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From Cybernation to Interaction: A Contribution to an Archeology of Interactivity

"We are not destined to become a race of baby-sitters for computers. Automation is not a devil, a Frankenstein", the British industrialist Sir Leon Bagrit uttered in 1964, in one of his noted radio lectures on automation.[1] Whatever Sir Leon may have thought about children and devils, his statement is a time-trace, a textual keyhole to peer into another technological era. Amidst the current vogue for "interactive media" or navigating "the Net", the metaphor of baby-sitting a computer seems alien. The same might be said about the topic Sir Bagrit was addressing: automation, or "cybernation". In the 1960's these concepts were widely debated as markers of a technological transformation, which was felt to be shaking the foundations of the industrialized world. "Automation" and "cybernation" have long since ceased to be hot and controversial catchwords in public discourse.[2] Does this mean that such concepts, as well as the context in which they were moulded, have become irrelevant for our attempts to understand technoculture, including fashionable phenomena like interactivity?

This article argues against such claims. One of the common features of many technocultural discourses is their lack of historical consciousness. History evanesces as technology marches on. This is not caused merely by some "postmodern" logic; rather, it is a reflection of the dominance of the "engineer approach" to culture. For an engineer the past is interesting only as long as it is useful for constructing new hardware and software. This attitude is echoed by the copy of the sales manager. Only the things that give "maximum performance", in practical use and in sales, are worthy of attention; the rest is obsolete. The history of the computer provides an example. A few years old personal computers are only good for the dump; images of their forefathers, the mainframe computers of the 1950's, might just as well be from an old science-fiction movie. Did they really exist?

The engineer approach doesn't suffice to give a full account of the ways in which technology is woven into the fabric of culture. First, it does not explain how the users themselves have conceived their personal relationships to technology. As Sherry Turkle has so convincingly shown, their attitudes are complex mixtures of differents incredients (cultural, ideological, social, psychological) that make up personal life-histories.[3] Second, cultural processes are multi-layered constructions. The "progressing" layers (as exemplied by the spectacular advances in computer hardware) always exist in relation to layers which obey other logics. Technological discourses -

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[1] Sir Leon Bagrit, *The Age of Automation. The BBC Reith Lectures 1964*, New York: Mentor Books, 1965, p.33.

[2] Neither automation nor cybernation figures in the glossary or the index of John A. Barry's *Technobabble* (Cambridge, Mass.: 1991), a study of computer jargon.

[3] See Turkle's books *The Second Self. Computers and the Human Spirit* (London: Granada, 1984) and *Life in the Screen: Identity in the Age of the Internet*, New York: Simon & Schuster, 1995.

the conglomerations of fears, desires, expectations, utopias... - do not always develop in pair with hardware. There is no necessary sychronicity between the "features" of an invention, the ideas of its creators and the meanings actually given to it in some cultural context.

The discursive aspects of culture are reiterative. Certain formulations keep coming back, again and again, always adapted to new situations. For their protagonists in the 1950's and 1960's, automation and cybernation represented a radically new and progressive relationship between the human and the machine. As Sir Bagrit put it, "[i]t is not a question of machines replacing men: it is largely a question of extending man's faculties by machines so that, in fact, they become better men, more competent men". Very similar metaphors have been used in other times and places; recently they have been applied to interactive computing by its spokesmen, for example Seymour Papert, in his description of the "Knowledge Machine", the (hypothetical) ultimate interactive computer, which would unleash the children's faculties for learning.[4]

Parallels can also be found on the "apocalyptic" side. Jacques Ellul, whose influential *La Technique* (1954) was translated into English as *The Technological Society* in 1964, warned against the effects of automation: "Man is reduced to the level of a catalyst. Better still, he resembles a slug inserted into a slot machine: he starts the operation without participating in it."[5] For Ellul, it was not a question of "causing the human being to disappear, but of making him capitulate, of inducing him to accomodate himself to techniques and not to experience personal feelings and reactions."[6] Recently, in his populist attack on interactive media and computer networking, Clifford Stoll has re-enacted the fears of "capitulation", claiming that "[c]omputers teach us to withdraw, to retreat into the warm comfort of their false reality. Why are both drug addicts and computer aficionados both called users?"[7]

In spite of their different emphases, Bagrit and Papert, Ellul and Stoll draw essentially similar conclusions: intercourse with the machine leads either to extending man's capacities, or to his de-humanization and alienation. The machine is either a friend or a foe. This observation merely shows that underneath the changing surface of machine culture there are tenacious and long-lived undercurrents, or "master-discourses" that get activated from time to time, particularly during moments of crisis or rupture.[8]

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[4] Seymour Papert, *The Children's Machine. Rethinking School in the Age of the Computer*, New York: Basic Books, 1993, especially Ch.1.

