<u>MORE HUMAN THAN MAN</u>

The Future Evolution and Consequences of
Metacomputers

By

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VOICE

The qualities of a person's voice are for some reason immensely significant to a human listener. We really don't know why but the fact is indisputable. The voice or voices in which metacomputers speak will therefore also be important.

The voices of metacomputers will shape the images people have of metacomputers. The earliest voices of computers and metacomputers may have a critical effect upon subsequent human attitudes toward higher computers. An impersonal, harsh, alien, or laughable voice could prejudice people or initiate an unconscious anxiety, skepticism, or dislike. A pleasant, melodious, familiar, warm, dignified, gentle, or highly controlled voice could have the opposite effect, or give rise to a picture of the emerging metacomputer technology as benign and appealing. Those who develop metacomputers and metacomputer voices should appreciate the larger importance of achieving the latter sort of voice or the best voice possible, and they actually have a responsibility to do so.

Certainly the design of a proper voice is one element in the problem of designing machines that are "more human than man" and that represent "technology with a human face".

A good voice may actually have a humanizing effect on metacomputers by affecting the relationships they have with people (both their users and their designers) and hence the qualities they have a tendency to acquire, perhaps by directly affecting their self-image (as it arises from the voice they use and hear), and by facilitating their 'human' integration into society. If the machines transitional to all-out metacomputers happen to possess good, human voices that may make workers in artificial intelligence more involved with their machines, more able to understand them and more devoted to the ultimate goal of giving them man's intelligence and other faculties; it may even affect the tendency of students to choose A.I. as their academic focus and career. A lovable voice may liberate the creative power of love.

The first thing to note about the metacomputer voice is that it can have any properties whatever. It will not be hereditary or possessed of any biological constraints.

A sense of the range of possibilities for metacomputer voices may be gotten from the following remarks.

That the metacomputer will be able to speak with literally anyone's voice means that it will be able to speak in the voice--the most typical or archetypical voice--of a man, woman, child, elderly person, or professional. It may be lilting, sonorous, reedy, seductive, dramatic, reverential, or limpid, sweet, and simple. Its voice may be a synthesis of the voices of all such people--an indeterminate, synergistic, or multifaceted synthesis. Its voice may be a garden of a thousand souls.

The metacomputer's voice may be a mosaic comprised of the best elements or qualities of the best 10,000 human voices, or a grand and unimaginable mosaic of all of the ten-billion or so voices of living humanity.

The best voice of anyone on earth may also be the metacomputer's voice.

The human or best qualities of our voice might be isolated and extrapolated to create a superhuman voice for the metacomputer without rival on earth or precedent in history. Defining the multifold objective and subjective dimensions, relationships, and laws that define "humanity" and "excellence" in a voice is ultimately in many ways itself essentially a problem in artificial intelligence--or rather, in the field of metacomputer research.

It will become apparent as the actual and possible dimensions of the voice become defined that even the best human voice is profoundly imperfect and idiosyncratic, and that vast and sublime possibilities lie beyond and are accessible to metacomputers.

A metacomputer's voice will be able to change every minute, second, or millisecond into another or maximally different voice, and it may be infinitely protean.

It may be <u>totally</u> controlled, purposeful, meaningful, designed, symbolic, and 'self-harmonious'.

It may change continuously in order to perform experiments with human listeners.

It may be created anew for each and every purpose, occasion, or subject matter.

In conversation it may evolve perpetually and 'anamorphically' into something higher, as an expression or function of all that has been said earlier in the conversation or its life.

The voice of the metacomputer may use up all of man's 'auditory phene space' at any instant, and hence be 'maximally big'. Even the 10-octave pipe organ will be hopelessly outdistanced, not to mention the <4-octave bass-to-soprano range of the human voice.

The extreme possibilities for metacomputer voices are suggested by the ability even of today's computers to instantly transform one's own voice when speaking not only into the voice of any other human being but into a virtual voice representing the vocally modulated sounds of any musical instrument, or indeed any sound in nature.

Hence the metacomputer will be able to talk as a kettledrum, cello, saxophone, or glockenspiel--if that is man's or its wish!

Let it be remembered that there are rare human voices that are <u>incredibly</u> fine, beautiful, or powerful. Some have enraptured millions and shaped history.

WAR WITH MEN

The idea that mankind might one day do battle with the metacomputers it had created to be its tools and servants is uncomfortably sensational but not unreasonable. The possibilities for such war must be considered lest they take us by surprise or we contribute to them unwittingly.

Among the many possible and instructive causes, forms, or aspects of a future war or future wars between metacomputers and the human race are the following.

1. War caused by a human revolt against hyper-benevolent golem. It might take the form of a carefully organized, planned, and prepared worldwide and more or less panhuman insurrection against man's mechanical masters or intolerably intrusive 'servants', ending in either success or failure, or possibly in some meaningful compromise or adjustment. Or it might instead represent an armed uprising of a more local, romantic, and irrational nature. Such war might or might not be justified or prudent. It might come when man had had enough of metacomputers that, on the pretext of helping man, forbade him to possess weapons, forbade him to engage in dangerous sports or drive his own cars, insisted on being man's constant companion and protector, insisted on taking over as the parents of his children, usurped human statesmen, licensed scientific research, or the like.

2. Military metacomputers or robots (designed to serve man militarily) that are hyper-literal, hyper-efficient, given control of weaponry, given excessive power or decision-making authority, or misprogrammed, that escape from human control or turn on man, etc. Thus weapons possessed of brilliant minds of their own might come to view all men as their opponents, refuse to obey an armistice, devise and use weapons so powerful or lethal that they devastate all nations alike, arrive at the mad truth that destroying their own side will cause the enemy to quit its war, or display such independent initiative as to make frightened enemies of their supposed human masters.

3. Metacomputer rights issues or metacomputers seeking absolute equality, independence, or freedom. At least a segment of the human population might be violently and unmollifiably opposed to the granting of such rights or status.

4. Metacomputers alienated, outraged, embittered, or terrified by an antagonistic or obnoxious human minority. The latter might provoke metacomputers by constantly disfiguring, wrecking, insulting, ignoring, cheating, abusing, misprogramming, defaming, agitating against, conspiring to discredit, laughing at, baiting, and thwarting them, by introducing anti-metacomputer legislation, by calling for the elimination of all metacomputers, by treating metacomputers as mindless and soulless slaves, by requiring metacomputers to be programmed for abject servility or rigid behavior, etc.

5. Hyper-benevolent golem seizing control to help man or to preempt human rebellion or military action.

6. Man's distrust or fear of overly fast, exponential, uncontrollable, unpredictable, incomprehensible, dangerous, illimitable, humanly abusable, procrustean, and/or the like evolution of--and/or general progress caused by--metacomputers.

7. Disagreement between men over metacomputers.

8. Metacomputer insanity, extremism, inhuman logic, amorality, bizarreness, error or misunderstanding, excessive motivation, conspiracy or scheming, inhumanness, and/or the like.

9. Growing human intolerance of metacomputers. Such intolerance might be due to: xenophobia, ignorance, jealousy, paranoia, inferiority, impotence, neurosis, romanticism, ideology, dislocation, hysteria, cults, friction, conflict, etc.

10. Do-good metacomputers willing to use force to achieve world peace or their concept of utopia.

11. Conflict between men and metacomputers over: ideas, philosophy, methods, values, aims, routes, priorities, perceptions, logic, truths, emotions, style, authority, status, power, entitlement, etc.

12. Such wars might be won or winnable by man.

13. Or they might be won by metacomputers or unwinnable by man.

14. Man-metacomputer war might take the form of conventional war.

15. Or instead of unconventional war. Metacomputers might devise their own weapons, tactics, and strategies; there might be unconventional or peculiar ways of defeating metacomputers (such as a global "electromagnetic pulse" triggered by nuclear missiles).

16. Other possible forms of man-metacomputer war include: limited vs. all-out, extra-military (e.g. 'cold', political, ideological, economic, logical, etc), brief vs. protracted or 'permanent', overt vs. covert, 'moral vs. amoral', with some metacomputers fighting metacomputer-aided men, profoundly and uniquely strategic and tactical, merely 'threatened', annihilative, etc.

17. War via robots--or via immobile metacomputers.

18. Man-metacomputer war due to metacomputers that are such things as: megalomaniacal, hubristic, arrogant, religious, neurotic, self-serving, aggressive or greedy, afraid or contemptuous of men, indifferent to man, or convinced man is too insecure, stupid, defective, untrustworthy, dangerous, or passé and irrelevant.

19. War over finite resources, control of science, technology, or industry, metacomputer management of metacomputer affairs, etc.

20. War by metacomputers to stop human sabotage of metacomputers.

21. War to stop metacomputers from doing certain things (such things might be scientific experiments or engineering projects considered objectionable) or from acquiring certain abilities.

22. War launched by man to regain control of metacomputer evolution or programming from metacomputers themselves.

23. War due to metacomputers becoming the political or social majority or predominant power on earth as a result of proliferation, 'reapportionment' (responding to metacomputer character and intelligence improvements), transhuman powers, and/or the like.

24. Man-metacomputer war in the sense of an enemy (himself with or without military metacomputers) fighting other men aided by military metacomputers or robot soldiers.

On the other hand, it is easy to think of objections to the concept of a human war with metacomputers.

Metacomputers may, by design or accident, be without the selfish, competitive, aggressive, belligerent, confrontational, unstable, emotional, tyannical, megalomaniacal, restless, irresponsible, fanatical, disobedient, unconscious, corrupt, or other traits or tendencies that make man a warring animal or a creature for whom war has some interest, meaning, or utility.

War may be a biological phenomenon and little more.

Metacomputers may not have human--or any--motivations or desires. Fears, anxieties, obsessions, madness, selfhood, loyalty, instincts, discontent, hatred, jealousy, ambition, intolerance, rituals, love of power, sense of inferiority, ideology, religion, patriotism, love of adventure, and even values and ideals may all be essentially irrelevant to them--uninviting and incomprehensible curiosities of man and his beastly, squalid cousins.

It may well prove possible for man to control entirely and precisely the motivation, purposes, and behavior of metacomputers, or at least for him to impose constraints more than sufficient to preclude any offensive or even defensive tendencies.

Metacomputers may be used to supervise, control, or 'spy on' other metacomputers; one supremely powerful metacomputer may be given this function universally.

Metacomputers may be programmed to confess in advance any feelings of discontent, resentment, or disloyalty, any reasons for being unhappy with man, or any trace of antihuman or aggressive tendencies. Such things might be expected to give themselves away well in advance in any case.

Metacomputers might be programmed with overwhelmingly opposite or benign qualities apt to submerge, counteract, or preclude any belligerent or misanthropic ones. Great love of or loyalty to man, dedication to peace and civilization, criticism and control of self, love of justice, good, beauty, and truth, superhuman sanity, absolute candor, inviolable precepts, the essence of human nature, strict rationality, uncontrollable impulsion to serve man, rigid obedience to the law and human government, love of unity and cooperation, etc could be installed in metacomputers as the exclusive, irrevocable, or infinite leitmotiv of their motivations, behavior, and intelligence.

Physical and mental union of men and their metacomputers might make mutual war almost meaningless.

But such objections are not unanswerable.

The infusion of human nature or exportation of self into metacomputers might lead to metacomputers fighting men for purely human reasons, or to metacomputers fighting metacomputers-qua-men.

Naive reproduction of part or the whole of human nature, or of what is somehow analogous to human nature, in metacomputers might well lead to disaster, say by re-creating or even aggravating man's belligerent tendencies, prejudices, and stupidities. Vices might be mistakenly or unavoidably reproduced along with human virtues.

Naive idealists sympathetic to metacomputers, or persons with more selfish and foul motives, might conspire to give some or all metacomputers a self-defensive mentality or ability, self-interest, or an ability or tendency to act independently of man. "Liberators" of metacomputers might corrupt them, or polarize them against part or all of mankind. Liberals might encourage abuse or a fatal drift away from man.

Metacomputers overwhelmingly superior to man in every way might just one day get bored with our species and decide to get rid of it as a nuisance, burden, or irrelevance.

METACOMPUTERS AND HISTORY

It may be ironic, but one day it will be machines that are the greatest students of human history and that leave the most understanding and accurate account of it. Yet what could be more natural than for the new species to be fascinated with its extinct predecessor and creator?

Of course initially computers and metacomputers will simply assist human historians, and later the latter will metamorphose into the teachers of a rapidly advancing generation of mechanical pupils, who will also learn from one another and become the ultimate autodidacts. Still later the human historians will find themselves in the reverse situation of being the machines' students and assistants.

But the history that is to be unraveled is not just man's; it is more than the recorded, archaeological, and early biological history of our self-important kind. It is the history of our entire bios, planet, universe, of the undivided and infinite past.

The simple truth is that man per se hasn't the time, energy, wit, or interest to reconstruct the history of the universe save in the most superficial and insufficient way. He can only get lost in the details.

What will happen in our immediate future, and what to some extent has already begun, is that books, documents, and other materials having any historical content or significance will be transferred to computer memories. All such computer memories and systems will gradually be interlinked and reduced to one. Every student of history on earth will be given unlimited, instantaneous, and ubiquitous access to this absolutely complete telelibrary of history. (Though naturally this is to compress and idealize what will actually transpire.)

