

Murray Turoff and the Birth of Computer-Mediated Communication

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Abstract: Social Media and Web 2.0 technologies are enjoying tremendous popularity at the current time. The increasing bandwidth for networked communication, as well as increased computer processing power have enabled the introduction of smaller and smaller network communications devices aimed at the end user – be they smart mobile phones, or net-books, or tablet computing devices. Numerous Web 2.0 applications such as wikis, mobile chat, blogs, audio and video sharing have emerged over the past five years. New social media platforms such as Facebook, Twitter, Skype and YouTube have made it easier than ever for anybody with a mobile communication device to communicate, stay in touch with family, friends and business associates. Social media have even become the digital weapon of choice to activists, dissenters, revolutionaries and even terrorists to quickly organize and communicate with each other. In this scenario, it is easy to forget that these technologies are all based on one simple foundation: computer-mediated communication (CMC). In this paper I explore the birth and evolution of CMC by profiling the “father” of CMC, Murray Turoff. The technology he invented in the early 1970s forms the basis of much of social media today. The paper thus aims to fill the gap and provide further light on a very important part of computing history.

Murray Turoff and the Evolution of Computer Mediated Communication

Introduction: From the ARPANET to the “Network Nation”

Today’s digitally networked environments enable ever newer methods of information distribution and manipulation. They enable individuals, groups, countries, and international organizations to engage in, participate in, and to actively enhance the flow of different kinds of information all over the globe. The sheer scope of these flows is vast, encompassing global collaboration, news dissemination, scientific research, political discourse, entertainment, and cultural exchange to name just a few. These information flows are one of the most important factors shaping globalization.

It should be noted that the biggest enabler of all these flows is the *Internet*. What began as a government-funded, mostly academic project has now become the single most important technology facilitating most, if not all global information flows. In doing so, it has also become the single most profound transformative force that informs today’s conduct of commerce, culture, education, politics and war. Transformations wrought by the Internet continue to accelerate and strengthen the ever expanding extent and reach of the global networked society.

The evolution of the Internet starting from its ARPANET beginnings in the late sixties, to the colossal global “network society” that it is today, is a fascinating story of collaboration among computer scientists (seeking better, bigger and faster networks), sociologists (seeking to use this new network to enhance human collaborations), and entrepreneurs (seeking to provide newer, more innovative services). The *connecting piece* in this story is how some early scientists used the nascent computer network to fashion a system for interaction and collaboration, across space and time. This history – of **computer-based collaboration** – is worthy of serious examination.

In 1971, just a few years after the “birth” of the Internet, Murray Turoff, a computer scientist working in the Office of Emergency Preparedness, Executive Offices of the President of the United States, was tasked with developing an electronic information and communication system to aid the U.S. government’s response to emergencies. The resulting system *EMISARI* (Emergency Management Information System and Reference Index) is considered to be the first computer-mediated, multi-machine communications and conferencing system and an early precursor to many of today’s chat, messaging, conferencing and collaboration systems¹. In actuality, the first such system that Turoff designed and implemented was based upon his policy Delphi work and was implemented and prototyped in 1970. It was called the “Delphi Conference” and it was tested on 20 professionals in government and academia for an eight week period on the subject of “uses for this technology.” The results of that exercise was reported in an article in *Technological Forecasting and Social Change* in 1972 and describes the interface, resulting content, and a list of the 20 participants who generated the content, voted on its significance, and discussed the significance of the voting using a “reply to” context structure. The underlying software structure was used as the foundation for the design of the Computer-mediated Communication (CMC) system, the EMISARI system. In the Delphi Conference all the entries were made anonymously to reflect the Delphi process design. For EMISARI, every entry, whether data or text, was identified by the user who contributed it and when they contributed it.

Throughout the seventies, sociologists, noticing the promise of social transformations emanating from networked communities, started actively studying the phenomenon. Of the many works of this period, perhaps none has so comprehensively and presciently cataloged the coming network society as the book “*The Network Nation*” authored by Murray Turoff and his collaborator, the sociologist Starr Roxanne Hiltz. Even in 1978, they were able to see well into the future that is today – a world where everything is connected, where computers and computing devices are ubiquitous, where a bulk of the world’s commerce is conducted online, where a majority of interactions among people are through emails, computer conferencing, online “chats” and SMS (text messaging systems) and social networks. Much of today’s scientific research is conducted online. Collaborative online encyclopedias and other categorization software organize much of the world’s information for us. But the present “networked society” also poses vast dangers to our independence, safety, security, privacy and identity, as also foreseen in the excerpts from the hypothetical online news service, The Boswash Times in the Network

¹ See Stewart, Bill, “The Living Internet,” http://www.livinginternet.com/r/ri_emisari.htm. In 1971, EMISARI was put to one of its first practical uses to coordinate policy information for U.S. President Nixon's wage and price control program to fight high inflation. Users of EMISARI accessed the system through teletypewriter terminals linked to a central computer through long distance phone lines. The EMISARI chat functionality was called the Party Line, and was originally developed to replace telephone conferences which might have 30 or so participants, but where no-one could effectively respond and take part in a meaningful discussion. Party Line had a range of useful features familiar to users of modern chat systems, such as the ability to list the current participants, and the invocation of an alert when someone joined or left the group.

Nation. Given this, it would be useful to document the evolution of the networked society from the time the earliest computer-based collaboration and conferencing system was created, to the present.

The Focus of this Paper

This paper is the first phase of my research project to trace and catalog the evolution of computer-mediated communications from its early stages to the present social networks. The project also aims to provide a biographical sketch of Murray Turoff and his long-time collaborator, Roxanne Hiltz.