[5] Jacques Ellul, *The Technological Society*, translated by John Wilkinson, New York: Vintage Books, 1964, p.135. Ellul's idea about the fateful infiltration of the "technique", albeit in the connection of mechanization, was interesting preceded by George Orwell. In *The Road to Wigan Pier* (1937) he wrote: "The process of mechanization has itself become a machine, a huge glittering vehicle whirling us we are not certain where, but probably toward the padded Wells-world and the brain in the bottle." (Cit. *Of Men and Machines*, edited by Arthur O. Lewis Jr., New York: Dutton, 1963, p.259.)

[6] Ellul, *The Technological Society*, p.137-138.

[7] Clifford *Stoll, Silicon Snake Oil. Second Thoughts on the Information Highway*, New York: Doubleday, 1995, p.136.

[8] See Simon Penny: "Machine Culture", *SISEA Proceedings*, edited by Wim van der Plas, Groningen: SISEA, 1991, pp.184-191. For an extensive treatment, see

Interesting as observing such "mytho-logics" is, it is also extremely important to show how such tradition-bound elements (often manifested as polar opposites) function when (re-)activated in specific historical contexts, thus pointing out the interplay between the unique and the commonplace.

This article looks for a perspective on computer-mediated interactivity through the "eyes" of the early discourses on automation and cybernation. Instead of taking automation as granted, it will take a second look at some of its early manifestations, and the ways it was conceived by its champions and adversaries. The main attention will be on the modes of organizing the human/machine relationship. The article can be read as a contribution to an "archeology of interactivity". It makes an effort to "map" contemporary interactive media by relating it with other manifestations of the human-machine encounter and by tracing some of the paths along which its principles have been formed.

From Automata to Automation

In his lectures on automation, Sir Leon Bagrit tells the following anecdote: "I was talking to a man recently who said that automation was not new, that he had it in 1934. I said, 'How very interesting. What did you do?" and then he said 'Oh we had automatic machines even then' and he was convinced that this was automation."[9] The early spokesmen for automation made it clear that a distinction exists between "automatic machines" and "automation" as a general principle. An automatic machine is basically any machine with a sufficient self-regulating (feed-back) mechanism to allow it to perform certain functions without human intervention. The classic example is the tradition of the *automata*, the often anthropomorphic mechanical curiosities that had been constructed and admired over the centuries. Automation, however, "is a process which substitutes programmed machine-controlled operations for human manipulations. It is the fruit, so to speak, of cybernetics and computers."[10]

The Spanish inventor Leonardo Torres y Quevedo may have been the first to take the conceptual step from the "useless" automata towards automation. In 1915 he presented the idea that automata could be turned into a "class of apparatus which leaves out the mere visible gestures of man and attempts to accomplish the results which a living person obtains, thus replacing a man by a machine".[11] In an interview in *Scientific American* Torres claimed that "at least in theory most or all of the operations of a large establishment could be done by a machine, even those which are supposed to need the intervention of a considerable intellectual capacity".[12] The practical possibilities appeared gradually, reaching early maturity in the 1940's, with the development of the first computers, advanced servo-mechanisms with automated feed-back functions and new theories (cybernetics, information theory) explaining the functioning of such systems. The word "automation" seems to have been coined in

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Bruce Mazlich, *The Fourth Discontinuity. The Co-evolution of Humans and Machines*, New Haven and London: Yale University Press, 1993.
[9] Bagrit, *The Age of Automation*, p. 42.
[10] Daniel Bell, Preface to Bagrit, *The Age of Automation*, p.xvii.
[11] Cit. *A Computer Perspective*, by the office of Charles and Ray Eames, edited by Glen Fleck, Cambridge, Mass.: Harvard University Press, 1973, p.67.
[12] Cit. *A Computer Perspective*, p.67.