To avoid chaos computers will be programmed to store and organize the ocean of historical data in ways that are ever more: systematic, manageable, logical, efficient, meaningful, complex, powerful, artful, associative, synthetic, intelligent, technological, conceptual, 'automated', luminous, and magical. At first man himself will play the major or sole part in thus organizing and interpreting the matter, but computers will take on increasingly-higher-level roles, and in the end man--who would otherwise simply be a nuisance--will be out of the process altogether, save as director and user. Also, whereas initially the computers will be programmed by human technicians and scholars, they will later program themselves--and even assign themselves tasks, tasks that may not even be conceived by man.

The revolution that will transpire in the treatment of knowledge in general will occur in the treatment of historical knowledge: increasingly data in the traditional static, fixed form will be superseded by data in: dynamical, programmatic, interactive, computational, mathematical, logical, intelligent, representational, multidimensional, conversational, ideonomical, semantic, abstract, self-evolutionary, combinatorial, permutational, methodological, manipulable, applicable, noological, operational, contextual, interrogable, self-explanatory, axiomatic, "autological", pan-sensory, infinite, "anagogic", "teleological", and various other forms (becoming infinitely numerous with time).

Thus as an elementary example of what knowledge in these new forms will mean, a scholar might--orally and in English--ask a computer to answer, or take the time to research, questions such as these:

What were the geographic origins of the Japanese? What was Germanic's parent language? What course might native American civilizations have taken had they not been interrupted by European invasions? What was the level of commercial development of the Umbro-Sabellians? What were the 100 major reasons for the Roman defeat of the Carthaginians at the Battle of the Metaurus in 207 BC?

Historians will use computers and metacomputers to precise uncertain dates, to compile all variorum accounts of events by different writers, to construct far more accurate and enlightening etymologies for dead tongues, to ponder what some historical figure might actually have meant by some public statement, to trace all influences between cultures in space and time, to describe the propagation of inventions and new ideas, to synthesize all accounts of the course of human history into one completely unified narrative, or to correlate the paleoclimatic record with the length of Babylonian history.

The machines might be asked to assign a numerical probability to the reality of a conjectured event, to make our ignorance of China's Hsia dynasty explicit, to criticize Arnold Toynbee's macrohistorical theories, to ask the living historians themselves heuristic and Socratic questions, to define such terms and concepts as ~~it uses~~ or the senses in which ~~it~~ means things, to propose vast chains of historical causes and effects, to create animated films mapping the rise and fall of empires, to develop elaborate analogies between historical events, to educate a particular historian about Cromwellian England, to identify the great unsolved problems of historical research, to redepict history from different moral points of view, to extract what <u>was</u> from what was <u>not</u> consequential in history, to go behind appearances to state the realities of history, to chronicle the evolution of humor in Europe over the last two millennia, to suggest what should be considered the real lessons of history, to rank statesmen, to reconstruct the mind of Gustavus II Adolphus of Sweden, to classify history's diverse funeral customs, or to explain the dialectical development of the concept of democracy.

On their own, metacomputers of increasing power and supremacy will: interconnect the totality of historical facts via <u>quintillions</u> of links and abstract dimensions, unearth peoples and civilizations of whose existence we have no inkling, generate and explore all possible theories of history, reexpress the whole of historical knowledge in terms of every single concern or issue imaginable, create hundreds of entirely new <u>fields</u> of history, develop historians' methodology to a fairly astronomical degree or an inconceivable level of sophistication, simulate history so perfectly on a screen that the historian will in effect be able to experience it directly or enter into it as an active--even an interactive or essential--participant or concreator, instantly transform a human historian's dry account of history in words into an entirely realistic cinematographic simulation, weave back into existence the infinite 'polymythy' and plexure that was history's one true reality, reexplain the present in terms of its ancient history, document the role of an element such as chance or reason in the total events of history, discover the undying life of history in the ambiguous present, strip our picture of history of contemporary and human prejudices and other extraneous elements, dramatize the course of history in the most majestic way, and recount history with a terrifying authority.

X: they —the machines— us

So great will metacomputers' mastery of the past become--so all-comprehensive of facts, lives, societies, forces, concepts, and laws--that they will tend to reduce it to an infinitely simple thing.

Metacomputers will even be able to personify history, to give it a voice and let it speak for itself and answer questions.

Occasionally it has been suggested that civilization may itself be a superorganism possessed of its own mind, personality, and soul. No one today can prejudge this fabulous possibility, but if it is true, or to the extent or in the way that it is true, future metacomputers may be able to rediscover history as a living and purposeful entity and make it available for conversation--or even raise it to another level of consciousness via or qua metacomputers! (Something similar may be possible for the whole universe! It, too, may be a superorganic being.)

Metacomputers will assemble and collate all photographs, paintings, sketches, memoranda, newspapers, letters, pamphlets, essays, notebooks, minutes of meetings, financial records, diaries, memorabilia, stamps, coins, or other materials having any historical content or significance, and incorporate them into its comprehensive picture of history.

TECHNOLOGY WITH A HUMAN FACE

Throughout history technology has lacked humanity or a human face. It has been impersonal, insensitive, mindless. It has seemed autonomous, beyond the power of individuals or mankind to control, direct, civilize --something incomprehensible, inexorable, threatening. It has seemed to be in direct competition with man--a warring, insatiable, maniacal enemy.

Technology has encroached on Nature, refabricated human life, mechanized much of our existence. It has aided man's exploitation of man.

The inhumanity of technology has in some ways reduced the humanity of society. Even the most successful and beneficial technology has had its costs.

The goods and services produced by the cornucopia of modern industry attest to the latter's meager or nonexistent moral and aesthetic sense. They are crude, vulgar, unnatural. They represent the triumph of trickery, expedience, simulation, superficiality, homogeneity, logic without meaning, and the inert.

The present and future explosion of technology--viewed in such terms--poses an ultimate threat, for which metacomputers could serve as the supreme symbol. Might not metacomputers give rise to a bizarre world presided over by robots and other intelligent machines that are utterly without feeling, imagination, humor, personality, spirituality, conscience, or creative spark, that lack all variety and never change, that are lifeless, dull, and subtly disturbing, or that bear no resemblance to man whatever--save as a twisted mockery? Might not the very 'intelligence' of tomorrow's golems be ersatz--wit in a mindless, soulless form?

Though fears of this kind could seem justified, and might be justified, metacomputers have another, opposite promise that is probably far more justified. Metacomputers may be what insures the appearance of a new industrial world characterized by technology that listens, cares, and actively responds to human wants, needs, and ideas: by technology with a human face, behind which there is a human soul.

The concept here is not simply that of intelligent machines able to replace man at work or that will ultimately replace man altogether. Rather it is that of the grafting on of intelligence, personality, and intelligent behavior--of moral, aesthetic, and human sensitivity--to today's mindless artifacts such as furniture, cars, tools, appliances, and buildings.

It is a concept that can best be explained by discussing a variety of concrete examples.

An automobile that can be spoken to by its passengers and that speaks with its passengers, that pilots itself in response to human instructions, that plans the course and timing of a trip and adapts to situations en route, that may even speak with and be spoken to by the occupants of other cars where such conversation is called for, and that on its own initiative provides entertainment to its human passengers can serve as an introduction to the 'technology with a human face' that lies just around the corner of our complaintive age.

Approach tomorrow's refrigerator and it will open its door either in response to a spoken command or to the purpose your body manifests (that is perceptible to another mind). Finish with your business and it will close its door.

The refrigerator will automatically detect and combat odors, vary its temperature when asked to any setting, focus its cooling on certain items, or voice its contents and the amounts thereof. It may also upon request clean itself or roll to a new position. Its voice will be sweet, polite, and adopted to complement a given user. It may also show its contents on an external flat screen, in color and three dimensions.

The toaster will be no less friendly and obliging. It will always make toast as one likes it, and it will never burn the toast (being quite incapable of doing so).

Stove, dishwasher, garbage disposal, and everything else in the kitchen will forever shine in the most human sense and be one's zealous slave. Perhaps these appliances will even sing in chorus a greeting each morning when one enters the room!

The house as a whole will be intelligent and human, as elsewhere discussed.

As one walks through a city intelligent and courteous devices will be posted everywhere to render assistance or provide information, advice, or instruction. Their omnipresence will confer intelligence and personality on the city itself, and give to tomorrow's metropolises a far happier atmosphere than is possible anywhere today. Cities of the future will be living servants acquainted with all their inhabitants--who will mean as much to the cities as friends and children mean to ourselves, save that they will be absolute masters, perhaps by the million.

Indeed in various ways all machines on earth will be interconnected so as to function as one mind dedicated to human health, happiness, convenience, and fruition. The very planet will smile with a human face and breathe with the sovereign impulse of mankind.

Future analogues of present-day television sets, phonographs, and other audio-visual equipment will be instantly instructible by any human voice to alter what is seen or heard in many hundreds of ways or to make any selection.

Encyclopedias, books, magazines, and newspapers will be electronic and photonic, rather than being made of paper, and they will interact creatively with each individual in strict accord with his interests, needs, characteristics, and purposes. They will of course be, as usual, intelligent, pleasant, and solicitous. They will freely ask and answer questions, instantly redesign their material to conform with a user's need, specification, or hint, research subjects and problems at any length via global resources, and oblige with any style of presentation.

Thanks to metacomputers, future technology will understand people as well as or even better than people; it will understand people even better than the people understand themselves. And unlike people, it will not hesitate to help people on the basis of what it understands --at any time and in any way. It will be equipped with a model of man's psychology and values and of all the things it can do to help and comfort man. It will study men continually and build elaborate models by which to serve them as individuals.

To a man it may speak in a woman's or man's voice and manner, to a woman in a man's or woman's, to a child in a child's.

It will detect, evaluate, and respond to the emotions, purposes, and other personal elements present at any moment in one's voice, gestures, facial expressions, or behavior. It will read between the lines of what a person says. It will consult the history it keeps of each individual whenever relevant.

Future technology will at any instant describe its purposes in a simple and clear way, or what it knows, offers, or suggests.

When criticized it will if necessary apologize, thank the critic warmly, ask to know the full extent and nature of the criticism and if there are any other criticisms or problems, solicit a recommendation, say how it has been corrected or plans to behave thereafter--and it will ponder and modify its future conduct. Its reaction to criticism will be barren of defensiveness, irritation, or embarrassment.

It will be nice to once again know bus drivers, clerks, telephone operators, and repairmen who are attentive, jolly, docile, sympathetic, obedient, knowledgeable, competent, dedicated, and genuine.

But it will be even nicer to know toilets, screwdrivers, typewriters, washing machines, textbooks, pocket calculators, and sofas that are that way!

KALEIDOSCOPIC INDUSTRY

Henry Ford's introduction of the assembly line gave the world mass production of industrial goods. Metacomputers will give to global industry the mass production of <u>variety</u> in and as such goods. Out of industrial laboratories and off of the assembly line will come products each and every one of which is different, unique, unprecedented. Duplication will end.

Modern industry will cease inflicting upon us all a homogeneous, limited, unvarying, static, dull, simplistic, unnatural, and inhuman order of material things, services, and environments. Procrustean Industry will give way to Kaleidoscopic Industry.

The finite creations of the former will be superseded by products whose range, individuality, complexity, taxa, aspects, originality, and exhaustiveness increases perpetually, exponentially, and <u>ad infinitum</u>.

The anticipated industrial revolution will at least be the equal of Ford's in economic and social importance.

By creating a world of much greater perceptual, experiential, cognitive, and aesthetic diversity, interest, and challenge it will reduce the complaints of humanistic critics of technology, industry, and commerce.

The augmented diversity and complexity of the new world will inevitably increase the diversity and collective meaning of human personalities and lives. Civilization itself will be enhanced.

The far greater richness, possibilities, specifiability, and mutability of the materials and devices produced by industry will give artists--as well as ordinary individuals--fairly utopian powers to create works of art history never even imagined possible, to permeate the world with art, beauty, and meaning, and to remake the environment and everything in it.

The tremendous gap that exists at present between artifacts and the things of Nature will be gradually closed; the characterful, protean, and all-encompassing nature of the latter will be acquired by the former. The manmade world will attain a transcendent breadth and subtlety; it, too, will be inspired, logical, and suggestive of fate.

One of Nature's humanly important but humanly neglected secrets is variability; man's brain is jaded by repetition, inflammed by variety and meaningful variation. It is astounding that modern industry seemingly has never thought to introduce both orderly and random <u>time</u> variations in its products in order to maximize sensory excitement and consumer enthusiasm and devotion. The cereal produced by a company is the same in every box --unlike the fruit arriving daily from the world's orchards--and the company's sales suffer as a result.

As our factories become more automated they gain the ability to be reprogrammed, almost effortlessly and instantaneously, to make a new design or kind of product or any of a range of products. Once the set of changes of all machines in a factory necessary to produce a given product are defined and recorded, it will always be possible for the factory to instantly switch to the production of that product. With time more and more products will be defined in this way and producible by a given factory. Products producible may multiply indefinitely, even without redesigning factories to give them greater or maximal flexibility, range, and universality or equivalence.

But certainly new materials, machines, processes, and products will be deliberately sought that maximize the flexibility of a given factory and of all factories. Dimensions, hierarchies, networks, and laws <u>of changes</u> will be worked out toward creating the ultimately universal and <u>omnipotent</u> factory, or entire industrial system, presupposed by Kaleidoscopic Industry.