Due to the size of the project, I have divided it into two phases. This paper addresses ***Phase I*** of the study. In this paper, my objectives are two-fold:

1. To trace the history of Computer-mediated communication
2. To provide a biography of the ‘social networking pioneer’ Murray Turoff.

The main questions that I focus on in this paper are:

- What is the educational and scientific background of Murray Turoff?
- What/who were the primary influences in his early professional life?
- How did he transition from a physicist to computer scientist to a ‘future-oriented’ sociologist?
- What was the genesis of his creation of the first computer-mediated conferencing (CMC) system?
- What, if any, were the cultural, political, organizational and technical challenges he faced?

Phase II of the study will cover the following topics:

- What were Turoff’s major projects in the realm of CMC systems?
- What led to his collaboration with sociologist Roxanne Hiltz?
- Were there other significant collaborators, and who were they?
- What were the joint research projects that were undertaken by Turoff and Hiltz?
- What influences have their research had on other researchers and technologists working in similar areas?
- What are their views on how the field of CMC has developed or evolved into the current global social networking systems?
- What threats do they see in the future of such systems?
- How do they see developments and changes in technology, global politics, global strife and terrorism and cultural norms affecting or influencing the networked society?

The significance of this research is three-fold. From a *technical* perspective, the paper aims to provide an understanding of and to catalog the technologies and architectures deployed in computer-mediated conferencing and social networking systems, and their evolution, over the last thirty years. From a *sociological* perspective, paper attempts to determine how much of an influence these systems have

had on social interactions among people, and vice-versa. From a personal *researcher's* perspective, the research is aimed at gaining an understanding of the personalities who are clearly the fore-fathers of current massively networked, social computing systems, what their compulsions were, their influences and who were influenced by their work, and what they foresee into the future.

Methodology

I use a combination of a qualitative study and one based on a survey of prior work in the area. I conducted a literature review on the advances and adaptations that have been made in this area over the last thirty years. I then identified specific projects that were initiated and conducted by Turoff and Hiltz. I used a combination of “long interviews” (McCracken, 1998) and published data. I conducted detailed interviews with Turoff and Hiltz, and researched secondary data such as published literature, manuals and technical documents, and interviews with colleagues.

Murray Turoff: Early Collegiate Years

Like many computing pioneers, Murray Turoff's early collegiate education was not in the field of computer science. Turoff was admitted to the University of California - Berkeley as a student majoring in physics in 1954. Eventually, he majored in both physics and mathematics. Turoff's opportunity to work with computers came during his last two summers at Berkeley, when he got the opportunity to work at the Hunter Point Naval Radiological Laboratory, in Hunter Point, San Francisco. This was around the period when the Hunter Point Lab was conducting highly classified experiments to determine the effects of exposure to nuclear radiation on animals. However, Turoff was not associated with any of this classified work. There, Turoff started working on one of the earliest computers manufactured, a Burroughs 200-series vacuum tube machine (Burroughs Corporation, 1956). It:

“...filled up... a gym sized structure, and you walked down the middle of the machine to replace the vacuum tubes.”

But despite its intimidating size, it offered an opportunity for Turoff to learn a brand new technology. He learnt some very early Assembly programming at the bit-level in the years 1956 and 1957. He also learned how to run a Van de Graf generator. After his graduation from UC Berkeley in 1958 with a BS in both Physics and Math, Turoff gained admission and support at Brandeis University, where he went to pursue a PhD degree in Physics. The professors in the Physics department at Brandeis had heard that Turoff had some experience with computers. At the time, the physics department only had a paper tape machine, which was used to store and feed programs into computers. However, the Brandeis university physics department had a fellowship arrangement with IBM, which gave them access to MIT's IBM 704 data processing system. The IBM 704 was a vacuum-tube based system (IBM Archives, n.d.). Turoff was appointed as an IBM fellow at the physics department. His initial job as a supported graduate student was to learn to use the IBM 704, and use it for any work required by professor in the physics department. Later, the 704 was replaced with an IBM 7040 computer, which used transistor technology.

As Turoff recalls, in the very first year of his graduate program, he gained tremendous experience programming IBM computers. Whenever a professor in the physics department needed computer programming, Turoff was sent off to work on the problem at MIT. Most of the work involved such

things as the calculation of excitation levels of subatomic particles or calculations of turbulence conditions.

Thus, as an entering graduate student, Turoff became the single person in the physics department whose job it was to go to MIT and learn how to program IBM machines. Eventually, Turoff recalls that he ended up doing computer work for the alumni office at Brandeis, which was the most computerized department on campus at that time. Turoff learnt how to use tape machines, card punch machines, and program the IBM computers. He also met and became acquainted with many computer science faculty members at MIT. One of those is Prof. Fernando Corbato, the MIT computer pioneer. (Corbato received his Ph.D. in computer science from MIT in 1956, and joined the MIT faculty in 1962. He has received wide recognition for his work on time-sharing computer systems and for his work on the Multics operating system (CSAIL, n.d.)). At that point, he taught a graduate programming seminar which Turoff had an opportunity to take.

In the 1960-1961 academic year, Turoff's thesis advisor at Brandeis, Dr. Jack Goldstein, left on a sabbatical to Israel and Turoff took a year off to work for IBM at their San Jose, California plant as a scientific programmer. He worked on programming support tools for the IBM 1620, a new unreleased small computer. He also worked on developing a numerical control system for the same computer through the Glendale Branch office and some its customers in this area. This is where he developed a lot of experience with assembly level programming and support tools. When he returned to Brandeis, he got a part time job (while completing his PhD) at the IBM Boston Branch office as a systems engineer. Given his background in analysis and mathematics he was used as a consultant to many IBM customers wanting to use some of the new and important business tools such as linear programming, data bases, and statistical packages. It was in this job that he picked up considerable experience in the use and misuse of such packages in the business environment. He also noted a number of major problems in using computers or developing uses due to poor lateral communications in many organizations he consulted for.