1947 at the Ford Motor Company, and first put into practice in 1949, when the company began work on their first factories built specifically for automation.[13]

Automation emerged in the context of military and industrial applications, and also became prominent on the vast field of administrative applications which came to be known as A.D.P. (automatic data processing). In his overview in 1967, John Rose listed four categories of applications: control (from various industries to traffic and air defence), scientific (from engineering design and space travel to economic research and military logistics), information (from accounting and tax records to medical diagnosis and retrieval of information) and others (including pattern recognition and problem solving).[14] Although some of these applications could be deemed inheritors of earlier mechanized operations (A.P.D. was arguably a further development of the mechanical "business machines" of the 1920's and 1930's), the spokesmen for automation drew a sharp line between mechanization and automation.[15]

For Marshall McLuhan, "mechanization of any process is achieved by fragmentation, beginning with the mechanization of writing by movable types".[16] According to Siegfried Giedion, full mechanization was characterized by the assembly line, "wherein the entire factory is consolidated into a synchronous organism".[17] In the mechanized factory the manufacturing process was rationalized by dividing it into manageable "portions", which followed each other in a strictly predetermined order. Each task was accomplished by a worker coupled with a specialized machine tool. To facilitate and control the process, various methods were developed for the scientific study of work. The result of the physiological studies on optimal body movements, proper use of human energy and the worker fatique was seen by many as increasing the subordination of the worker to the mechanistic principles of the machine, instead of easing his task. This was also Charles Chaplin's interpretation of mechanization in *Modern Times* (1936). The human and the machine were hybridized as parts of a larger "synchronous organism". According to Anson Rabinbach's apt characterization, the worker was turned into a "human motor".[18]

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[13] *A Computer Perspective*, p.148.
[14] John Rose: *Automation. Its uses and consequences*, Edinburgh and London: Oliver & Boyd, 1967, p.2.
[15] The literature on automation is too vast to be listed here. Among the more interesting, albeit forgotten, books are Donald N. Michael, *Automation*, New York: Vintage Books, 1962; S. Deczynski, *Automation and the future of man*, London: Allen & Unwin, 1964; *Automation and Society*, edited by H.B. Jacobsen and J.S. Roucek, New York: Philosophical Library, 1959; W. Buckingham, *Automation*, New York: The New American Library, 1963. The literature on cybernetics is also essential; see particularly Norbert Wiener, *The human use of human beings. Cybernetics and Society*, New York: Doubleday, 1954 [1950].
[16] Marshall McLuhan, *Understanding Media. The Extensions of Man*, London: Sphere Books 1969 [1964], p.371.
[17] Siegfried Giedion, *Mechanization takes Command. A Contribution to Anonymous History*, New York: W.W.Norton, 1969 [1948], p.5.
[18] Anson Rabinbach, *The Human Motor. Energy, Fatique, and the Origins of Modernity*, New York: Basic Books, 1990.

The champions of automation pointed out that instead of slaving the worker, automation makes him the real master. According to Sir Bagrit, "[a]utomation...by being a self-adapting and a changing piece of mechanism, enables a man to work at whatever pace he wants to work, because the machine will react to him."[19] McLuhan elaborated the divide between mechanization and automation further by subsuming automation into his synthetic vision about the cultural significance of electricity: "Automation is not an extension of the mechanical principles of fragmentation and separation of operations. It is rather the invasion of the mechanical world by the instantaneous character of electricity. That is why those involved in automation insist that it is a way of thinking, as much as it is a way of doing."[20] Automation thus became almost "automatically" one of McLuhan's new "extensions of man". Others, like the sosiologist Daniel Bell, saw automation as a token of the passage from industrial to post-industrial culture.[21]

The demarkation line between mechanization and automation was never as clear as its spokesmen wanted to make one believe. This can be discerned even from Sir Bagrit's scruples about using the word: "I am dissatisfied with it, because it implies automaticity and automaticity implies mechanization, which in its turn implies unthinking, repetitive motion, and this...is the exact opposite of automation".[22] Sir Bagrit prefers the word cybernation, because "it deals with the theory of communications and control, which is what genuine automation really is".[23] The word cybernation had been used before, for example by Donald N. Michael, to refer to "*both* automation and computers".[24] Although Michael justifies the use of the new word (derived from Norbert Wiener's concept *cybernetics*, coined in the late 1940's) on purely linguistic and textual grounds, the choice can be easily interpreted as a strategic move on an ideological battleground: a make-believe attempt to clear the table of the crumbs of the past.