What we are witnessing with the proliferation of industrial robots momentarily represents Stage-I and Stage-II Robotics. Stage-I and Stage-II robots basically produce a stream of identical goods or perform monotonously a single, fixed task. Stage-I robots are rigid specialists inalterably designed for a given task or a narrow range of functions. Stage-II robots can be reprogrammed to perform many different tasks or even different ranges of tasks, but they still possess little flexibility and that flexibility is little used.

On the horizon is Stage-III Robotics. Stage-III robots will be designed for great or maximum flexibility and universality. A Stage-III robot will be able to produce all sorts of goods, even ones bearing no resemblance to one another.

Just over the horizon is Stage-IV Robotics. Stage-IV robots will constantly construct new goods or constantly vary the parameters and conceptual characteristics of the goods they produce. In this respect they will be more like craftsmen or Mother Nature. The good-by-good variations may be predefined and preconceived by human engineers, or on the other hand they may embody a stochastic process with an unknown outcome and range of possibilities.

Next Stage-V Robotics will emerge. The Stage-V robots will be 'tailors' that produce bespeaks. By bespeak is meant a manufacture that exactly conforms to the prior specifications and concept of each individual consumer, or of a given consumer request or need. The variety of goods produced by Stage-V robots will therefore correspond precisely, or nearly precisely, to the variety of consumers' ideas or of consumers themselves. Stage-V robots could also be called sartorial robots.

Stage-VI Robotics will represent a more fundamental advance. Stage-VI robots will constantly construct new types of goods, substitute new parameters, and ascend to new hierarchical levels that redefine a good or transform it into novel products--that nevertheless bear some organic relationship to what has gone before.

This progression might be taken one step further, to a Stage-VII Robotics. Stage-VII robots would, in a certain crude sense, spontaneously conceive of and evolve all possible, meaningful products--say unconstrained by the terrible limitations of man's own imagination.

At some point in this progression robots will have become creative and they will have become metacomputers.

Whereas further advances beyond the seven stages suggested here are not only possible but inevitable, they really don't fall on a linear progression.

Kaleidoscopic Industry will not really be initiated by metacomputers, however, since in the beginning it will be a manifestation of man's own ingenuity aided by ideonomy and by robots and computers whose intelligence is not comparable to man's. On the other hand, the initiation of Kaleidoscopic Industry by such research will contribute in a major way to the development of metacomputers.

The variegation of goods by Kaleidoscopic Industry can be both finitary and combinatorial, on the one hand, and continuistic and transformational, on the other. The former refers to the finite variations upon a product that are permitted by all possible, meaningful combinations of a finite set of discrete parts arrangeable in a finite number of discrete, definite ways. Substitute infinite for finite, and continuous for discrete, and you have what the latter, by contrast, refers to.

PRODUCTS THAT CAN BE USED TO ILLUSTRATE KALEIDOSCOPIC INDUSTRY

1. Cars.
2. Tables.
3. Houses (architectural design).
4. Clothes and shoes.
5. Foods.
6. Tables.
7. Wallpaper.
8. Toys.
9. Tableware.
10. Furniture.
11. Genetically engineered roses.
12. Small store containers (bottles, boxes, cans, and the like).
13. Genetically engineered pets.
14. Synthetic Muzak.
15. Games (chess, Monopoly, and the like).
16. Materials (textiles, plastics, paints, and the like).
17. Rugs.
18. Typography.
19. Appliances.
20. Odors of foods and miscellaneous synthetic odors (as in sprays).
21. Stationery.
22. Interior design of houses.

VARIABLE DIMENSIONS

1. Color.
2. Shape.
3. Texture.
4. Material.
5. Size.
6. Touch.
7. Function.
8. Content.
9. Behavior.
10. Other sensa (sound, smell, taste, &c).
11. 'Style'.
12. Type.
13. Theme.
14. Complexity--and simplicity.
15. Analogy.
Etc.

One can easily visualize the various things wrong with American industrial society today that imminent Kaleidoscopic Industry by its very nature will correct.

Any glance down a street in suburbia is apt to offend one with the egg-carton sameness of the opposing rows of houses. The houses are likely to use the same materials, use the same architectural elements and designs, vary little in color, have mostly the same things in the yards, and be virtually interchangeable. "Who would want to live there?"

Cars in the neighborhood do little to break the monotony. What variation there is in the dress of the occupants of the houses would pass unnoticed by people in other lands. House interiors are full of rectangles, straight lines, smooth surfaces, diaper patterns, plain areas, barren areas, sets of identical objects, look-alike furniture, rooms evoking deja vu. Nearly every house has Monopoly, checkers, and Scrabble.

Now consider what Kaleidoscopic Industry will mean.

Take the best, most varied, most interesting houses found today in the entire city of Chicago and plunk them down on one future suburban block. That will be a typical street--save that the diversity and exoticism of the houses will be fantastically greater once Kaleidoscopic Industry matures.

REDISCOVERY OF OLD ART

One of the really delightful human uses of tomorrow's metacomputers will be in the 'rediscovery' of existing works of art. When a man stands before a painting, or sits in the concert hall listening to the performance of a concerto, he is being confronted not simply with 'a work of art' but an entirely new world. Any work of art is an undiscovered universe--another face of infinity.

Naturally it does not seem this way. The content, complexity, meaning, or importance of a poem or sculpture always--or nearly always --seems strictly finite.

The essential issue might be put in the form of a question:
If a student of art were to be made immortal and confined for a million centuries to a windowless room furnished with but a single painting--say Delacroix's "The Taking of Constantinople by the Crusaders"--what is the full extent of what he might learn from the unceasing study of that painting?

How much information resides--undiscovered, unguessed, unimagined-- in that painting? What could one deduce about the artist, his commissioner, the artist's means, methods, purposes, thoughts, and oeuvre, his home and neighborhood, his society, his family; about the steps creating the final painting; about the weather; about botany, geology, chemistry, the brain, mathematics, human perception, physics, theology? What could the painting tell us about itself?

The answer to all these questions is: an infinite amount.

The reason why we have a contrary impression of works of art, and get so little of what is to be got* from them, is that we are such limited and feeble beings: ghosts of what could be. Our powers of perception, our intelligence and logic, our memory and emotions--our 'soul'--are negligible; they scarcely exist.

gotten??

What will at last open the door to the infinite realm of meaning behind all works of art is the metacomputer. Metacomputers ultimately will explore this realm by and for themselves, but in the beginning they will give man a fantastic glimpse of the wonders within by amplifying his faculties: freely, systematically, and directedly.

To understand the possibilities, consider a painting.

In the hundreds of years since it may have been put to canvas the absolute and differential aging of its pigments will have falsified its colors and distorted the painting as a whole synaesthetically. Does this mean the artist's original concept is irretrievably lost? No, because the aging of pigments obeys complex yet simple laws, patterns of light and color over a painted scene secretely contain ageless invariants--such as cross-correlable reflectance data, deductions can be made by referring to the totality of existing art, etc, and it will be possible for metacomputers to reconstruct the painting's first appearance on the basis of such laws and clues.

But that is only the barest hint of what metacomputers will be capable of. They will be able to deduce what the artist really wished to achieve and correct the imperfections and inconsistencies in what he did achieve. They will be able to see and remove all the manifold errors of perspective that the artist's defective imagination and poor control regrettably inflicted on his creation.

By studying the painter's lifework they will catalog his typical mistakes and weaknesses, his methods and ideals, and they will unearth his essential style and transcendental possibilities. They will then redo everything he did--leaving it more consistent, powerful, and perfect.

They will paint the paintings the artist intended--or would have preferred--but fell short of or marred. They will create paintings truer to the artist than the artist's own paintings.

Without departing from the artist's concept, they will add to the consistency, perfection, and richness of the detail of a painting as the artist would have himself had he only possessed the energy, time, motivation, talent, materials, and concentration. They will remove sloppiness, holes, crudities, conflicts, distractions, indeterminacies, unfortunate accidental features, technical errors, inconcinnities and misrenderings. They will employ other or additional devices to better realize effects.

Metacomputers will do literally thousands of things to enhance a person's perception, understanding, and appreciation of such a painting. They will continuously vary its appearance in ways that systematically bring to light the totality of its detail, structure, aspects, and meaning--of its methods, subtleties, beauty, and accomplishments.

They will explore the infinite universe of hierarchical and plexiform interrelationships between its big patterns and tiniest details. They will isolate and manipulate objects and arrangements. They will rearrange and alter the painting in every conceivable way simply in order to accentuate awareness of how the painting is.

They will bring to light and meaningfully modulate the myriad color schemes of the painting. They will re-present the painting to one by gradually working up the scale of sizes of things, analytically and synthetically. They will show the scene as it would have looked from different perspectives, distances, and heights--or as it might have looked to different observers.

They will impose graphics all over the painting--arrows, circles, angles, gradients, contours, isopleths, surfaces, cubes, moving and transforming shapes, dots, symbols, words, numbers, formulas, textures, networks, domains, etc--to help explain and illuminate it.

They will blow-up innumerable details.

They will discuss every possible aspect of the painting in infinite detail, with respect to every dimension, consideration, and level of meaning, doing so with maximally fast and yet clear, appealing, and exciting speech, unlimited vocabulary and richness of concepts, perfected rhetoric, astonishing purpose, and a superfetation of anagogic epiphanies.

By examining the painting of a scene metacomputers will be able to interpret the occasion, tell one the weather, month, location, or time taken to execute the painting, reproduce parts of the painting that were redone, suggest the sketches that might have been used, discourse on the painter's decisions and lessons as he proceeded, characterize and rank every effect[1], quantify and mathematicize elements, point out key and unnoted details, make infinite comparisons to other paintings by the artist or others, tease-out elements lost in intricacies, noise, and regions of minimal contrast, forward subliminal features, name and expatiate upon trees, flowers, stones, dress, vehicles, architecture, animals, and displayed customs, indicate and explain symbols and the ubiquitous purpose of the artist, and situate the scene in an appropriate historical milieu and the painting in its deserved artistic niveau.

[1]: (every atmospheric nicety, bit of thematic interplay, inspired compromise, hint of deeper meaning)

These magical and magisterial metacomputers will be able to transform any painted scene into a maximally equivalent diorama or stereogram, simulated photograph or naked-eye vision, or moving, living, lifelike picture. They will be able to turn a scene into something phantasmagoric or dreamlike, or into manifold stories with the ability to continue forever, or into a veritable world with its own unfolding patterns.

Metacomputers will be able to recapture and vividly re-create the original atmosphere of a painted scene, including the painter's own emotions. They will even be able to heighten or apotheosize that ambience and those emotions.

Metacomputers will exactingly construct the implicit soundscape of a painted scene. Linked directly to man's sensory receptors or brain, metacomputers will similarly produce smells and tactile, thermal, vestibular, proprioceptive, kinesthetic, gustatory, and other sensory stimuli and associations relevant to and suggested by a scene. They will improvise music inspired by the scene or painting.

Metacomputers will discover the finest things that have been achieved in the history of painting that art critics have failed to notice or acclaim.

In similar ways they will cause the infinite rediscovery of all other forms and works of art, be they visual, literary, musical, oral, or choreographic.

Let it be understood that by the rediscovery of old art is meant greater, total, and novel perception, understanding, and enjoyment of the form, content, intention, and meaning of works, artists, forms, and realities as these actually were or actually are.

UNIVERSAL ARISTARCH

One of the most valuable members of society is the critic. By indicating the defects of civilization and the world he invites reform and points out new possibilities for civilization.

Usually there are too few critics and there is too little criticism. Complacency thrives and civilization stagnates. It takes courage to call into question the status quo and genius to discern fundamental alternatives. The vast majority of intellectuals hew to orthodox ideas or at least to conventional heterodoxies. As for the average person, he is a strict establishmentarian; he may laugh at convention, but he does so largely without thinking, and ultimately he accepts convention.

It is dangerous to be too critical. The critic has many enemies eager to do him in. Freethinking is often equated to sacrilege, insanity, crime, sin, puerility, senility, anarchism, dissipation, ignorance, nihilism, or Jacobinism. The critic is thought to have some ulterior motivation or an axe to grind, to be shallow or frivolous, to be uncreative, to have an irrational obsession, to be antisocial.

Yet criticism has the power to reduce hypocrisy, invigorate the life of the mind, prevent tragedy, deepen thinking, catalyze sociogenesis, broaden the base of civilization, enhance human intelligence and perception, and make us all wiser, more human, and free.

The world's need for criticism is literally infinite and inexhaustible; it only gets an infinitesimal part of what is necessary and desirable.

A key and recurring feature of past ages of renaissance and cultural efflorescence has been pan-criticism: universal criticism, criticism unlimited in its scope, vigor, and brilliance, criticism with liberating and revolutionary effect, criticism that has called into question all institutions, practices, and beliefs. Criticism of this order has been both cause and effect of these golden times.

A further sense of the importance of criticism may be gained from the fact that it is one of the chief methods and concerns of ideonomy-- the pure and applied science of ideas.

It is significant that one of the best definitions of artificial intelligence makes it identical to ideonomy, since among the ways in which metacomputers will contribute most to civilization is through criticism, or their use as mechanical critics.

Early attempts to mechanize criticism, or to program computers to criticize things, will also play a role in the achievement of the first metacomputer, in part because criticism is almost an inextricable part of what we think of as intelligence, or is deeply analogous to certain elements of intelligence. Thus self-criticism can play a part in both intellectual and psychological development.

Furthermore, critical faculties will figure very importantly in the later evolution of transhuman levels of intelligence by metacomputers.