Turoff's computer knowledge grew tremendously during this time, and he eventually developed a massive computer simulation of a planetary nebula for his doctoral thesis. This was a complex modeling program written in FORTRAN, and was at the time the only computer simulation of a planetary nebula – one that encompassed all physical processes taking place within a single working model. It was while developing and testing this computer simulation, that Turoff started getting his ideas on the utility of interactive, online computing.

The Idea of Interactive On-line Computing

Working in astrophysics posed a lot of computational challenges to Turoff. At the time, there were different theories of physics when it came to astrophysics. His primary problem was: How to put the different theories of physics together to model some astrophysical phenomena like the planetary nebula or the sun? It required many different theories from the atomic level, to radiation level, or “radiative transfer,” and the dynamic properties of low density plasmas. All these areas had different theories that had to fit together numerically. The output of one model drove the input of the other. Thus, the blow-up of the original star, of the gases expanding was being driven by the radiation from the now condensed star. This caused the radiative transfer of energy to the expanding low density plasma of the nebula

shell, providing low-level plasma impacts on the planetary nebula. According to Turoff, this was not dissimilar in some ways from upper atmosphere physics – plasma, the solar winds and things of that sort. But it was a very difficult challenge to merge up all the different theories and actually develop a simulation of a planetary nebula. It took about 3 hours to run a single case-study on the biggest MIT computer.

The only time Turoff could use the computer to run the simulation was Friday night after midnight, or Saturday night after midnight, and only once on any one weekend. If his program had an error, he would have to wait a whole week to run another test of that case study which again was 3 hours long. So he was acutely aware of the problem of working on large problems in a multi processing batch-environment. This was also the time when *computer time-sharing* was actively being researched by scientists such as John McCarthy and Fernando Corbato at MIT. Even though he was not a computer scientist, Turoff saw immense potential for time-sharing computers. He immediately recognized that time-sharing would be especially beneficial for working on large programs interactively in an on-line environment. He realized that time-sharing would enable programmers like him to interact directly with the computer even as a program was running – a process that would enable him to correct his programs as soon as an error was identified, rather than waiting for another week before testing a new theory or model. As Turoff explained it, with on-line interactive programming, you can do intermediate steps, incremental programming and things that are much more efficient than trying to deal only with paper and pencil, programming computers in large batch programs run only once a week. The *Compatible Time-Sharing System* (CTSS) was first demonstrated in 1961 at MIT, under the leadership of Corbato.

Work at the Institute of Defense Analysis

Turoff earned his doctoral degree in Physics from Brandeis University in 1964 (awarded in 1965) and joined the Institute for Defense Analysis (IDA) in Alexandria, VA. The IDA is a non-profit corporation that operates federally funded R & D centers, in order to provide objective analysis of issues related to the country's security and defense.

“IDA traces its roots to 1947, when Secretary of Defense James Forrestal established the Weapons Systems Evaluation Group (WSEG) to provide technical analyses of weapons systems and programs. In the mid-1950s, the Secretary of Defense and the Chairman of the Joint Chiefs of Staff asked the Massachusetts Institute of Technology to form a civilian, nonprofit research institute. The Institute would operate under the auspices of a university consortium to attract highly qualified scientists to assist WSEG in addressing the nation's most challenging security problems” (IDA, 2009).

In 1958, IDA was responsible for establishing the Defense Advanced Research Projects Agency (DARPA). Over the years, the IDA has started cutting-edge projects such as distributed simulation of war fighting, and has tied up with the National Security Agency through a Center for Communications and Computing.

The reason why Turoff joined the IDA and not an academic institution can be traced to historical events of the time. This was during the time of heightened cold-war between the Soviet Union and the United States (and their allies, respectively). During the late 1950s and the 1960s, both the Soviet Union and the United States were actively researching and prototyping the Inter-Continental Ballistic

Missile (ICBM). The ICBMs would be capable of making sub-orbital flights carrying nuclear weapons. Theoretically, even if a nuclear weapon was detonated between forty kilometers and four hundred kilometers above the earth, it could cause enough of an electro-magnetic pulse (EMP) that could cripple military and civilian communications, power, and other infrastructure (*Foster et al., 2008*). The U.S. military was therefore very interested in knowing what would happen to U.S. infrastructures in such an EMP attack. They asked the IDA to determine how much chance of success (and risk) they could have, if they developed an anti-missile defense system. Thus in 1965, at the height of the Cold War between the USSR and the West, the IDA was a beehive of defense-related activities, with interesting physics and computer projects.

As Turoff recalls, the IDA hired him because they:

“...wanted a physicist who was familiar with thin plasmas such as in the upper atmosphere and were interested in knowing more about the impact of solar flares and nuclear weapons on the upper atmosphere to predict EMP impacts. (The IDA)... had problems with computers (and) they (eventually) asked me to turn my attention to my background in that area. A key question at the time was ‘could a computer actually provide enough computational power for an anti-missile defense system?’ At the time it (the anti-missile system) was called the ‘NIKE X’ system and AT&T was designing and building the system. IDA had been asked to determine how much chance of success they would have.”