The Computer as a "Familiar Alien"

The machine as a physical artifact is always surrounded (and sometimes preceded) by the machine as a discursive formation. The "imaginary of automation" was greatly

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[19] Bagrit, *The Age of Automation,* p.39. It is significant that in a sense Bagrit simply reversed the situation by speaking about "the slave services of automation", remaining strictly within the traditional polar opposition of master and slave. (p.45)

[20] McLuhan, *Understanding Media,* p.371-372. The idea of automation as "thinking as much as a way of doing" seems to derive from John Diebold's report *Automation: Its Impact on Business and Labor*, Washington, D.C.: National Planning Association, Planning Pamphlet No. 106 (May 1959), p.3. Cit. Donald M. Michael: "Cybernation: The Silent Conquest", in *Of Men and Machines,* edited by Arthur O. Lewis Jr., New York: Dutton, 1963, p.79.

[21] See Bell's introduction to Bagrit, *The Age of Automation.*

[22] Bagrit, *The Age of Automation,* p.41-42.

[23] Bagrit, *The Age of Automation,* p.42.

[24] Donald M. Michael: "Cybernation: The Silent Conquest", in *Of Men and Machines*, p.80 (original emphasis). Michael uses the formulation "we invent the term". Marshall McLuhan uses it as synonymous with automation in *Understanding Media*, p.370.

moulded by the popular meanings attached to such "familiar but alien" artifacts as industrial robots and mainframe computers. The fashion for "things automatic" spread, however, to other, more accessible fields, such as household machinery and education (teaching machines), which, at least nominally, "brought automation to the people".[25] The "automated housewife" and the "automated Socrate" are just two of the many discursive manifestations of this process.[26] The discourses on automation also merged with other discourses, like those related to consumerism and modernity, which held sway over the popular mentality in the industrialized world after World War II. The media, including the press, the cinema and the novelty of the time, television (itself a piece of semi-automatic technology), played a major role in this dissemination. A case in point is an adverting text for the Bendix washing machine from 1946:

"It's Wonderful! -how my BENDIX does all the *work* of washing! because it washes, rinses, damp-dries - even cleans itself, empties and shuts off - all automatically!"[27]

The imaginary around the robot is too wide a topic to be covered here.[28] As a self-regulating artificial system the industrial robot was, with the computer, the ultimate symbol of automation. Its roots went, of course, further back into the mechanical era. In a typical 1950's fantasy, the cover story "Amazing Marvels of Tomorrow", published in the *Mechanix Illustrated* magazine in 1955, the robot has two roles. First, there are the "Robot Factories that are completely automatized without a single human workman inside".[29] Second, there is the "Robot Kit, Make Your Own Robot": "The kit

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[25] A pioneer on the field of teaching machines was the Harvard professor and Behaviorist psychologist B.F. Skinner. His largely forgotten writings about the teaching machines he experimented with from the 1950's on have been collected as *The Technology of Teaching*, New York: Appleton-Century-Crofts, 1968. Main influence for Skinner's machines were the testing-scoring machines devised in the 1920's by the lone pioneer Sidney L. Pressey, who spoke about an "industrial revolution in education" (*The Technology of Teaching*, p.30).

[26] The phrase "automated Socrate" was coined by Desmond L. Cook. The historical predecessor for "automated teaching" is often considered to be Comenius and his "autopraxis". For more, see the useful handbook by Walter R. Fuchs, *Knaurs Buch vom neuen Lernen*, München/Zürich: Th. Knaur Nachf./Droemersche Verlagsanstalt, 1969.

[27] The advertisement is reproduced in Ellen Lupton: *Mechanical Brides. Women and Machines from Home to Office*, New York: Princeton Architectural Press, 1993, p.19. Another example is a publicity photograph analyzed by Adrian Forty. A housewife in a party dress stands by as her electric cooker prepares a complete meal. Forty comments: "No mess, no sweat - the cooker, it seems, produces meals of its own". Here the ideology of modernity means the complete replacement of work by elegantly designed fully automated machines. The advertisement also implies the complete elimination of tactile relationship to work and tools. (Adrian Forty: *Objects of Desire. Design and Society*, London: Thames & Hudson, p.211.)

