	O34
Sheila and Yossi Carmel Garden	O21
Shelley and Joel Tauber Family American Honor Plaza	O36
Shlomo Rechavi Garden	O22
Stanley and Helen Grosman Garden	O24
Theo and Margot Lowengart Bridge	O37
Townsend Avenue	O20
Urs and Aviva Felber Jubilee Plaza	O35
Victor and Adrea Carter Garden	O26

GATES

Austria Gate (Prof. Klausner St.)	G1
Matatia Gate (Prof. Klausner St.)	G2
Ramniceanu Gate (Dr. George S. Wise St.)	G4
Josef Kryss Gate	G5
Frenkel Gate (Haim Levanon St.)	G7
Dan Bochner Gate (Haim Levanon St.)	G8
Jozef Saper Gate (Haim Levanon St.)	G9
Gate 10 (Klatzkin St.)	G10
Chella and Moise Safra Gate (Prof. Klausner St.)	G14
Gate 16 (Dr. George S. Wise St. – West)	G16
Gate 17 (Dr. George S. Wise St. – East)	G17

PUBLIC CAR PARKS

Social Sciences	P1
George S. Wise	P2
Magnet House	P3
Broshim Technical College	P4
South Car Park	P5
East Car Park	P6
Botanic Gardens	P7
Registration Center	P8
Dental School	P9
Mitchell	P10
Parking Facility for the Miriam and Adolfo Smolarz Auditorium	P11