It is not surprising that Turoff found himself at home in such a setting. At the IDA, Turoff could use both his background in upper atmosphere physics and computers. As he recalls, his time at the IDA was the most interesting part of his career. It was better than any of the institutions and universities that he worked for later, with respect to providing an atmosphere for true collaborative, interdisciplinary research. Over time, Turoff was gradually working more and more on computer problems, and less and less on physics of the upper atmosphere. *At IDA most projects were made up of interdisciplinary groups of professionals and he had an opportunity to work in many groups composed of physical and social scientists, engineers, and management scientists. He feels that this experience had considerable impact on the way he considered and met research and development challenges throughout his life.*

At the time Turoff joined the IDA, it was managed by a Board of Directors who came from fourteen “outstanding universities such as MIT, Princeton, Columbia, and University of California – Berkeley,” to name some. The Department of Defense (DOD) was the only customer for the IDA. The IDA consisted of about eighty dedicated people from all possible areas. There were scientists and researchers, managers and engineers. Their job was to respond to the problems that the DOD had, and perform evaluations for the DOD. Recalling those days, Turoff says that “the people at IDA had the power and authority to state the truth to the DOD.”

At the IDA, senior professionals received project contracts based on their expertise, and they in turn had to find others to work on them. No one was told what project to work on but they had to fill a monthly time card with their time allocated to ongoing projects. There was a lot of negotiation among the professional doing the projects undirected by management. Turoff always chose to work on those projects that required an inter-disciplinary mix. Thus he was working with people from a variety of disciplines such as social scientists and economists – which offers an explanation of how this physicist-

turned computer scientist would go on to develop the first computer network for social communications a few years hence.

Turoff worked on the NIKE X project during his early days at the IDA. The NIKE X project (Finkler & Turoff, 1965), (Thelen, 1997) was the first anti-missile system that was built using many computers. While AT&T built the computing elements, Turoff was called upon to assess whether the computers could handle the complexity of the computations involved. The system had to find and target missiles from the radar, and be able to get around jamming devices. It was extremely computation intensive, and the computer consisted of a large multi processor, and had an incredibly fast nano-second memory. It was a true multi-processor system, one of the first ever designed. Turoff built a simulation of the computer to determine how many calculations it could actually do.

Time-sharing and the beginnings of Computer-mediated Communications

One of the projects that Turoff worked on was particularly significant, one that led up to his developmental work on computer-mediated communications. During the early 1960s, the DOD and the Navy were funding several research projects that focused on time-sharing computers. “Time-sharing” was an important new concept at the time, and arose out of the frustrations that computer scientists experienced with batch processing systems. For example, scientists working in Artificial Intelligence at MIT were frustrated at the fact that corrections and changes could only be made once a day, working on batch-processing systems. They envisioned a system where a computer’s processing time would be shared by several programmers, who could connect to the computer using a terminal, and then respond to periodic outputs from the computer. Some of the scientists who expressed such frustration were Fernando Corbato and Robert Fano. Thus, when Fano sent a proposal to J.C.R. Licklider, who was the head of the Behavioral Sciences and Command and Control programs at ARPA, the project was immediately funded with about two million dollars, because Licklider himself was frustrated with batch processed systems, and was looking for interactive, time-sharing systems (Chiou, Music, Sprague, & Wahba, 2001).

Other projects funded by the DOD included one on interactive computing such as Project MAC at MIT, Doug Engelbart’s work at the Stanford Research Institute, the Artificial Intelligence project led by Ed Feigenbaum at Stanford University, and the development of the ARPANET by BBN Technologies. All these projects involved the concept of time-sharing in computers. In order to track the progress of these projects, the DOD and the Navy, which were the primary funders of the projects, asked IDA personnel to do a study that involved going around the country and evaluating all the projects that were underway in various institutions, pertaining to time-sharing in computers. Turoff was part of the team of three professionals who were involved in conducting this evaluation.

The second member of this team was Ronald A. Finkler, who, according to Turoff, was “a real nuts and bolts designer, programmer, senior analyst, - who did everything in binary originally - very knowledgeable about hardware, software, and operating systems...” Finkler was originally from Royal McBee computers, and is credited with being one of the designers of the first FAA computer system for controllers. The third member of this team was Wally Sinaiko, who was a psychologist, and according to Turoff, “*actually was one of the psychologists that studied the design of the very first hot line between the Russia and the US, with the use of teletype machines.*” Sinaiko had prior associations with

the Office of Naval Research and then current associations with the Smithsonian.

The project required the three members of the team to travel around the country, study every time-sharing project, interview the principal investigators as well as some of the users, determine what the implications were, and develop an assessment report. Turoff stated during an interview that there were a lot of claims of success before any real results. The MIT project MAC was very impressive, but the best system that Turoff saw, in his view, during this study was the JOSS system developed by the RAND Corporation (Shaw, 1964). This was an early system developed by Chuck Baker and Cliff Shaw, and was a collaborative effort between a psychologist and computer scientist. It was designed to allow professionals with some math experience to write their own programs. However, RAND placed many restrictions on the use of JOSS, including use of the name. Therefore it did not become very popular at the time relative to systems like BASIC or APL. Another system that showed a lot of actual use by non-programmers was a system for numerical analysis developed by UC at Berkeley which used an actual round CRT screen and two keyboards to create graphical output of incremental steps in a numerical analysis. In its concept of nested mathematical functions and mapping these to keys by the user, it was probably a forerunner of APL and some of the later programmable scientific calculators.

According to Turoff, the non-technical part of MIT's project MAC was already doing nightly seminars for businesses on "how Time sharing would eliminate middle management and allow the top executives to control the company from their corporate office." Turoff felt that Ulric Neisser a cognitive psychologist, who was at MIT for a summer to study the ability of time sharing to augment the human intellect, had the clearest view of the status of Project MAC. He actually showed the group a protocol analysis design he had developed with pencil and paper to begin to understand complex professional problem solving. Turoff felt that this proved to him the need for social scientists to be studying the impact of computers on humans and human organizations in order to design better systems.