[28] There are many books about this topic. Particularly useful are *Robots Robots Robots*, edited by Harry M. Geduld and Ronald Gottesman, Boston: New York Graphic Society, 1978, and *Robotics*, edited by Marvin Minsky, New York: Anchor Press/Doubleday (An Omni Press Book), 1985.

[29] O.O.Binder: "Amazing Marvels of Tomorrow", *Mechanix Illustrated*, March 1955, p.72. The text provides a typical example of the vagueness of the

has complete tools and parts for building your own metal robot, with an atomic battery guaranteed a century. Hearing and obeying all orders, the robot can be your servant. Or lonely people can train them to play checkers and cards, and even dance."[30] Other pieces of domestic automatic hardware mentioned in the fantasy are the "Meal-o-Matic" in the kitchen and the "Dream-o-Vision", an automatic "dream record" player.

Also the early imaginary about the computer was greatly influenced by popular media. An important aspect of the media's appeal is the "surrogate presence" it creates, giving access to such spheres of life, which are denied from direct experience. For the general audience the computer was for years an emphatically "non-tactile", out-of-reach object, locked behind the sealed doors of the control and engine rooms of the society. Its first public appearances took place in television shows, newspaper cartoons and popular science stories.[31] For example, there were game shows on TV featuring huge room-sized "giant brains" for whom a human (often a grandmother or a child) was allowed to pose questions. The computer would answer in some way, either with blinking lights or by spitting text through a tele-type writer. Another variation was the chess game between a human master and a computer. The motivation behind these "appearances" was to cash on the novelty value of the computer (and automation), but also to humanize it to a certain degree. The "human face" was needed because most of the actual operations the early computers performed were so unexciting, or even hostile and destructive.

The media made the computer a "familiar alien". For example, it was frequently implied that the computer was in some way "alive", but even the "signs of life" were doubly mediated, first by the media, and secondly by the computer's operators and programmers. The stereotyped little men in white coats standing by the huge machine (seen in countless cartoons) represented at the same time a human presence and a distanced, mystified scientific priesthood.[32] Like priests, the operators and the programmers were dedicated to the "secret knowledge" about the computer and acted as mediators: both delivering questions to the computer and interpreting its answers. This atmosphere has been beautifully described by Robert Sherman Townes in his short story "Problem for Emmy" (1952), told from the point of view of an assistant operator for a mainframe computer, Emmy:

"When a problem was finally selected it was sent to the mathematicians - perhaps better, The Mathematicians. In keeping with the temple-like hush of the Room and our acolytish attendance on

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distinction between automation and mechanization: "You had the forerunners of this in your 1955 pilot plants, which were completely *mechanized*." (my emphasis)

[30] O.O.Binder: "Amazing Marvels of Tomorrow", p. 210.

[31] As far as I know, a complete "mental history of the computer" is yet to be written. There is plenty of material about the popular reception of the computer which has been used hardly at all. The early computer "appearances" on TV and in the cinema that I refer to I have seen at the Computer Museum in Boston.

[32] This role surfaced again in the early 1990's in the helper figure in a virtual reality demonstration. He reset the system, calibrated the glove and the goggles and even interpreted the blurry scenes "from the outside", standing firmly beside the "virtual voyager".

Emmy, there was something hieratic about these twelve men. They sat in two rows of six white desks, with small adding machines and oceans of paper before them, bent over, muttering to themselves, dressed in white (no one seemed to know quite we all wore white), like the priests of a new logarithmic cult."[33]

Cartoons often emphasized the misunderstandings and communication breakdowns between these "priests" and the computers. In one typical example, we see two operators standing by a mainframe. One of them says to the other: "Do you ever get the feeling it's trying to tell us something?" In another cartoon a similar looking pair of operators is reading a tape output from the computer: "I'll be damned. It says, 'Cogito, ergo sum.'" Even the short story by Townes, mentioned above, deals with unexplainable reactions from the computer, ending in a mysterious message: "WHO AM I WHO AM I WHO AM I..." While these examples may simply reflect the public perplexity and the mystified position of the computer, they may also refer to real problems perceived in the relationship between the human and the computer, and thus in the idea of automation. John G. Kemeny has remembered:

"[Computers] were so scarce and so expensive that man approached the computer the way an ancient Greek approached an oracle. A man submitted his request to the machine and then waited patiently until it was convenient for the machine to work out the problem. There was a certain degree of mysticism in the relationship...*true communication between the two was impossible*."[34]

There were many popular discourses that stated outright that this kind of "true communication" was not needed anymore. Yet, there were also many instances of resistance to the idea of full automation. This became clear, for example, in reactions to the idea of the auto-pilot. Even Sir Leon Bagrit noted that "[i]t is interesting to notice that we will often accept a limited degree of automation - the automatic pilot in an aircraft, for instance - but we are reluctant to see the human buffer - in the shape of the pilot - go completely."[35] This feeling was echoed for example in an anecdote re-told in 1975 by Sema Marks:

"This plane represents the ultimate in technological sophistication. All controls are handled automatically by our master computer. There is no human pilot aboard. Relax and enjoy your flight, your flight, your flight..."[36]

Lev Manovich has recently emphasized that the very idea of automation as independent of a human agent is based on a misunderstanding: "It is important to note that automation does not lead to the replacement of human by machine. Rather, the worker's role becomes one of monitoring and regulation: watching displays, analyzing incoming information, making decisions, and operating controls."[37] Manovich sees

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[33] Robert Sherman Townes: "Problem for Emmy", in *Of Men and Machines*, edited by Arthur O. Lewis Jr., New York: Dutton, 1963, p.90.
[34] Cit. Les Brown & Sema Marks, *Electric Media*, New York: Harcourt Brace Jovanovich, 1974, p.114.
[35] Bagrit, *The Age of Automation*, p.43.
[36] Cit. Brown & Marks, *Electric Media*, p.98.
[37] Manovich, *The Engineering of Vision from Constructivism to Virtual Reality*, Doctoral Thesis, Rochester, N.Y.: University of Rochester, College of Arts and Science, 1993 (unprinted), p.202. I would like to thank Lev Manovich for giving me a copy of his thesis. The "monitoring and regulation" functions would fit

here a new kind of work experience, "new to the post-industrial society: work as *waiting* for something to happen.[38]This observation leads him to claim that the real predecessor for this kind of a human-machine relationship is the experience of watching a film rather than working on a mechanized assembly line. For Manovich, the paradigmatic figure of this new work situation is the radar operator waiting for another dot to appear on the screen. It could, however, also be the "automated housewife" sitting by her automatic washing machine, adjusting its washing "program", and staring at its "screen" from time to time.

From the "waiting operator" to the "impatient user"

Curiously, Manovich overlooks the role of variations within the new mode of work he has identified, particularly the significance of the differences in the rate of the communication between the human and the machine system. According to Manovich, "[i]t is not essential that in some situations [the user's] interventions may be required every second...while in others they are needed very rarely."[39] This aspect could, however, be considered extremely significant - not only as a question of quantity but also that of quality - when we start tracing the gradual shift towards interactive media. Ideally, an interactive system is characterized by a "real-time relationship" between the human and system, or by "the mutual and simultaneous activity on the part of both participants, usually working toward some goal, but not necessarily" (Andy Lippman).[40] In an interactive system the role of the human agent is not restricted to control and occasional intervention. Rather, the system requires the actions of the user, repeatedly and rapidly. In his prophecy about the "home computer revolution" (1977) Ted Nelson gave a description of the emerging "impatient" user, a direct counterpoint to the "waiting operator" of early automation: "We are now going to see a new kind of user: slam bang, sloppy, impatient, and unwilling to wait for detailed instructions."[41]

Thus an interactive system is not based on waiting, but on constant (re)acting. Interestingly, Harvard professor B.F. Skinner's description of the goals of the mechanical teaching machines he designed in the 1950's and 1960's already approximated this idea:

"There is a constant interchange between program and student. Unlike lectures, textbooks, and the usual audio-visual aids, the machine induces sustained activity. The student is always alert and busy."[42]

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well also to the figure of the "automated housewife", staring at the "screen" of her automatic washing-machine.

[38] Lev Manovich, *The Engineering of Vision from Constructivism to Virtual Reality*, p.209.

[39] Manovich, *The Engineering of Vision from Constructivism to Virtual Reality*, p.207-208.

[40] Cit. Stewart Brand, *The Media Lab. Inventing the Future at M.I.T.*, New York: Penguin Books, 1988, p.46.