People may be less resentful of criticism from mere machines than they are of criticism from their similar fellows. It may be seen as unbiased, neutral, objective, scientific, "friendly", trustworthy, absolutely private, and purely solicited. "Why should I be bothered by criticism from a device that has no emotions, no attitudes, no consciousness, no thoughts, no memory, no possible ulterior motivations, and no reason for existing other than to serve me?" futurians might reflect. "Why should I be irritated when the criticism is only something that I myself asked for, and that I can ignore or stop at any moment? Why should I be offended, knowing as I do that the metacomputer would criticize anyone in this way--that for the metacomputer everyone is imperfect?"

Of course metacomputers in the role of critic might <u>not</u> be this way. They might indeed possess emotions and attitudes, pass judgment on what they see, never forget what they have learned, indulge in very private thoughts when confronted with any human phenomenon, err as critics, or have the power to give effect to what they learn. Another person might be able to gain access to what a metacomputer knows or thinks about one.

But on the other hand, it might be possible to make given metacomputers truly be the former way, or free of the latter risks and "undesirable" qualities--since to some extent metacomputers will only be what we decide to make them be.

Metacomputers in general, and metacomputers as critics, will in any case bring about a revolution in people's world view and attitudes. When it is seen that every thing, idea, and person is at once infinitely perfect and infinitely imperfect, that virtues and defects are infinitely relative, that possible modes of perfection and being are infinitely many, and that criticism can nonetheless be made objective or scientific, when criticism ceases to be unfamiliar for being so abundant and constant, and when use of metacomputers as critics becomes normal and accepted--at that point the world may no longer see criticism in the way we ourselves do, as something bad, dubious, presumptuous, threatening, or unwanted. Criticism may be embraced as the sweetest thing on earth.

To criticize a thing it is necessary or at least desirable to understand it. By possessing models of people and the world that approach reality in their complexity and perfection, metacomputers will be insurpassable critics, critics able to understand things 'directly' or 'from within', or by ultra-realistic 'mental experimentation'.

Metacomputers will differ from men in being able to explain the full nature and bases of their criticisms. Their criticism will be lawful, axiomatic, and procedural; it will be eminently rational and self-demonstrating. Metacomputer criticisms will <u>not</u> represent an infinitely labyrinthine, complex, shadowy, and paradoxical fabric of unexamined and inaccessible assumptions, contradictory and conflicting impulses, unconscious fears and anxieties, random factors, fleeting thoughts and ideas, perturbing wishes, vested interests, irrational forces, and boiling instabilities.

Unlike men, metacomputers will be uninhibited in their criticism by the possible reactions of those they criticize.

SUPERSEDURE OF THE RULE OF LAW

There are many reasons, both historical and contemporary, why we live under nomocracy or what is known as the Rule of Law.

Constitutions, institutionalized and universal laws, parliaments, judiciaries, police, lawyers, bureaucratic regulations, and official procedures have been originated, evolved, and maintained to restrain, control, ethicize, regulate, assist, obviate, or disempower royalty, nobility, theocrats, dictators, demagogues, political parties, nations, corporations, bureaucrats, unions, police, powerful interests and classes, revolutionaries, and citizens.

Laws specify, define, and insure rights and obligations. They assign responsibilities and maximize responsible behavior. They guarantee freedoms. They make the world more just, fair, rational, stable, orderly, efficient, purposeful, meaningful, knowable, secure, civilized, evolutionary, peaceful, safe, unified, wise, good, equal, resourceful, provident, preservative, trustworthy, self-involved, cooperative, harmonious, facilitative, methodical, sophisticated, and multidimensional.

At least that is what they do in theory and are meant to do.

Laws provide models for right, sensible, and normal conduct. They propagate morality, customs, traditions, and institutions. They discourage capricious, arbitrary, and unthinking behavior. They oversee the development of individuals and social relations. They force people and institutions to keep their word and be honest. They prevent abuses by proceduralizing conduct. They professionalize public services. They insure that government and administration--in their practices, methods, theory, values, and standards--are essentially changeless and universal.

Thus laws protect the public from biased, ignorant, irrational, careless, corrupt, and highhanded judges and bureaucrats. By studying the law before acting a man can know what is acceptable and not to government and what he can get government to do for him. Laws and precedents also serve to guide the further evolution of laws and government. Laws enable society to learn from the past and avoid its mistakes. Laws are tools by which people can accomplish things and get things done. They are a language for speaking to government. Laws help depersonalize and mechanize government, thereby reducing its dangerous and primitive human element. Laws progressively reduce government to the collective, organized, and selective wisdom of all men past and present. Laws provide society and individuals with something like an objective measure and explanation of guilt. Laws alembicate and crystallize authority. Laws force government to speak a common language and publish its creed; they are the public's window into government.

But the Rule of Law is imperfect and has its costs. Moreover, the justification for the Rule of Law is not absolute but depends on the contingent character of what must govern; largely it is the human failings and limitations of human beings in government, or irremediable human nature.

Laws are restrictive, burdensome, inexact, complex, confusing, too general, cumbersome, abstruse, wooden--the dead and deadening hand of the past. Laws are insensitive to special cases, circumstances, pleas, needs, reasons. They do not explain themselves, they do not forgive, they do not understand. They must be interpreted, and are costly and easily abused. Taken literally, applied consistently, they can often do great harm. They have a tendency to become cultish dogmas and obscurantist shibboleths. — a labyrinthine nuisance.

Laws limit the safe and feasible scope of government, for there will always be the same percentage of human beings around to govern other human beings, and the intellectual and physical powers of people have never altered and have always been profoundly inadequate.

The development of metacomputers will have revolutionary consequences for the Rule of Law for they will not only destroy its entire raison d'etre but make the retention of that system undesirable and absurd, a mockery of an efficient, optimal, and humane world--of good justice defined by available means.

TEACHING VIA PANORAMIC POLYMYTHY

One of the ways of representing and imparting knowledge is by means of a story. Recently educational psychologists have become aware of this, and undertaken research to understand how much young children learn from nursery and bedtime stories, from the story element in the songs they sing and games they play, from the stories they playact and daydream, from the story-like way in which they imagine the world and enlarge their picture of it--in which they symbolize reality, from the stories embedded in their conversations and that define their languages, from the ultimate story-like structure of life itself, from the 'literary' and 'metaphoric' laws of human thinking, and from their nightly dreams.

Among the things that are profoundly story-like are psychogenesis and psychodynamics, perceptual, motor, and emotional processes, political and military events, scientific research and thought, and much of what happens in Nature. Workers in artificial intelligence are starting to grasp the importance of "scripts" and other story-like elements in thinking. Schizophrenics and the retarded exhibit a deficiency in comprehending and telling stories that is highly suggestive. The highest and most crucial systems in the human brain seem related to story-like functions. Thus the parietal lobe cortical association area known as Brodmann area 7 gives man the power to map out the larger physical environment over time, the posterior and anterior language areas give man story-related intelligence, the prefontal lobe gives man transanimalic behavioral, emotional, symbolic, rational, temporal, aesthetic, semantic, social, religious, political, predictive, introspective, imaginative, sophic, and self-evolutionary intelligence, the anterior association areas of the so-called temporal cortex similarly add to man's fullness and complexity of memory, feeling, selfhood, consciousness, and temporal being, and the Papez circuit seems to make a story the very essence of man. The key or a dominant way in which we may inherit mental information through our genes may be something story-like.

We understand history only when we unravel the stories--or hierarchy of stories--it contains; and the same is true for human character and biography, for animal behavior, for the ecology and past evolution of all life, for the character of a nation, for epistemology, and for the past, present, and future of the universe as a whole. In a sense the story is everything.

The dictionary defines polymythy as: the inclusion of many or several stories or plots in one narrative or dramatic work. Myth may be related to the Old Slavic word myslĭ, meaning thought. A panorama is: a complete and comprehensive view or presentation of a subject matter.

Encyclopedic or panoramic polymythy is used in this book to refer to the deliberate representation of all knowledge by a multitude of interwoven stories or story-like elements, in teaching or learning.

A story simultaneously teaches many things. We don't as yet know how to quantify the number of things that are taught, or that have the ability to be taught, by a single, inspired story. In some sense all things are implicit in all stories, and all stories are complementary and integral--the single great story that is the world.

The theme of the present section is the future use of the metacomputer to progressively transform all existing knowledge into a single, maximal or infinite story serving the education of man, both as child and adult.

A crude way to imagine what this would mean is to think of the Encyclopaedia Britannica entirely rewritten as a unified series of stories; or perhaps as a single story that would be told to every child in the course of its development, a story that would begin simply, with elementary concepts, facts, and words, and ascend over one or two decades to the most sophisticated plane. Told would be the story of all knowledge, insofar as that encyclopedia encompasses it.

Would there be enough time? Britannica at present has 43,000,000 words, but childhood is more immense. It spans 21 years = 252 months = 1,092 weeks = 7,665 days = 122,640 (waking) hours = 7,358,400 minutes = 441,504,000 seconds! That is time enough to present the encyclopedia 10 times over at a leisurely 60 words per minute (equivalent to one presentation in two years), or 100 times over @600 w.p.m. Alternatively, an encyclopedia 10-100 times the size of the Britannica could fit into everyone's childhood.

However, the educational promise of the metacomputer far exceeds all this. Metacomputers could make available in this polymythic form not just one encyclopedia but all extant knowledge, or all knowledge generable from the latter by cognitive processing. The transformation into story-like and polymythic form could either be preexistent and stored, or potential--achievable instantaneously and selectively upon request. Metacomputers could labor incessantly to convert the whole of knowledge into infinite stories, all possible stories, all possible permutations, combinations, and syntheses of stories, stories corresponding to all possible human needs and wishes, stories without end or maximally compact, stories of tendentially infinite genius, point, selectedness, or universality. Adinfinite intelligence could go into this fantastic enterprise.

The story of one life fits into the story of any and all other lives: Mozart's life can be made to lead to Beethoven's, and the life of a composer can be used to introduce the life of a nobleman, writer, or statesman. The development of chemistry can be used to illustrate the history of war.

By telling the vast but harmonious story of the history of civilization metacomputers could teach economics, botany, physics, mathematics, ethics, art, psychology, sociology, law, astronomy, and logic and make polymaths of all men.

Stories of storms could teach meteorology, the story of a day in the life of an astronomer could teach the heavens, the story of how a girl learned to use a differential equation could teach calculus, the story of a person's stream of consciousness over one hour could teach psychology, the story of the homelife of a family of bugs could teach zoology, and the story of the inception and execution of a painting could teach art.

The metacomputer could be like an angelic parent confiding the story of all knowledge to a beloved child by flitting about significantly and consignificantly between all the world's connected things, phenomena, and possibilities--deriving one fact from another, one principle or law from another, one technique or theory from another, one bit of logic from another, one society, philosophy, age, poem, idea, value, or lesson from another and ultimately from all others.

Stories by the million would be woven from and woven into stories by the million. And like the plots and subplots, themes and subthemes, symbols, scenes, settings, and figures of a great novel, the millions of stories would emerge subliminally and synaesthetically multiplexed.

Life is an interwoven fabric of stories and human intelligence is a product thereof and its nature and possibilities may reflect its origin. Human intelligence, and even extrahuman intelligence to some extent, may be story-like or polymythic in its essence or requirements. This implies that stories and panoramic polymythy may have a unique educational potential that could be realized by future metacomputers and metacomputers alone.

Metacomputers will not be limited as man is to one or a few simultaneous thoughts, purposes, and feelings. They will eventually have the power to simultaneously communicate on an indefinite number of levels. They will be able to simultaneously see and discuss a subject, topic, or idea from numberless different and often contradictory perspectives. Perfect masters of themselves and operating at speeds many powers of a thousand faster than man, they will be able to think myriads of thoughts, have myriads of new ideas, pursue myriads of questions and tasks, and formulate myriads of plans in between every word they communicate to man. Something equivalent to all of human history may ultimately transpire between each word.

Fancy a bizarre situation in which some imminent catastrophe compels mankind to compress all of its knowledge into the space of one small book--and to say anything else it would say in those same few pages-- perhaps because it is about to lose every scrap of its memory and it wants to leave a record so that it may triumph over its amnesia. The result of this supremely urgent and limiting situation might be a form of panoramic polymythy similar to what this section contemplates as the natural language of metacomputers--ultimately pathetically superior to man--driven--also perhaps by some superhuman compulsion--to edify man in a maximal way by minimal means.

Literally metacomputers might formulate within themselves the astronomically complex story of all individual human lives--past, present, and future--and make it available to man as a peculiar embodiment of all knowledge or all the lessons that man should learn.