Marrying Delphi with Interactive Computing at the Office of Emergency Preparedness

The experience of studying numerous time-sharing systems, as well as interactive computing, in collaboration with psychologists who studied how humans responded to and reacted with computers led Turoff to realize the potential of group decision analysis, individual decision-making, and the Delphi method. The Delphi method is "may be characterized as a method for structuring a group communication process so that the process is effective in allowing a group of individuals, as a whole, to deal with a complex problem (Linstone & Turoff (Eds.), 1979)." The Delphi concept was a spin-off from defense research conducted in the 1950s by the RAND Corporation. "Project Delphi" was the name given to an Air-Force funded study to "obtain the most reliable consensus of opinion of a group of experts ... by a series of intensive questionnaires interspersed with controlled opinion feedback (Linstone & Turoff (Eds.), 1979)." Delphi was the design of group communication structures based both on the nature of the application and the nature of the group.

While at IDA, Turoff met Norman Dalkey, who was one of the developers of the Delphi at RAND Corporation (Olaf Helmer and Ted Gordon were the other chief developers). They met at the sidelines of a NATO professional conference on strategic modeling in Amsterdam. As Turoff recalls,

“I met Norm Dalkey at a NATO professional meeting while at IDA at a conference on strategic modeling. Norm and I went out one evening to tour the red light district in Amsterdam and ended up talking about Delphi and some work I was doing on gaming to allow people to play roles online in strategic war games rather than trying to make assumptions about human actions and program them directly in the game. So we were both very interested in the same human collaboration problem which is addressed by Delphi.”

Turoff left the IDA to join the newly formed Systems Evaluation Division in the Office of Emergency Preparedness (OEP) in 1968. The name of OEP and its place in the executive offices was established by an act of October 21, 1968 (82 Stat. 1194), in the final days of the Lyndon Johnson administration. However, the organization existed under numerous other names dating back to 1951 and originally sprouted out of the Office of Strategic Services (OSS) in the Second World War. This new office now directly advised and assisted the President in the coordination and determination of the federal emergency preparedness policy (U.S. National Archives, n.d.). Turoff joined the Systems Evaluation Division (SED) of the OEP. At the time, there were already a lot of people in government engaged in Delphi-based forecasting studies. Actually, the majority of this new division was from IDA. With the withdrawal of university membership from defense nonprofit boards like IDA (due to student anti-war protests) there was concern among the professionals that they would not be able to be as open in their criticisms of DOD as had been the practice up to that time, when necessary. Therefore, there was a feeling they might as well move to being in the government and do the same mission for director of the OEP organization and the president. The SED in OEP accomplished a lot of government firsts, such the first government Energy Conservation Study, and the cost optimization of the government phone network using advanced network analysis techniques to handle the non-linear nature of that problem.

The first Delphi study Dr. Turoff designed at OEP was a forecasting study on the future of the steel and ferroalloy industry (Linstone and Turoff, 1975). This was to try and plan the future of the national stockpile of strategic materials. It was done with the collaboration of the National Academy of Engineering and 44 planners from companies making up the industry who participated as the Delphi participants.

The director of the OEP, General Lincoln (Eisenhower's logistic general in World War II and a West Point Professor), having seen that first Delphi, expressed to Turoff that he had difficulties in getting impartial information from regular government analysis processes dealing with major policy issues. He said that others were often tried to support what they thought were his views on a given issue. However, he wanted to obtain information and arguments that were contrary to his own, so that he could then be prepared to defend his own policy decisions when they were made public. He asked Turoff to build a Delphi designed for this purpose and for putting together into one communication process, supporters of different resolutions of the same policy issue. Turoff thus designed a Policy Delphi structure *“to produce the strongest opposing arguments about resolutions to a policy issue, using the properties of a Hegelian Inquiry process as defined by C. W. Churchman (Linstone & Turoff, 2010)”* A classified Delphi on a specific strategic policy issue using this design was developed and executed by Dr. Turoff and Edward Paxton at RAND. Shortly after, Turoff conceived of the idea of combining the ideas of computer programming and interactive computing with the Delphi method in a specific communication structure for the analysis of specific policy issues.

The main problem with the Delphi Method is the amount of time and resources that is required to present the problem to a large group, then collecting and collating initial observations and comments, with a view to agreeing on what the problem is. This is then followed by similar processes of identifying solutions, and finally reaching consensus of the best possible response to the problem. Turoff realized that much of the tedium of data collection, collating, as well as the influence of individual members of the group, could be avoided by using an on-line, but highly interactive computer system. The idea of marrying the Delphi method with an interactive computer system took more concrete shape in Turoff's mind.

The Birth of Computer-Mediated Delphi

Turoff felt that a major improvement could be made if the Delphis were conducted on computer terminals. At the time, the OEP's Computer Laboratory had hired the Language Systems and Development Corporation (LSD) to help with some system software problems with the Univac 1108. Turoff suggested some changes to the programming language that LSD was developing for the Univac 1108, XBASIC, which would enhance the system's network computing. LSD incorporated these changes. Soon, Turoff started working on an on-line Delphi which created a line version of the Policy Delphi but which eliminated the round structure and allowed the participants to participate at any time in any part of the discussion. This system went into operation in Spring 1970 on an experimental basis. Turoff asked twenty professional friends from within and without government to participate on determining desirable uses of this new communications technology. Many of these participants were very well known in the area of computer and information systems. The online Delphi Discussion started on March 16th 1970 and stretched over 13 weeks. The experiment was approved in private by Robert H. Kupperman, Assistant Director of the OEP. One long term objective was to design this type of online system to allow OEP to make better use of the thousands of Presidential Advisors, volunteers from industry and academia, with professional knowledge relevant to the types of emergencies OEP was responsible to exercise command and control functions when declared a national emergency.