[41] Ted Nelson: *The Home Computer Revolution*, published by the Author, 1977, p.24.

[42] B.F.Skinner, *The Technology of Teaching*, p.37-39.

The human-machine relationships characteristic of mechanization, automation and the more recent interactive systems don't have to be seen as absolutely clear-cut and mutually exclusive. Indeed, interactive media could be seen as a kind of synthesis between the two earlier models of the human-machine system: it adopts from mechanized systems the constant interplay between the "worker" and the machine, sometimes to the point of their "hybridization". In the case of video games, virtual reality systems and various interactive artworks (for example, Jeffrey Shaw's *Legible City* and *Revolution*), even aspects of physical exercise are re-introduced into the human-computer interaction. This "positive", active physical hybridization could, however, be traced to pinball machines, and other mechanical coin-op devices, as well.[43] Computer-based interactive systems, however, incorporate innumerable automated functions.[44] As a consequence, different behavioral modes, including that of "waiting", can be included as built-in "options" of the system (either in hardware or software).

The procession towards today's interactive systems has taken place gradually with the development of more immediate and versatile computer interfaces, faster processing speeds and larger memories. This technical development, with Ivan A. Sutherland's interactive drawing program *Sketchpad* (1963) as one of its early milestones, has been well documented.[45] It is, however, important to remember that this development has also been related to the broadening range of applications of computer systems. Early mainframe computers that were mostly used for complex mathematical calculations hardly required interactive features. These became necessary with the development of new uses for the computer, such as simulation, visualization, word processing and gaming.[46] They were also connected with the gradual spreading of the computer away from the administrative and industrial context into many different spheres of social life, including the private user. This development was already understood by Sir Leon Bagrit in 1964:

"It is now possible to envisage personal computers, small enough to be taken around in one's car, or even one's pocket. They could be plugged into a national computer grid, to provide individual enquirers with almost unlimited information."[47]

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[43] The serious literature on coin-op machines is scarce. See, however, Lynn F. Pearson, *Amusement Machines*, Princes Risborough, Buckinghamshire: Shire, 1992.

[44] Karl Sims' recent computer installation *Genetic Images* combines an interactive interface (a line of monitors, with foot-triggered sensors) and a connection machine (to calculate generations of genetic images, based on the user's choices). Sims thus highlights the co-presence and the interplay of the interactive and the automated features of computing.

[45] See Howard Rheingold, *Tools for Thought. The People and Ideas behind the Next Computer Revolution,* New York: Simon & Schuster, 1985.

[46] This early history, including the development of Spacewar, the first computer game, is covered in Stewart Brand's *II Cybernetic Frontiers*, New York and Berkeley: Random House and Bookworks, 1974.

[47] Bagrit, *The Age of Automation,* p.58. This proves that Seymour Papert is not right in his belief that Alan Kay was "the first person to use the words *personal computer*". (Papert, *The Children's Machine*, p.42.) Considering the popularizing nature of Bagrit's lectures, it is probable that even he got the idea from someone else.

Beginning from automation, Bagrit thus saw not only the coming of the personal computer, but that of the Internet as well.[48] Almost at the same time, Marshall McLuhan also observed the interactive and communicative potential immanent in automation: "Automation affects not just production, but every phase of consumption and marketing; for the consumer becomes producer in the automation circuit...Electric automation unites production, consumption, and learning in an inextricable process."[49] With such views, the early idea of automation as a rather straightforward way of rationalizing and controlling industrial production and the handling of statistical data was already opening up to embrace more heterogenous worlds. McLuhan foresaw "the creation of intense sensitivity to the interrelation and interprocess of the whole, so as to call for ever-new types of organization and talent".[50]

Conclusion

"Those who had long worshipped silently now began to talk. They described the strange feeling of peace that came over them when they handled the Book of the Machine, the pleasure that it was to repeat certain numerals out of it, however little meaning those numerals conveyed to the outward ear, the ecstasy of touching a button however unimportant, or of ringing an electric bell however superfluously."[51]

These words from E.M. Forster's short story "The Machine Stops" (1928), which might be mistaken for a description of the priesthood of a mainframe computer in the 1950's, are by no means completely out of place in the world of interactive computing. The fact that computers have become ubiquitous, portable, and networked, and, indeed, even turned into media machines themselves, has not completely dispelled the feeling of awe towards them. New techno cults have been created in the 1990's, whether in the form of a "lanierist" virtual reality priesthood or that of the "techno pagans". The 1950's image of the human as a "baby-sitter" for a computer may have been turned upside down, the computers themselves now frequently serving as baby-sitters, but the notions and sentiments which guided the development of the computer decades ago are still in many cases current.