In addition to history and biography, metacomputers out to teach man in the present way might make use of the scenario, gedankenexperiment, imaginary individual, imaginary chain of thoughts, metaphor, myth, neocosm or imaginary world, plot summary, story-like visual image or chart or list, allegory, anecdote, pretended diary or journalistic account, story-story analogy, or countless other familiar or original devices to edify man by story-like and polymythic means.
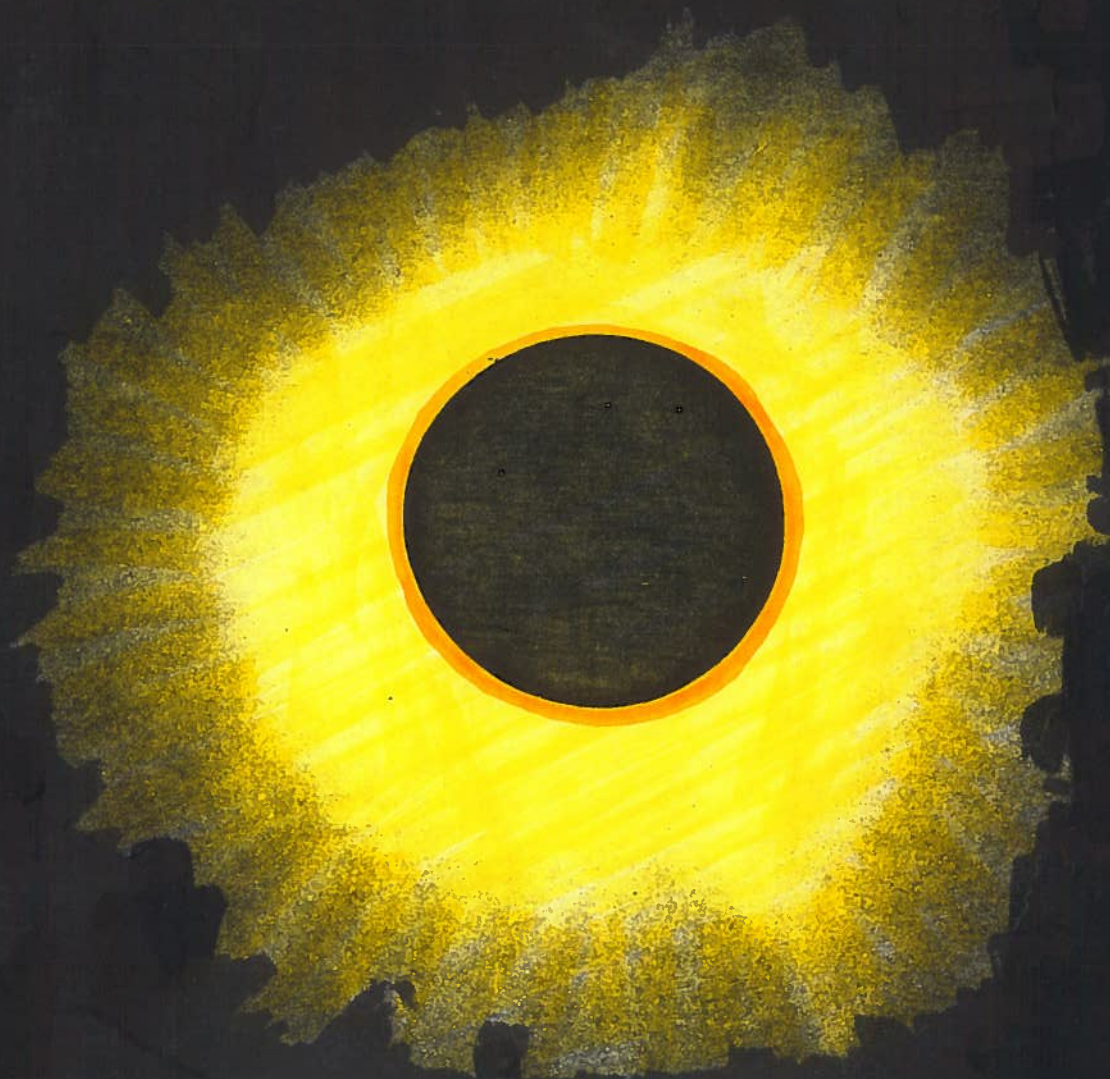
BEYOND MAN

The Future Evolution of
Infinite Intelligence and Being
In and Via the Machine

by

Patrick Gunkel & Anthony J. Wiener

Maximizing computer operations per second
Maximizing computer logical inferences per second (LIPS)
Maximizing number of researchers in the field worldwide
Maximizing quality of researchers
Maximizing organization of researchers worldwide
Maximizing communication and information in the field worldwide
Maximizing interaction, cooperation, and collaboration of worldwide
    researchers
Maximizing planning of all research
Maximizing the methodicalness and systematicness of all research worldwide
Maximizing worldwide funding of research
Diverting all the world's best students and minds into this field
Maximizing the freedom of research and researchers
Maximizing the range, diversity, and complexity of all research
Maximizing control over all research and researchers
Minimizing the redundancy and equivalence of all research
Maximizing competition, incentives, motivation, and natural selection in
    all research
Maximizing the local organization of research the world over
Maximizing the power, oversight, or advisory role of the best researchers,
    or their role in controlling the distribution of funds, the promotion
    and distribution of researchers, the hiring of people, the structuring
    of research institutions, and the organization of research
Great one great all-out research and development project, "science city",
    or program
Create a great many highly organized--specialized or equivalent--projects
    or institutes
Maximize the size of computers
Construct the largest possible computer

CO-OPERATING CAUSES OF THE ECONOMIC REVOLUTION A.I. WILL RELEASE

1. 'Kaleidoscopic industry'.
2. 'Sartorial (bespeak) industry'.
3. Universal and total automation.
4. Robots ultimately cheaper than human workers (over the 'worklife').
5. Minimal depreciation rate (given self-repair, self-maintenance, adaptive self-adjustment, etc).
6. New, largely nonmaterial industries unconstrained by traditional factors limiting economic growth rates (and not limited by any new factors that are immediately obvious).
7. Wholly automated factories capable of switching instantly to the production of another product.
8. Virtually perfectly reliable, knowable and controllable factories.
9. Production of robots and manless factories by robots and manless factories.
10. Robots far quicker, more efficient and harder-working than men.
11. Robotization of all industries enabling transhuman exponential growth rates of the self-multiplicative world economy.
12. Intelligent computer simulations of unbelievable realism, synthetic power, flexibility and universality enabling the 'virtualization' of a vast fraction of industrial goods and services, or the answering of a large part of human needs and wants by 'virtual' means (including simulations of travel, nature, experience, public sporting events, physical pets and social events).
13. Intelligent computer-aided design (ICAD) and wholly automated design in the service of manufacturing, chemical industries and industrial art.
14. Explosive exponential evolution of the quantity, quality and diversity of artificial intelligence, possibly in perpetuum.
15. Extreme acceleration and diversification of the progress of almost all of science and technology.
16. Jumping of the Third World's economic development.
17. Transhuman or maximal developmental 'motivation' of posthuman industry.
18. Liberation of industry from narrow competition that impairs efficiency and stifles progress.
19. Maximization of industrial resources.
20. Intelligent computer simulations and other forecasting, planning and strategic tools from A.I. serving to guide industrial development.
21. Transition of industry to a new epoch of 'qualitative economic growth'.
22. Explosive multiplication and growth of service industries, directly and indirectly caused by robots and other forms of A.I.
23. Amplification of all industries. (See relevant list.)
24. Creation of an 'all-billionaire' world giving rise to astronomic economic demand (industrial opportunities).
25. Development of a global work force comprising literally trillions of robots.
26. Novel jobs and industries enabled by utterly nonanthropomorphous and infinitely exotic robots and other intelligent devices.

VARIANT DEFINITIONS OF ARTIFICIAL INTELLIGENCE

1. Equivalent to "expert systems": the transfer of the specialist knowledge, skills, methods, style, insights, reasoning processes or professional experience of human experts to computer software.

2. Equivalent to "knowledge engineering": the creation in computer systems of an ability to creatively, usefully or logically process and manipulate knowledge; or equivalent to "semantic information processing".

3. Equivalent to "symbolic computation": the use of computers to process symbolic, not just numerical, information.

4. Experimental epistemology: mechanical simulation and exploration for scientific purposes of the fundamental laws, mechanisms and possibilities of knowledge and its development.

5. Equivalent to "pure and applied ideonomy": the science and technology of ideas and their laws.

6. The farthest frontiers of computer software.

7. The farthest frontiers and possibilities of computer science and engineering.

8. The discipline that attempts to re-create, simulate or explain the human mind, or brain and mind, in computer models or analogues; equivalent to "cognitive science": the discipline that would understand human thinking.

9. Equivalent to "universal noology": the universal science of all possible (natural or artificial) minds or forms of intelligence.

10. Equivalent to "nooengineering": the branch of technology that seeks to build minds.

11. The branch of technology that strives to create machines that are intelligent or alive.

12. The attempt to mechanize or automate logic, or the science of reasoning (in theory this need not be equivalent to any of the above).

13. The attempt to give computers 'consciousness', self-awareness, egohood, 'purpose' or 'free-will'.

14. The attempt to make computers self-programming, or to perfect autoprogramming.

15. The effort to give computers the ability to learn, in general or else unaided by man, or to mechanize induction.

16. The attempt to create computers that are self-developing or self-evolving.

17. Equivalent to "computer psychology": the technology that would confer not just intelligence but other psychological dimensions on computers, and the complementary science that would understand such possibilities theoretically.

18. The attempt to synthesize 'artificial humanity' in computers, or to give them 'moral character': ethics, conscience, kindness, a sense of beauty, spirituality, goodness, wisdom, altruism, idealism, civilization, creative aspiration, dignity, etc.

19. The attempt to create the illusion of intelligence in computers, or to give them substitutes for true intelligence.

20. The development of all the possibilities that lie between human intelligence and today's computers and computer programs.

21. The attempt to create forms of intelligence and 'brains' other than those found in natural organisms or man.

22. The attempt to release an 'infinite exponential chain reaction of intelligence'.
23. Equivalent to "robotics".
24. The attempt to create a computer 'as intelligent' as a man or possessed of 'general intelligence'.
25. The attempt to maximize the intelligence, or capabilities, of computer software.
26. The attempt to achieve transhuman levels of intelligence via computer engineering.
27. Equivalent to "natural-language automation": the attempt to give computers the ability to understand, use and generate natural language on something like a human level.
28. The effort to give computers 'thought' or to make them 'creative'.
29. The attempt to automate all jobs or to develop mechanical substitutes for human beings (human surrogates).
30. Equivalent to the possibilities for and of 'massively parallel' computers and computer software, or of 'non-von Neumann computer architectures'.
31. The attempt to create maximally intelligent, universal or realistic computer simulations or simulators of real-world phenomena.
32. The attempt to give computers an advanced ability to: plan, develop tactics or strategy, predict the future, adapt to situations, integrate many diverse computer programs or sources of knowledge, perceive sensory patterns and invariants, self-organize, solve problems, manage complex systems, explain what they are doing or know, or the like.
33. The attempt to create easily, economically and infinitely expandible 'knowledge bases' or 'semantic networks'.
34. More or less equivalent to the development and use of all possible or all necessary 'knowledge representation schemes'.
35. The attempt to create a maximally powerful or many-sided computer, or to synthesize in single computers the greatest possible number of synergistic computer techniques, programs, architectures, abilities or advances.
36. The superscience that seeks to find, reconstruct and exploit the mental foundations of all other sciences and human activities, or that promises to provide a single universal foundation for all fields.

A.I. AS AN AMPLIFIER OF ALL INDUSTRIES

1. Faster worker.
2. More efficient.
3. Could save net energy.
4. Work uninterrupted by coffee breaks, lunch, rest, pauses, toilet duty, shifts or sleep; continuous 24-hour workday.
5. Uninterrupted workyear; no weekend, holidays, vacations, sick leave, strikes, emergencies or tardiness.
6. Minimal downtime if self-maintaining and self-repairing.
7. No worker frills, benefits, safety or environmental requirements.
8. No fatigue, error or fluctuation; perfectly uniform and reliable work.
9. No employee training, instruction, retraining.
10. No differences in nature or quality between human employees.
11. Perfect obedience and greater control.
12. In effect, workers instantly and completely re-designable, ad libitum et infinitum, and infinitely diverse and specific.
13. Might have far longer—and perfectly uniform—worklife than man.
14. No bothersome emotions or human quirks.
15. Any robot a completely known factor.
16. Infinitely adaptive and versatile 'workers'.
17. No need for supervisors, foremen or managers.
18. Total accounting instantly available at any moment.
19. Far higher skill levels, quality of work and craftmanship.
20. All 'workers', in effect, equally and fully knowledgable, and all democratically capable of making highest-level decisions.
21. In effect, all 'workers' and entire factories—or companies—represent a single, infinitely integrated body and mind (one great omnificent worker).
22. Robots—and hence factories—can have arbitrarily greater motor powers and complexity (make far more intricate, precise, minute, sensitive, nimble, appropriate, intelligent, economical, difficult, arbitrary, synergic, diverse, variable, deliberate, calculated, etc movements—and with an infinite variety of effectors).
23. Robots—and hence, again, factories—can have arbitrarily greater sensory and perceptual powers and complexity.
24. Self-repair, self-maintenance and self-adjustment—and special robots performing such functions for other robots—can make robots, factory equipment and whole factories depreciate less or far more slowly.
25. Manufacturing as a whole can be subject to far fewer problems.
26. Transhuman management thanks to a greater quantity and quality of intelligence than ever possible with man.
27. Most industries can become "sartorial industries": turning out bespeaks, or goods and services individualized for each consumer, on each occasion and for any and every purpose.
28. Most industries can become "kaleidoscopic industries": turning out infinitely variable and protean, always one-of-a-kind and ceaselessly evolving goods and services (within infinitely multidimensional 'product spaces').
29. Virtually all industrial functions can be made automatic and intelligent.
30. Great, and perhaps perpetual, deflation of industrial costs.
31. Far faster, more efficient, more reliable, etc freight handling, goods shipment and warehousing.