However, Murray Turoff soon ran into trouble when the computer services division personnel started noticing that people outside the computer lab and OEP were gaining access to the computer. These were the people who were participating in the Delphi experiment. When this was discovered, Turoff had to be symbolically "punished" for giving outsiders access to the OEP computer and his computer terminal was taken away from him for several weeks (Hiltz & Turoff, 1978) by Kupperman! This incident illustrates the territorial wars that were prevalent in many organizations about allowing non-technical users access to expensive computers at that time. Despite this, the success of the on-line Delphi experiment led to the full-fledged development of the EMISARI computer conferencing system a year later when the Wage-Price Freeze occurred in 1971.

From the start, Turoff designed the EMISARI (Emergency Management Information System and Reference Index) as a full-fledged computer conferencing system, not limited to just the context of emergency management. The software provided, in addition to Delphi capability, a general-purpose conferencing capability that could be used for other situations. Kupperman later recalled that Turoff took a teletype home, worked round the clock, and came back with a working first version of EMISARI in four days.

The Wage-Price Freeze Problem and the Role of EMISARI

The wage-price freeze² was promulgated by President Nixon on August 15, 1971. At the start of the Wage Price Freeze the director of OEP got on a conference call with about 25 regional officers and asked if anyone had any problems. He was largely greeted with silence. A week later the real time chat feature of Turoff's modified Policy Delphi (Party-Line) was used for the same function. The input of problems were in text, some anonymous. This conference lasted for over two hours. A decision was then made to operate EMISARI in parallel with the use of faxes, telegrams, and phones. After three weeks, the other alternatives could not keep up with much of what was going on and gradually every discussion was moved over to the EMISARI operation. A conscious decision was made to limit text comments to ten lines, so people would stop trying to write typical government memos. Based upon feedback from the users, a group of about ten programmers and Turoff were continually engaged in designing and implementing extensions throughout the three month period that OEP was the primary agency for the Wage-Price freeze.

EMISARI soon became very popular as a system for the OEP personnel in various regional offices to conference with each other, and to generate and share timely information on the policies, problems and progress related to the wage-price freeze. The sixteen regional offices of the OEP had to respond to requests and inquiries, and the OEP management had to ensure that policy interpretation was correct in all regions. For all of this, a communication medium that allowed for conferencing and remote decision-making was required, and that happened to be EMISARI. The connections between the main computer running the system to the remote terminals were through government telephone lines. The New York Telephone Company reported that the regional OEP office there received over 10,000 calls in the first week (Hiltz & Turoff, 1978) pp 52.

The Architecture of the EMISARI system

From the beginning, Turoff recognized that management information systems had two main shortcomings: The first was that the persons who are the data sources seldom received any feedback, and thus were not aware of the usefulness of the information. Because of this, the second shortcoming arose, which is that there was no assurance of quality in the information. EMISARI was built to address these shortcomings.

The basic "unit" of EMISARI was the "contact" person in a regional office or the various organizational units of OEP, who was the source of information. She/he was responsible for collecting all relevant information, and interpreting the information. This information was separated into text files, which included: Policy and Guidance; Actions taken; Bulletin board; and News. Each of these could be searched for key words, singularly or jointly. The system could be tailored at any time to include different items of data (single variables, columns of data, or tables). Contacts were identified as being responsible for reporting any given data item. Anyone could see when and who had reported a

² August 15, 1971: In a move widely applauded by the public and a fair number of (but by no means all) economists, President Nixon imposed wage and price controls. The 90 day freeze was unprecedented in peacetime, but such drastic measures were thought necessary. Inflation had been raging, exceeding 6% briefly in 1970 and persisting above 4% in 1971. By the prevailing historical standards, such inflation rates were thought to be completely intolerable (The Econ Review, 1971).

given item of data. Since both messages and conference comments were possible and a directory maintained everyone's responsibilities, it was quick and easy to engage in relevant discussions.

There were three ways by which members of the system could talk to each other. **(1) A “party line,”** in which simultaneous conversations could be conducted by 15 persons. This disappeared after the conference was over. [Note: This was an early precursor of today’s chat systems.] **(2) A “Discussion”** where the written conversations were stored [Note: This was much like today’s Blog and Wiki postings with comments.] **(3) Messages between contacts,** which could also be attached to specific data items such as tables and footnotes [Note: This bears a lot of similarities to the capabilities of Facebook.]. EMISARI was a menu-based system, as illustrated in Figure 1.