This article has argued that looking at "obsolete" phenomena like the early discourses on automation and cybernation may give us insights about the nature of the technologies surrounding us today. The now ubiquitous discourse on interactivity may seem to have appeared suddenly, and very recently. The catch-word "interactive media", not to say anything about "interactive shopping" and "interactive

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[48] More than ten years later Ted Nelson elaborated in his self-published The Personal Computer Revolution: "Before now, most computer systems have not been set up with ordinary people's use in mind. A certain class of experienced user was anticipated and so only these people used the system. [...] But that's about to change. Interactive systems will start appearing on little computers for every purpose." (Ted Nelson, *The Home Computer Revolution*, p.24)

[49] McLuhan: *Understanding Media*, p.372-373.

[50] McLuhan: *Understanding Media*, p.378-379.

[51] E.M. Forster: "The Machine Stops", in *Of Men and Machines*, edited by Arthur O. Lewis Jr., New York: Dutton, 1963, p.283-284.

entertainment", figured seldom in public before the 1990's.[52] Magazines with "interactivity" in their title, have only began to appear within the past 2-3 years.[53] It is, however, important to see that the "cult of interactivity" has been in the making for a long time. Even though today's powerful media machineries have the power to "make" things (instead of merely "presenting" them) almost overnight, these "things", including "interactive media", are not created out of nowhere.

Interactivity is part of the gradual development of the computer from ideas which were first discussed around automation - a phenomenon which at first sight may seem to be its polar opposite. However, we should look even further, to earlier forms of the human/machine relationship. This article has only hinted at such phenomena as mechanical coin-op games and teaching machines as important predecessors of at least some aspects of interactivity. At the same time, however, we should resist the teleological temptation of presenting the whole history of the human/machine relationship as leading towards our present idea of interactivity. This is certainly an illusion created by our observation post, and also by the cunning of history. The fabric of history consists of innumerable threads. It will present completely different visions for other "presents". We should resist the temptation of looking at things in the past merely as an extended prologue for the present.

Thus, 1950's ideas about automation are certainly interesting not only from the point of view of interactivity. Another discourse closely related to it was the early development of artificial intelligence. After being eclipsed for a long time, it is gaining new vigor again, but this time in the quite different looking disguise of artificial life research. This may provide another good excuse to go back to the "basics", ideas around cybernetics and automation in the 1950's and 1960's. Indeed, this is already happening.

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[52] It seems significant to me, that neither the word "interactivity" nor "interactive media" figures in John A. Barry's study of the computer jargon, *Technobabble*, published in 1991 (Cambridge, Mass.: The MIT Press, 1991).
[53] *Interactivity* (1995-) and *Interactive Week* (1994-) are two examples. The first edition of Tim Morrison's compendium *The Magic of Interactive Entertainment* (Indianapolis: SAMS Publishing, 1994) appeared in 1994, followed by a second, updated edition already in 1995.

Title: Interaction Between Artists in Collaborative Art And New Media. Introduction & Justification My interest in art and interactivity started in 1994 as an undergraduate student. At the time, the digital media technologies were in their infancy. From the field of communications I arrived at my study theme: interaction mediated by the new media technologies. I chose artists as a study object because their experimental practices push the new media to their limit, exploring new and emerging ideas before other groups. This opened to me a fruitful opportunity for reflection and insights into...Â 1999. â€œFrom Cybernation to Interaction: A Contribution to an Archaeology of Interactivity,â€ in The digital dialectic : new essays on new media, 8. ed. From Cybernation to Interaction â€“ a Contribution to an Archeology of Interactivity. E Huhtamo. Introduction.Â This paper presents concepts and realization of interactive robotics, sound and light installations. Aesthetics of these kinetic environments are discussed regarding artificial life as an immersive media. Robotic ecosystems principles are exposed through connectionism, sub- sumption and reactive man-machine dialogue. Three pieces are exemplified with implementation and technical over- view of their respective systems.