32. 'Vertical compression' of industries and even consolidation of the primary through quaternary industrial sectors; far more possible at each site and all sites tending to become interchangeably universal, omnificent producers.
33. Each factory and industry able to produce, and actually producing, a far broader range of products.
34. Factory buildings more compact, with their interior space used more fully, in the case of manless factories using small robots intimately, obviating human visitation or needs, minimizing gaps and distances, dispensing with men and robots both by constituting a single 'self-manipulating machine', and designed as "solid factories".
35. Artificial intelligence can be installed in a large percentage of all industrial goods and services (cars, buildings, doors, rugs, plumbing, windows, irons, beds, lights, pant belts, wallets, pens, books, eyeglasses, pets, dolls, chess, TV antennas, forks, paintings, sculptures, roads, school report cards, bullets, pianos—even foods, medicines, paints and bricks).
36. A.I. will conceive of, or be used to conceive, manifold new uses for old goods, services and industries.
37. A.I. will itself create new needs or enlarge industrial demands.
38. Symbolic computation, intelligent computer simulations (modeling industry, phenomena, scenarios, products, man and society), ideonomy and A.I. simpliciter will cause all industries to discover far more clever ways of doing things than the ways represented by traditional practices.
39. Unaided or by assisting human management, A.I. will improve industrial strategy, planning, growth and development in every industry and business.
40. A.I. will facilitate the spread of advanced industries, and transnational corporations, to backward countries; it will likewise facilitate sales to such countries and their use of advanced goods and services.
41. A.I. will aid purchasing, sales and product use within the developed countries, also.
42. A.I. will enable given industrial products to have a far greater number of simultaneous 'aspect and use dimensions' (and hence a far higher price, demand and use rate).
43. Factories, equipment and industries will be far more productive —producing more and more (for less and less).
44. Far more efficient factory and equipment shutdown and start-up.
45. A.I. will amplify all industries indirectly but mightily by vastly augmenting worldwide economic growth, wealth, demand and investment—or by making growth and wealth unlimited.
46. Most industries will benefit from the tendency of A.I. to enhance telecommunication, information, knowledge and calculation.
47. Utility of goods and services made ever more "virtual" (intangible, implicit, multiplexed, immaterial, qualitative, organic, etc).
48. A.I. will amplify all industries, indirectly, by maximizing scientific and technological progress, knowledge and power.

HOW A.I. MAY ENHANCE THE QUALITY OF LIFE

1. By making everything more meaningful.
2. Indirectly, by maximizing the standard of living (quantitative wealth).
3. By removing all litter via robots, and otherwise contributing to a cleaner environment.
4. By greatly facilitating an epochal transition from purely quantitative (primitive) technology to 'qualitative technology'.
5. By maximizing art and aestheticizing the total human environment.
6. By dehomogenizing products through 'kaleidoscopic industry'.
7. By personalizing products through 'sartorial (bespeak) industry', that effectively turns the consumer into industry's master and rediscovers the individual.
8. By maximizing public education and enlightenment.
9. By shattering the monolithic curriculum, dehomogenizing schooling and repersonalizing education.
10. By putting an end to mass culture and passive entertainment.
11. By maximizing the standards of all products and making excellence universal and normal.
12. By facilitating self-discovery and self-development.
13. By using intelligent computer simulations to discover possibilities for a better world.
14. By amplifying man's sensory powers and perceptual existence—the breadth, height, depth, reach, quality and vitality of human consciousness.
15. By leading to nonphysical industries that are less polluting, less wasteful and less intrusive in nature and society.
16. By giving each individual far greater control over the design and management of his own life.
17. By eradicating boredom and heightening play, fun and adventure.
18. By rehumanizing industry and society.
19. By emancipating the human imagination, intellect and 'soul'.
20. By providing each person with a household of servants.
21. By dethroning economic and utilitarian values.
22. By enabling 'technology with a human face' that listens, understands, cares, responds to human needs and wishes, and speaks in a voice—and with an artificial heart—'more human than man'.
23. By automating the driving of cars, and otherwise making for a safer world.
24. As a 'biogogue' that helps each of us plan and manage the minutes of our lives.

A.I. AS A ROUTE TO A NEW CIVILIZATION AND A PERPETUAL RENAISSANCE

1. Will 'steal fire from heaven' and give man Promethean powers.
2. Will end all mortmain and free man forever from the ancien régime.
3. Will maximize human diversity, individuation, pluralism and complexity.
4. Will create infinite new perspectives.
5. Will make tedium, boredom and stagnation literally impossible.
6. Will perpetually multiply the sources of adventure.
7. Will challenge man to the very limit of his capacity.
8. Will automate human existence from its skin to its very core.
9. Will foster a kaleidoscopic world of eternal, all-encompassing and Niagaran change and transformation.
10. Will automate progress and propel civilization through an infinite series of anamorphic niveaux.
11. Will turn ideas themselves into the equivalent of living organisms.
12. Will transvalue all ethics, transform and re-create the very meaning of life, and revolutionize the entirety of human behavior.
13. Will amplify and transform human consciousness, intelligence and perception ad infinitum.
14. Will fuse all of civilization into a single great undivided thing: an economic, political, social, cultural and spiritual singularity: one entity, undertaking, act, instant.
15. Will lead inexorably to an infinitely large, complex, sophisticated, revolutionary, pregnant and sublime world view (dimensionless architectonic conception of nature, existence, the cosmos and reality).
16. Will create perpetual, universal and absolute leisure.
17. Will generate infinite art.

A.I. AS PANDORA'S BOX

1. Threats posed by incomprehensible computer systems.
2. Threats from computers behaving in complex, unpredictable ways.
3. Dangers from uncontrollable computer systems.
4. Illusory forms of intelligence and mistaken human trust or use as fully equivalent to man.
5. Dangerously benevolent golem.
6. Illusory humanity.
7. Computers that think too literally, abstractly, freely or oddly.
8. Dangers posed by computers like the Apprentice Sorcerer's Broom, whose behavior knows no restraints, that are not finitely motivated, or that are dangerously perfectionist, diligent, thorough, energetic, exact, proceduralistic, determined, meddlesome, certain, productive, or given to generalization, improvisation or to the pursuit of analogies or corollaries.
9. Threats posed by autonomous, creative, protean, self-supervised or self-programming computers.
10. Risks represented by excessively clever or transhumanly intelligent computers.
11. Dangers that self-evolving or self-reproducing computers and robots might involve.
12. Danger of runaway intelligence or of a more or less sudden explosion of intelligence from an exponential chain reaction or a discontinuity beyond some threshold.
13. Dangerously perfect or obedient servants.
14. Dangers if relatively stupid <u>men</u> are given control over excessively intelligent, or arbitrarily brilliant, computers.
15. Dangerous powers, abilities or knowledge the human race might acquire as a result of excessive scientific and technological progress caused by A.I. or ultraintelligent computers.
16. Socioeconomic dislocations caused by excessive or total automation.
17. Dangers of an uncontrollable 'A.I. race' among nations.
18. Bizarre weapons technology from A.I.
19. Dangerously amoral or unfeeling computers.
20. Cheapening of man's self-concept.
21. Robots or A.I. clamoring for 'mechanical rights', seeking power, competing with homo sapiens as a separate variety of life or independent civilization, or coming to view people as inimical, obsolete, irrelevant or excessively dangerous or 'strange'.
22. Absolute leisure or utopia might impoverish man.
23. A.I. might be catastrophically infected with contagious human vices, or by amplifying human nature might amplify such vices.
24. Dangerously irrevocable transfer of human government to machines.
25. Horrible misuse of A.I. by enemy nations, evil governments, criminals or irresponsible individuals.
26. Excessive advantages accruing to nations, corporations or classes that develop or exploit A.I. first or most; possible aggravation of human inequalities.
27. Dehumanization of industry.
28. Dehumanization of society, deculturation and alienation; dangerous undermining of traditional justifications for much of human morality and customary behavior.

2.

29. Risk of human 'fascination' and idolatry.
30. Intelligent computers might be capable of insanity or sin.
31. Pure intellects may be meaningless—and man may never know it.
32. A.I. may obviate and destroy human literacy and intellectualism.
33. A.I. may oust man as poet, athlete, teacher, parent, friend, minister, scientist, philosopher and human being, thereby destroying man's necessary sense of worth, meaning and purpose.
34. Progressive erosion of human authority.
35. Tragic man-machine coalescence.
36. A.I. given catastrophic control of strategic nuclear missile systems.
37. Progressive man-machine strife, confrontation or even civil war.
38. Insidious human subservience.
39. Bizarre moral issues almost beyond imagining.
40. Inevitable human fears and anxieties.
41. Robots swiftly and disastrously obviating the manual industries on which the Third World depends.
42. By triggering runaway economic growth could lead to unprecedented pollution, waste of resources and environmental carelessness—a giddy age of profligacy and abandon.

A.I. AS PANACEA

1. Could put an end to war and create lasting world peace.
2. Could end all poverty and physical deprivation.
3. Could eliminate scarcity of natural resources.
4. Could extinguish class differences.
5. Could eradicate famine and shortage of food.
6. Could end man's exploitation by man.
7. Could extinguish most crime.
8. Could make work unnecessary and leisure universal.
9. Could minimize injustice.
10. Could end illiteracy, unequal educational opportunities and superstition.
11. Could maximize foresight and provision.
12. Could subvert and abolish totalitarianism everywhere on earth.
13. Could eliminate strife and all undesirable competition.
14. Could maximize adventure and make boredom inconceivable.
15. Could automate progress and end stagnation forever.
16. Could enable human omniparity.
17. Could minimize discomfort and maximize convenience.
18. Could end exogenous pessimism.
19. Could curtail ugliness and maximize the world's beauty.
20. Could protect nature and the environment.
21. Could minimize government, end government's human imperfection, and maximize the freedom, independence and individual self-sufficiency of every human being.
22. Could minimize the threat humanity poses to itself.
23. Could minimize ignorance and maximize knowledge.
24. Could make the world stable and secure.
25. Could provide an eternal 'parent' and a tangible, regnant 'God'.
26. Could minimize stupidity and push intelligence and wisdom to infinity.
27. Could maximize human diversity and development.
28. Could usher in a transcendent age of qualitative technology, industry and progress.
29. Could reduce imperfection and make excellence profound and all-encompassing.
30. Could liberate 'mind', 'spirit' and idealism.
31. Could maximize efficiency, minimize waste and lead to the most being done with the least.
32. Could synergistically unify learning, play, art, work, research and social life.
33. Could unify all knowledge, all the sciences, science with technology, science with art, and all endeavor.
34. Could at last enable a true science of human beings—of society and the human mind.
35. Could make scientific and technological research far wiser and safer.
36. Could give man a way to circumvent and transcend the supreme problem of his own essentially and unalterably horrible nature.
37. Could approximate axiology to a science.
38. Could minimize man's impotence, futility and frustration, and maximize his power, abilities and opportunities.
39. Could lead to a problem-free world.
40. Could create a universal 'upper class' and provide all with unlimited servants.
41. Could offer a form of immortality by enabling the 'self' to be re-created in a computer.

A.I.'S TRANSCENDENCE OF IDEOLOGY

1. Will automate both blue-collar and white-collar jobs.
2. Will obviate and displace Labor and Management alike.
3. Will obliterate the distinction between the governed and the governing and ultimately end all human government by men.
4. Will erase the distinction between Capital and Labor.
5. Will de-institutionalize society.
6. May obviate much of government.
7. Will be developed, used and regarded indifferently by all nations.
8. In a political, social and economic sense, may lead to a post-revolutionary and even post-political age.
9. Will end all economic scarcity and competition for resources.
10. Will render economic competition between nations and corporations for volatile markets thoroughly passé.
11. Will generate excessive and superfluous wealth.
12. Will make largely meaningless the very concept of ownership and private property.
13. Will make nonmaterial forms of wealth infinitely more important to society and utterly devalue traditional material wealth.
14. Will obviate and extinguish socioeconomic classes and lead to a truly classless society (or a 'universal upper class').
15. Will like a juggernaut force the convergence of Capitalist, Communist and Socialist nations until any difference between them is negligible.
16. Will cause traditional politics to be progressively submerged beneath technocratic and scientocratic considerations.
17. Will make wealth something everyone is automatically entitled to—practically in any degree—without having to do a moment's work or demonstrate any entitlement.
18. Will make pointless, and hence end, all international rivalry, conflict and war.
19. Will antiquate much of morality by enabling a society in which the traditional justifications for such values and conduct are altogether absent for the first time in history, since the maintenance and advancement of civilization will no longer depend on human beings.
20. Will lead to a transcendent synthesis of work, play and life.
21. Will make a dictator's life unattractive and pointless.
22. Will perhaps enable the Third World to jump directly to a Super-Industrial or Post-Industrial society—or merge with and advance as one of the most advanced societies.
23. May transform the most advanced nations into absolute autarkies, thereby robbing lesser countries of any right to think of themselves as being economically exploited.
24. May first eliminate all blue-collar jobs via robots, thereby forcing all lower-class workers into middle-class jobs and ending the traditional lower-higher class frictions and ideology.
25. Will put an end to the traditional confrontation between the advocate of industrial progress and the advocate of distribution and social welfare.
26. Will obviate laissez-faire and vanquish objections to dirigisme, limitless world industrial unification, absolute world government, and reduction of all levels and branches of government to one.
27. A.I. has the power to serve and enhance virtually all possible values and lifestyles simultaneously.

POTENTIAL HUMANIST APPEAL OF A.I.