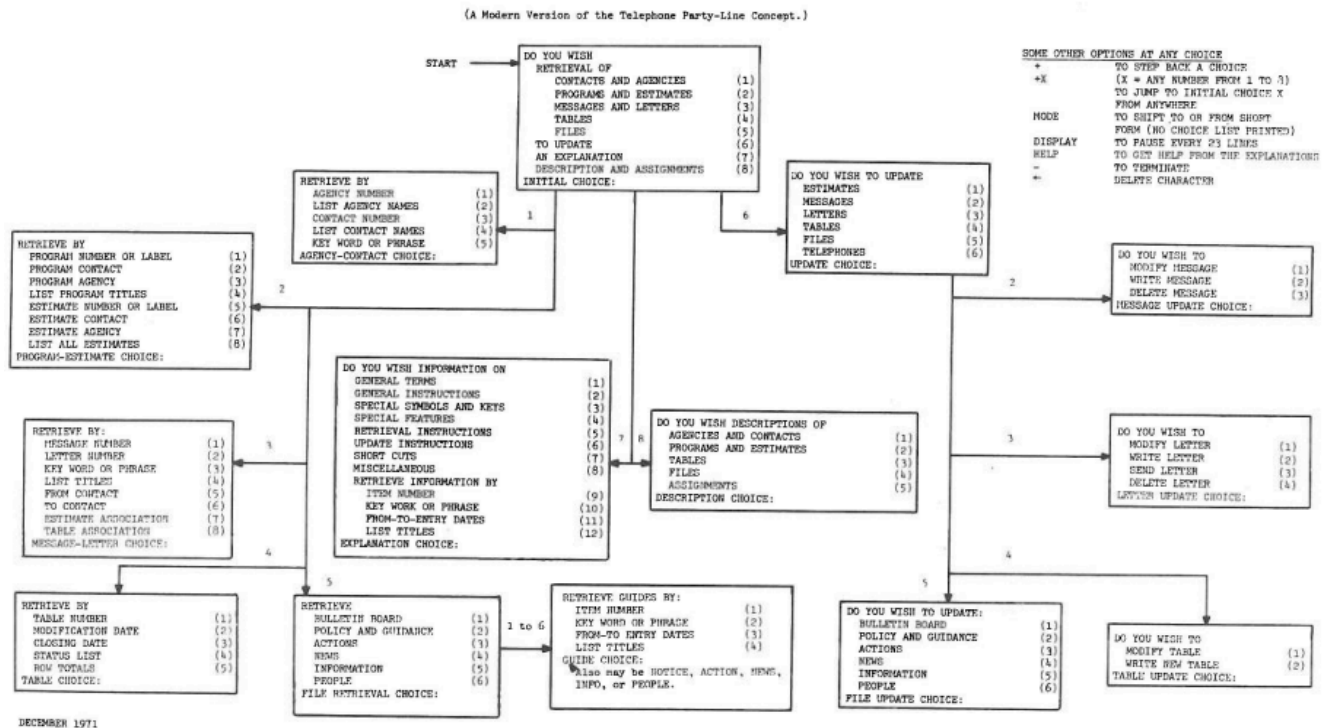


Figure 1: A View of the EMISARI System Menu

During the first ten weeks of the wage-price freeze, EMISARI was heavily used. As noted by Wilcox and Kupperman, It was accessed 900 times for entering data, the policy files were accessed 1900 times, individual estimates and text messages were accessed 2900 times. The number of terminal users was 80 (Wilcox & Kupperman, 1972). The system also underwent considerable program improvements, implemented in XBASIC by LSD Corporation and evolved into EMISARI-RIMS (Resource Interruption Monitor System) (Rheingold, 2000).

The Decline of EMISARI

However, despite all its success, the EMISARI system became a point of contention between the original personnel of the Computer Lab at OEP and the management, under whose control the EMISARI operated. The former resented the enhanced role and visibility of people working under Turoff. When the OEP was dissolved in 1973, and was absorbed into a new agency, the Federal Preparedness Agency (FPA) under the General Services Administration (GSA), the EMISARI project

was considered to be a low priority, and was not adequately funded, even though it was still being used for all sorts of policy analysis and crisis management discussions.

When the OEP was dissolved, Kupperman, the Assistant Director of OEP who was an unstinting supporter of EMISARI, left the organization. So did the main EMISARI team, consisting of Murray Turoff, Richard Wilcox and Nancy Goldstein. John McKendree, a consultant working for the GSA took over responsibility of EMISARI. The system was mostly dormant, but continued to be pressed into service whenever there was a national crisis situation, such as the voluntary petroleum allocation program in 1973. Whenever the nemesis of EMISARI, the Computer Lab at the OEP (now GSA) wanted to terminate the EMISARI system, a new crisis would arise, for which the system would be pressed into service. This happened in 1974, during the national truckers' strike. EMISARI was used nation-wide to provide the White House with twice-daily reports.

But despite these successes, the writing was on the wall. According to McKendree, Computer Services was more interested in using the FORTRAN language, which was more along the traditional, batch processing methods that they had operated before EMISARI (Hiltz & Turoff, 1978), pp60. The system eventually became dormant and neglected, and for all practical purposes, died by 1975. As Turoff recalls, "It still had occasional use until 1985 but no new work on it was done. The discussion piece with party line, discussion, and confernece and including voting went into the (Univac) 1108 software sharing system and lived on for some time in a number of university computer services departments for internal management or user service."

The Emergence of the Networked Society

Murray Turoff left OEP and joined the New Jersey Institute of Technology, where he designed and developed the next-generation computer-mediated conferencing system. This was the *Electronic Information Exchange System (EIES)*. This was a period of intense collaboration between Turoff and sociologist Starr Roxanne Hiltz. (When Dr. Turoff got the offer from NJIT he was hoping to involve a social scientist to evaluate these types of systems and their design. Professor Hiltz was chair of the sociology department at Uppsala College in New Jersey. After working on some proposals to the NSF in 1974, she formulated a paper on the use of computers to support social communities. She sent that to the ASA (American Sociological Association) journal and received back a letter that the paper would not be sent for review and was rejected because there was no possibility of social communities existing through a computer. After that she mostly published in the Computing literature.)

NSF supported the development of EIES and put out a special RFP that allowed potential user groups that represented "invisible colleges of researchers" to be supported for using EIES to support their "community of practice" provided they also included an evaluation effort. In addition EIES was allowed to support experimental efforts that would produce new insights. The unique feature of EIES as a research system was that it was designed not only to support a common communication structure, but also communications structures designed for particular groups. A large number of very different tailored CMC systems were developed for such areas as project management, standards setting, planning, online learning, and group decision support systems. A number of new systems were subsequently developed by prior EIES users such as FORUM, the WELL, and KOM (in Europe). EIES also had the first user oriented marketplace system which had a very successful test allowing any

EIES user, using play money, to buy and sell information. It incorporated public feedback from those that had made a purchased (Turoff, 1985). However, NJIT, as a state university, felt it could not operate such a system using real money.

Reflections

In 1978, the book *The Network Nation*³ co-authored by Murray Turoff and Roxanne Hiltz became a defining document and a standard reference in computer mediated communications. In her 1993 review of the book in *The Village Voice*, Pulitzer Prize winning author Teresa Carpenter said:

“The Network Nation ... contained a fascinating vision. In it home computers are as common as the telephone. They link person to person, shrinking, as the authors put it, 'time and distance barriers among people, and between people and information, to near zero.' In its simplest form, the Network Nation is a place where thoughts are exchanged easily and democratically and intellect affords one more personal power than a pleasing appearance does. Minorities and women compete on equal terms with white males, and the elderly and handicapped are released from the confines of their infirmities to skim the electronic terrain as swiftly as anyone else.”

Around the same time *The Network Nation* was first published, Barry Wellman, a sociologist from the University of Toronto was also studying the emerging network society, but from a purely sociological angle, arguing that societies are best seen as networks of people rather than hierarchically organized social structures. He developed this theory in his 1979 article “The Community Question,” and then expanded that idea substantially in his 2001 article “*Physical Place and Cyber Place: The Rise of Personalized Networking*⁴” to include technological advancements that enable individuals to expand their individual networks temporally and spatially. Dr. Wellman was one of the early users of EIES as part of the invisible college multidisciplinary group working the analysis of human networks.

Fast-forwarding a decade, the early nineties saw a major escalation of the networked society. The nascent Internet, which had maintained a predominantly academic presence through the eighties, suddenly became a household presence with the development of the world-wide-web (WWW). A network that connected all people in the globe became a clear possibility, pulling more scientists and sociologists to study the shape of things to come in this new environment.

One of those attracted to this area of research is Jan van Dijk, a Dutch professor of communications science, who, in a seminal book “*The Information Society*” published in 1999, noted the rise of the network society, and the inherent dualities that existed in it:

“A combination of scale extension and scale reduction marks all applications of the new media in the economy, politics, culture and personal experience. This combination is the prime advantage and attractiveness of these media. It explains their fast adoption in what was considered to be a communications revolution. A dual structure returns in several oppositions described in the former chapters: centralization and

3 See Hiltz, S. R., and M. Turoff. 1978. *The Network Nation: Human Communication via Computer*. New York: Addison-Wesley. [Revised Edition. Cambridge, MA: MIT Press, 1993.]

4 See Wellman, Barry, “The Community Question: The intimate networks of East Yorkers,” AJS Volume 84, No 5, March

*decentralization, central control and local autonomy, unity and fragmentation, socialization and individualization*⁵.”

Van Dijk foresaw the tensions that such networked flows would cause:

*“The main actors designing and introducing this advanced and expensive technology are at the top of corporations and governments. They are the investors, the commissioners and the decision makers. It is to be expected they use it to strengthen central control, be it in flexible forms, and to limit personal autonomy and free choices at the bottom of the organization not matching their interests. In this book it was noticed several times that ICT enables better means of advanced and intelligent forms of central control than old technologies. It is a matter of social and organizational struggle whether the (other) opportunities of ICT to spread decision making will be utilized.”*⁶”

He also predicted that the changes brought forth by the networked society would be evolutionary rather than revolutionary, and that the networked society will not be an altogether *different* type of society.

While many researchers generated ideas focused on on-line communications during this period, it was Murray Turoff who designed and implemented an actual, working, computer-mediated communication system that became the model for future implementations of this kind. Murray Turoff thus provided the first model and prototype of a class of social computing systems that would become ubiquitous thirty years later. All through the 1980s and early 1990s, the second-generation computer-mediated communications system (EIES) developed by Turoff became the main experimental platform for numerous researchers and developers interested in creating and evaluating collaborative systems and the ramifications of such a system in the shaping of society. Thus, his influence in the field of CMC is all the more important and worthy of further study.

Conclusion

In the above, I have traced the birth of the first ever computer-mediated communications and conferencing system that was developed by computer pioneer Murray Turoff in the 1960s. I have provided a biographical sketch of Turoff, his educational background and how his experiences at graduate school prepared him to develop such a system. Early in his career, this physicist-turned computer scientist taught himself how to program and use computers. He visualized computers as interactive communications devices. He was no doubt influenced by his associates and experiences at his first post-doctoral employer, the Institute for Defense Analysis. There Turoff met many social scientists, managers, psychologists and computer scientists. The IDA has provided a vantage point for Turoff to examine and study numerous developments that were happening in the field of computer science. He used the developments in time-sharing systems and merged it with concepts from the field of psychology and social sciences and developed his own system that would enable decision-makers to conference, communicate and share ideas. After leaving the OEP, Turoff continued his work in enhancing computer-mediated communications at the New Jersey Institute of Technology. He developed the Electronic Information Exchange System, collaborating with his research partner and

1979, pp 1201-1231.

⁵ See van Dijk, Jan, “The Network Society: Social Aspects of New Media” (1999, 2nd edition 2005), pp 220-223.

⁶ Ibid.

wife Starr Roxanne Hiltz. This work was truly innovative and prescient for its times, and provided a fertile ground for an entire generation of social scientists and computer scientists working on developing newer forms of computer-based communications systems. Turoff was awarded the EFF Pioneer Award in 1994 for "significant and influential contributions to computer-based communications and to the empowerment of individuals in using computers (EFF, 1994)."

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