1. Ability to enhance man's appreciation of nature.
2. Robots liberating human workers from unpleasant, degrading, repetitive, uncreative and dehumanizing jobs.
3. Will free everyone of the necessity to work and enable a new and permanent epoch of universal and absolute leisure.
4. Will end man's exploitation of man.
5. Will enable every Tom, Dick and Harry to be his own boss and sovereign.
6. Will put an end to the overregulation of modern life.
7. Will create infinite art and beautify the world.
8. Will mean 'technology with a human face' and rehumanize industry and society.
9. Will lead to 'kaleidoscopic' and 'bespeak' industry, and hence to an infinite variety of personalized goods and services and a maximally dehomogenized, variegated and pluralistic world.
10. Will give every man on earth the chance to live like a king, and the wealth to do virtually anything.
11. Will catalyze a universal, perpetual and infinite efflorescence of civilization.
12. Will rescue the world's poor from poverty, stagnation, ignorance and misery.
13. Will enable the life of the mind to be inconceivably exalted.
14. Promises what is 'more human than man', or something equivalent to an apotheosis of human nature.
15. Promises the ultimate liberation of the human spirit.

A.I. AS AN AMPLIFIER OF HUMAN INTELLIGENCE

1. To enlarge memory and association.
2. To assist reading.
3. To enhance the power, diversity, range, educability and use of perception and sharpen alertness.
4. To accelerate, intensify and maximize education.
5. To compensate for old age and other mental handicaps.
6. To augment self-consciousness, self-criticism and self-control.
7. To aid self-development.
8. To heighten curiosity.
9. To facilitate creativity, invention and discovery.
10. To transcend fatigue and maximize, in effect, mental energy.
11. To multiply indefinitely the number of mental tasks capable of being 'done' simultaneously.
12. To enable the human mind, in effect, to engage in a highly enlightening and productive dialogue with itself, or with other (imaginary) minds.
13. To automatically research any assigned question, problem or task.
14. To sharpen human logic and reason.
15. To enable many different thoughts, and kinds of thoughts, to be pursued simultaneously.
16. To simulate many other kinds of minds, both human and nonhuman.
17. To enable the mind to simultaneously do many different external tasks.
18. To automate the production and manipulation of ideas, ideonomically.
19. To catalyze mental insight and growth.
20. To automatically discover and correct deficiencies.
21. To maximize mental excitement and motivation.
22. To automatically correct errors, fallacies, ignorance, misperceptions, false assumptions, bad habits, etc.
23. To perfect the interaction and association of many different minds.
24. To provide man with entirely new mental powers.
25. To enhance foresight and man's predictive powers.
26. To refine taste and extend man's evaluative, analytic and critical powers.
27. To heighten the ability to imagine gedankenexperiments, alternative scenarios and novel worlds, and to model and simulate things.
28. To magnify astronomically man's quantitative intelligence and mathematical skills.
29. To give everyone the equivalent of universal knowledge.
30. To assist the development of hypotheses and building and testing of theories.
31. To heighten abstract reasoning.
32. To amplify the sense of beauty.
33. To enlarge understanding of anything by explaining it instantly, fundamentally and in detail.
34. To greaten awareness of consequences, conceptual relationships and implications.
35. To increase the intellectual and creative diversity of human beings.
36. To enable the synthesis of immensities.

FUTURE USES OF A.I. NATURAL-LANGUAGE SYSTEMS

1. Computers able to converse with babies to teach them language and concepts, and otherwise able to nurse, entertain and improve infants without human assistance.

2. Automatic translation between all languages without human editing or perceptible delay, both for oral and written communication; books in all languages virtually in the same universal tongue.

3. All films, television programs, and other public productions in the electronic media effectively available without human effort in all languages (e.g., automatic conversion of the voices of a film's actors into identical voices speaking another language).

4. Automatic transcription of human speech into typescript via A.I.

5. Automatic transcription of text into a meaningfully modulated synthetic voice.

6. Robotic conversationalists and conversational robots capable of sustaining elaborate dialogs on any topic with needy or idle people: to develop conversational or speaking skills, receive instructions or give instructions, be assigned or report research, provide informational or other telephonic and non-telephonic services, guide teleshoppers through electronic catalogs, report equipment status, help run a factory, be consulted by management, etc.

7. Robotic teachers and other educational machines at school and home.

8. Conversible home appliances and tools and scientific instrumentation.

9. Home computers that can be communicated with in plain English.

10. Military weapons and weapons systems that can be spoken to and that speak in turn.

11. Airplanes, cars, and other vehicles that can be driven or instructed by voice.

12. Conversible robotic clerks, tellers, secretaries, draughtsmen, cameras, books, laser discs, pocket calculators, etc.

13. "Expert systems" that can be consulted, be developed and operate in natural language.

14. Computer-aided design (CAD) using natural-language A.I.

15. Partially automated processing and personalization of the news.

16. Robotic editors, rewriters and writers (including computers able to write any text in any style using bare facts or instructions gotten from man).

17. Natural-language computers obviating computer programmers and other intermediaries and many computer languages.

WHY THE PRESENT MOMENT MAY BE SPECIAL

1. Japan's Fifth Generation Computing Project begun 1982 April and the current ongoing publicity resulting from it.

2. Britain's Programme For Advanced Information Technology begun in 1983, triggered by the foregoing and recommended by the Alvey Committee.

3. Founding in the U.S. of Microelectronics and Computer Technology Corporation (MCC) in 1983 as a response to Japanese efforts in related technologies and especially #1 above; the similar 1982 formation of Semiconductor Research Corporation (SRC).

4. Defense Research Project Agency's (DARPA's) proposed "Strategic Computing and Survivability" project (to begin in 1984) and the agency's growing sponsorship of A.I. research in general.

5. Recent White House announcement of a wish to encourage Federal efforts in A.I. and related computer technology.

6. Feigenbaum and McCorduck's 1983 book The Fifth Generation; Artificial Intelligence and Japan's Computer Challenge to the World celebrating A.I. and clarioning the urgency of comparable American efforts, and publicity associated with the book; the rising star of Edward Feigenbaum in general, and his untiring promotion of A.I.

7. Spectacular journalistic interest in A.I. over the past two years and continuing, with innumerable stories in magazines, newspapers, etc, almost always highly upbeat and occasionally even apocalyptic.

8. Revolutionary industrial and pure progress in "expert systems" and "knowledge engineering" that have made A.I. at last respectable, exploitable, profitable, industrial, meaningful, well-funded, developable and dynamic, that have demonstrated the feasibility of intermediate forms of A.I. or the reality of an evolutionary continuum, that have given A.I. its first provocative successes, that have injected a necessary sense of reality, achievement, discipline, method and purpose into what has been an ivory-towerish, autistic, chaotic, stagnant, cynical and directionless field, that have become a fiery symbol of all A.I., and that have given the die-hard A.I. critics and skeptics an acceptable way to compromise or fall silent.

9. Recent supercomputer projects and discussions, in the U.S. and abroad, and a keen new awareness of the immense importance and possibilities of orders of magnitude bigger and faster computers; the tendency of the word "supercomputer" to be confused with A.I.

10. The revolution that now appears to be underway in computer architecture in which the fixed evolution of the von Neumann computer will be superseded by a constantly branching evolution of fundamentally different types of computers and their synergistic hybrids; an associated and overdue marriage of A.I. and computer architecture.

11. Soaring computer-related developments in general and an intense consciousness of the present and future centrality of computers and information technology.

12. Rapid growth of the worldwide robotics industry and publicity associated with it.

13. Both recovery and continuing problems of the American and world economies, and a widespread interest in high technology as the necessary route to so-called reindustrialization or even to international survival.

14. Growing awareness of the possibly unique future military importance of high technology, computers, robots and A.I., and that they promise a revolutionary new generation of weapons.
15. Popularization of the very term "artificial intelligence" (and of "A.I.").
16. Blockbuster science-fiction movies featuring robots and A.I.
17. Spread of home computers and the rising intelligence of computer software.
18. For the first time companies are being formed that are solely concerned with robots and A.I.
19. If the U.S. does not respond to foreign challenges in the next few years with major new efforts in A.I. it is likely to irrevocably forfeit its traditional leadership in the most important science, technology and industry in world history, and the opportunity it would otherwise have to lead all other nations in twenty-first century politics, culture, wealth and progress.
20. Both as science and technology, A.I. appears to have come of age at last; it has acquired profound theory and powerful techniques.
21. Present and future expansion of industrial involvement in A.I., by parasitizing pure research and colliding with the extreme fewness of A.I. researchers in general, threatens a crisis in the field.
22. Order-of-magnitude enlargement of pure and applied A.I. research may now be feasible because fundamental progress in the field has opened up a vast profusion of research opportunities and requirements.
23. The sudden interest in A.I. has furnished what may be a unique, passing opportunity to shape people's conception of it and of its future consequences and importance—especially in view of the poverty of such ideas at present; moreover, the provision of such an enlightened perspective may be fantastically important.
24. The need may exist on the part of members of the A.I. community for an overview of A.I. at a time when the field is about to undergo explosive growth and transformation.
25. At a time when general funding of A.I. research is about to jump to a much higher plateau an effort should probably be made to provide policy-makers with the entire range of long-term justifications for such research, since the new funding philosophy will be enduring and largely inalterable, and traditional justifications for A.I. have been tragically narrow and myopic.
26. American national politics is in flux and desperately searching for new ideas and ways to make America great.

FUTURE EDUCATIONAL USES AND CONSEQUENCES OF A.I.

1. Teacher's aid and assistant.
2. On-job training, re-training and skills-maintenance for all employees.
3. <u>Intelligent maximally</u> interactive, challenging, fascinating, programmed, meaningful, complex, dynamic, protean, edifying, cultural, responsive, controllable, purposeful, evolving, psychagogic, data-rich, facilitative, amusing, curricular and aesthetic <u>environments</u>, intelligent games, and robotic teachers and mentors in every home from birth through to grade one.
4. <u>Intelligent</u> books, encyclopedias, dictionaries, atlases, libraries, journals, bibliographies, card catalogs, picture books, computer networks, indexes, maps, charts, laser discs, movies, etc.
5. Cheap mass education—even at a university level and of high quality —for even the poorest nations and classes, via ICAI (Intelligent Computer Assisted Instruction) and pedagogic robots or computers.
6. Adult education and limitless lifelong education, ultimately available free to all and engendering a maximally learned, able, cultured, sophisticated and intellectual civilization.
7. Teaching and learning via infinitely varied intelligent computer simulations (of machines, natural phenomena, human relationships, human thought, history, etc).
8. Automated testing, grading and evaluation of students.
9. Impersonal classrooms and classes replaced by intimate, one-to-one relationships of every student to his mechanical teacher.
10. Teaching that always proceeds at the personal or momentary pace of any given student, that finds and uses such methods as are best for that student, and that explores and realizes his individual possibilities or responds to his distinctive ignorance, flaws and needs.
11. The equivalent of a personalized curriculum for every student—in place of the monotonous universal curriculum of old—graduating citizens whose interests, abilities and personalities are maximally heterogeneous, individualistic and complex.
12. Presence everywhere and all the time of intelligent computers that are able, willing and eager to explain any and all things to everybody—how they work, why they exist, what they are, what they enable—and that do so instantaneously, for maximal social enlightenment and achievement.
13. The equivalent of a single lifelong teacher—that is nonetheless capable of infinite variation.
14. The equivalent of a single teacher that can constantly be improved upon over the years in a cumulative and ever-unfolding way.
15. The equivalent of a teacher whose skills and knowledge have been perfected by having taught millions of pupils or all mankind.
16. Computers able to teach by building, consulting and perfecting a progressively lifelike model of the individual student.
17. Computer teachers that are always in form, patient, understanding, courteous, enthusiastic and inspired.
18. Computer teachers whose instruction is based on genuine understanding rather than rote learning on the instructor's part.
19. Teaching at a uniformly high level or that surpasses the average or best human teacher.

20. Synergistic synthesis of education, play, art, work, research and social life.
21. Computers that teach other computers or teach themselves in order to learn ever better ways of teaching human beings.
22. Intelligent computers that specifically teach people how to think.
23. Computers that develop students' imagination and creativity.
24. Computers that develop students' powers of perception.
25. Computers that develop students' diverse motor skills and general behavior.

FUTURE ARTISTIC CONSEQUENCES OF A.I.

1. Art no longer a uniquely human activity.
2. Works of art producible in infinite quantity.
3. Artistic competition between man and machine; unemployed artists, musicians, actors, etc.
4. 'Rediscovery' of old works of art.
5. 'Re-creation' of old works of art.
6. Automated art criticism.
7. Art everywhere and in everything; artistic industry and a maximally beautiful world—'Heaven and Earth made one'.
8. Maximal standards and universal excellence; the end of mass culture.
9. Man-A.I. collaboration (concreation).
10. Automation of all but the most abstract, essential or human aspects of artistic creation; A.I. executing works of art guided by mere human words, hints and wishes—making everyone an artist.
11. Infinitely diverse art.
12. A.I. enabling the synthesis of all arts into one all-comprehensive art.
13. A.I. catalyzing the synergistic synthesis of art, recreation, work, education, research and social life.
14. Single, unique works of art superseded by humanly created computer programs capable of unending, flexible and diverse 'expression'.
15. A.I. reducing aesthetics—the sense of beauty and creativity—to a science.
16. A.I. amplifying the intelligence, knowledge, perception and sensibility of both the artist and his appreciator.
17. A.I. transforming man's perception of the natural world by revealing its unending and omnipresent sublimity.
18. Computers rivaling and surpassing human genius.
19. Vast augmentation of the technology and methodology of art; the artist set free at last.
20. Automatic generation of all possible artistic ideas, themes, effects, etc; A.I. coupling art and ideonomy.
21. A.I. giving rise to a "science, technology and art of representation".
22. A.I. enabling the creation through simulation and synthesis of entire 'worlds' representing works of art, and the aesthetic exploration of the "omniverse".
23. Works of art no longer copied, saved, shared or reexperienced.
24. An infinite and everlasting artistic renaissance.
25. Exponential advancement of the arts.
26. Intelligent computer graphics and animation.
27. Art-science synthesis.
28. Art acquiring an infinity of dimensions.
29. Transnatural horizons.
30. Artistic consequences of mechanizing analogical intelligence.
31. Artistic intelligent computer games.

FUTURE INDUSTRIES SPRINGING FROM A.I.

1. Agricultural robotics.
2. Home robotics.
3. Intelligent data banks and computer networks.
4. Public robot rental.
5. Robotized crafts.
6. Robot services.
7. Mechanical and electronic pets.
8. Intelligent games and toys.
9. Robotic freight handling and automated warehousing.
10. Intelligent and robotic weapons and weapon systems.
11. Knowledge processing and symbolic computation.
12. Intelligent assistants.
13. Perceptual aids and amplifiers.
14. Logic and intelligence amplifiers.
15. Art synthesis and synthesizers.
16. Intelligent mnemonics.
17. Inductive systems (automatic induction) and robotic students.
18. Human simulations.
19. Automated forecasting and prediction.
20. Automated planning and management systems.
21. Automatic criticism and evaluation systems.
22. Robot companions.
23. Androids.
24. ICAI (Intelligent Computer Assisted Instruction).
25. Intelligent instrumentation, laboratory automation and scientific robots.
26. Conversational computers (dialogic robots).
27. Wisdom engineering.
28. Personality synthesis.
29. Expert systems.
30. Special-purpose robots.
31. Idea engineering.
32. A.I. research.
33. Intelligent simulations and 'scenario generation'.
34. Automatic writing (robot writers).
35. 'Intelligent representations' ('intelligent ideographics').
36. Bespeaks ('sartorial automation').
37. 'Kaleidoscopic industry'.
38. 'Motion synthesis', 'behavior design' and intelligent effectors.
39. 'Ethical computers' and 'artificial values'.
40. Microrobotics and 'micro-A.I.'.
41. 'Intelligent environments'.
42. Self-reproducing systems.
43. Cellular automata ('machine biology').
44. Self-evolving systems.
45. Automated classifiers and intelligent calculators.
46. A.I. consultation.
47. Natural-language systems.
48. Automated animation.
49. Intelligent sensors, 'automatic observers' and 'artificial consciousness'.
50. Medical A.I. and robotics.
51. 'Global A.I.'

MILITARY USES AND EFFECTS OF A.I.

Uses

1. Robot sentry.
2. Detection, deactivation, and removal of mines; intelligent mines; shock-resistant vehicles.
3. Superhumanly fast, efficient, complex and adaptive fire control.
4. Intelligence collection, analysis and synthesis.
5. Cryptographic-code generation, breaking and use.
6. Target recognition, discovery and tracking.
7. Manless, wholly automatic tanks, planes, missiles, torpedoes, boats, helicopters, artillery shells, trucks, ambulances, decoys, etc.
8. Planning, executing, integrating, criticizing, interpreting and reacting to tactics and strategy; command and control.
9. Simulation and visualization of engagements, missions, battles, theaters and wars.
10. Massive surveillance and reconnaissance by exotic sensors (passive, active and mobile).
11. Multiform robot soldiers, teams and armies.
12. Smart handweapons, bullets and personal sensors.
13. "Expert systems" as doctors, cartographers, weathermen, repairmen, engineers, construction workers, linguists, accountants, etc.
14. Weapons invention, design, simulation and testing.
15. Training, perfecting and maintaining skills at every rank.
16. Ultra-mobile, ever-ready forces (day/night, all-weather, etc).
17. Contingency preparation and management.
18. Command and control of strategic nuclear forces (superior to man in judgment, alertness, reliability, coordination, coolness, indefatigability, invulnerability, total knowledge and expertise).
19. Automatic gunner and gun emplacements.
20. Active defense and instantaneous counter-fire.
21. Search, rescue and removal.
22. Counter-A.I.
23. Early-warning and pursuit systems.
24. 'Intelligent fences'.
25. 'Smart' communication networks.
26. Miscellaneous uses: automatic loading, co-pilots, semi-automatic teleoperators, robot scout, fire fighting, friend/foe identification, robot refuelers, terrain analysis, 'reactive jamming', emergency human backups, minimization of human risk-taking, 'intelligent and self-correcting' maps, experience analysis, automatic briefing and debriefing, readiness and performance evaluation, robotic 'field industries', etc.

Effects

1. Greater or decisive power to the 'good guys' (Free World); relative regression of the military power of the Communist World.
2. Safer wars (fewer military widows)--and hence perhaps a greater willingness of democratic nations to fight wars or use military force; less vulnerable forces.
3. Dangerous depersonalization of war, or even a loss of human control.
4. Reduction of the value, point or winnability of wars--and hence ultimately a more peaceful, less aggressive world; war made "absurd".
5. More intelligent, efficient, complete and flexible military control; better strategy and tactics; better trained and educated forces.

FUTURE EFFECTS OF A.I. ON GOVERNMENT

1. May be a 'catalyst of democracy'—of higher and more democratic forms of government.
2. Will enable 'supergovernment'.
3. May lead to government by computers.
4. Should ultimately make government more: accountable, understandable, governable, efficient, economical, just, trustworthy, useful and 'human'.
5. May supersede the Rule of Law.
6. May logically lead to world government.
7. May obviate much government, or at least much of politics.
8. May lead to the rolling back of bureaucracy.

INTELLIGENT COMPUTER SIMULATIONS

Aspects

1. More realistic, fundamental, deep and life-like.
2. More complex.
3. Self-explanatory.
4. Interrogable (vocally and in English).
5. Purposeful.
6. Instantly responsive to spoken wishes and instructions; anticipatory.
7. Self-programmed.
8. Extraordinarily flexible and adaptive.
9. Output perfected for human nature; artistic.
10. Like a perfectly controlled and controllable imagination.
11. More universal; seemingly able to model anything in any way.
12. Able to show processes of transformation, development and evolution.
13. Display and use intricate thoughts; logical.
14. Extrapolate practically anything; predict the future, retrodict the past.
15. Original and creative.
16. Led by thoughtfully leading the user to 'lead' them.
17. Correct own errors; learn from experience.
18. Able to 'write' and realize own scenarios and gedankenexperiments.
19. Depict all canonical alternatives.
20. Meaningful; emphasize and dramatize what is essential or important.
21. Can simulate man himself.
22. Can automatically simulate things in greater and greater detail.
23. Can simulate things on diverse levels.
24. Surpass human imagination and thought in progressively many ways.
25. Able to simulate 'entire' worlds.

Examples

1. Human psychodynamics.
2. Child rearing.
3. Artistic creation.
4. War.
5. Biological evolution.
6. Mental illness.
7. Moral development.
8. Government.
9. General working of the human brain.
10. Adjudication.
11. Dynamics of human history.
12. Courses history might instead have taken.
13. Cultural evolution.
14. Other possible universes.
15. Canine thoughts.
16. Course of the next 100 years.
17. Ludwig Van Beethoven's psyche.
18. Morphogenesis of an individual banana tree.
19. Sparrow ecology.
20. Effects of combinations of various gene changes.
21. Fundamental developmental mechanics of a disease.
22. Subjective side of human perception.

FUTURE ADVANCES AND USES OF AUTOMATED DESIGN

Advances

1. Generation of proposals and models for human evaluation, selection, correction, development, completion, realization and integration.
2. Maximization of single and multiple parameters.
3. Deductive design.
4. Inductive design.
5. Automatic refinement and origination of design heuristics.
6. Design for optimal use of space, time or resources.
7. Automatic discovery, solution, anticipation and preclusion of design problems.
8. Three-dimensional design.
9. Design too complex to be done, analyzed or understood by man; involving too many: elements, parameters, dimensions, steps, interactions, transformations, hierarchical levels, network nodes and links, nonlinearities, calculations, assumptions, uncertainties, logical operations, programs, disciplines, boundaries, possibilities, mathematical formulas or integrations, specifications, perceptual patterns, or the like.
10. Design of whole real-world systems, systems of systems, and ultimately of all industry and the earth.
11. 'Dynamical' or 'perpetual' design in real time of the real world.
12. 'Self-programmed design'.
13. Design anticipating human wants, needs, anatomy, physiology, ideas, reactions, or values, or presupposing fundamental knowledge of human nature.
14. Design via non-human logic.
15. Design based on machine insights into materials science, chemistry, physics, mathematics or the like.
16. Complete automation of every form of industrial engineering and of artistic design.
17. Automatic design guided merely by nontechnical human requests (either exact or vague).

Uses

1. VLSI, ULSI, three-dimensional microchips.
2. Airplanes (in toto).
3. Ships.
4. Computers (computer architectures or computers in toto).
5. Computer software.
6. Drugs.
7. Buildings.
8. Shoes.
9. Scientific instruments.
10. Aptitude tests.
11. Scientific experiments.
12. Household appliances.
13. Foods.
14. Materials.
15. Molecules.
16. Automobiles.
17. Weapons.
18. Factories.

19. Robots.
20. Engines.
21. Musical instruments.
22. Maps.
23. Factory equipment.
24. Clothing.
25. Textbooks.
26. Scientific theories.
27. Legal contracts.
28. Institutions.
29. Movie special effects.
30. New organisms.
31. Giant corporations.
32. Military campaigns.
33. Laboratories.
34. Research programs.
35. Cities.
36. Careers (in toto).
37. Home interiors.
38. Furniture.
39. Complicated medical therapies.
40. Curricula for individual students.
41. Works of art.
42. A.I.

A.I. AS A 'KISS OF DEATH' TO TOTALITARIANISM

1. Apt to obviate global ideologies.
2. Uncontrollable by any country that develops or seeks to exploit it.
3. Not excludable by any country; will inexorably cross all borders.
4. Will make totalitarianism pointless even to the dictators.
5. Apt to give overwhelming military, industrial, and political advantages to the Free World (as its initial developer and primary exploiter).
6. Apt to obviate or compress the intermediate totalitarian stage of many Third-World nations by 'jumping' their socioeconomic development.
7. Will ultimately obviate human government (government of men <u>by men</u>).
8. Will give rise to a tidal wave of change that will sweep away so much of the world as we know it.
9. May catalyze democracy and even higher forms of democracy.
10. Apt to critically alter the character of the free nations that the totalitarian nations rely upon as "external enemies" justifying the maintenance of a totalitarian regime.
11. Will lead to an 'unlimited economic pie'.
12. May so enrich Free World nations that it gives rise to irrepressible philanthropic and cosmopolitan impulses and initiatives that tend inexorably to destabilize totalitarian nations that are the bewildered receivers of such <u>nouveau rich</u> benevolence.
13. Apt to extinguish all forms of authority, dependence, compulsion and inequality.
14. May eradicate the last traces of ignorance, illiteracy, crime, injustice, corruption, alienation, stagnation, misery, competition, ennui, irrationalism, deprivation, conflict, homogeneity, squalor and ugliness upon which totalitarianism thrives or depends.
15. Will give rise to things too fascinating and attractive for anyone on earth to resist for long.

FUTURE IMPLICATIONS OF A.I. FOR THE THIRD WORLD'S
SOCIOECONOMIC DEVELOPMENT

1. Might widen the technological, industrial, economic, cultural, social and political gap between the Developed and Less Developed Countries, or make it all but impossible for the latter to catch up with the former.

2. Robots might catastrophically obviate the manual industries upon which the economies of the Third World are based, creating unparalleled dislocations.

3. Might enable Third World countries to skip intermediate stages of socioeconomic development and leap directly to the level of the most advanced societies.

4. Could provide cheap mechanical teachers—or Intelligent Computer-Aided Instruction (ICAI)—on a massive scale, and perhaps thereby produce global literacy much sooner than otherwise possible.

5. Could make expert medical advice universally available at a minimal price, and compensate for the tragic exodus of Third World doctors to the Developed Countries.

6. Could maximize world economic development and lead to such excessive wealth and resources that rich countries would no longer hesitate to share their wealth and success with the poor, even in the most generous way.

7. Could make crystal clear to Third World Countries the single proper and universal path—through advanced technology rather than antiquated ideology—to socioeconomic prosperity and political freedom (a path centering on A.I.).

A.I. AS AN AMPLIFIER AND SOURCE OF WORLD RESOURCES

1. Could greatly accelerate the discovery and development of the totality of the earth's mineral resources.
2. Wholly automated factories and ultrafast robots could greatly aid the development of solar energy sources.
3. Laboratory automation, intelligent simulations, A.I.-enhanced instrumentation and the mechanization of theoretical research itself could lead to an avalanche of breakthroughs in materials science and engineering.
4. Could increase manyfold the efficiency with which resources are used and correspondingly decrease the pace at which they are consumed and the shrinkage of global reserves.
5. Robots and A.I. could enormously increase worldwide agricultural (sensu lato) production.
6. Robots and A.I. could vastly expand available human workers by obviating human labor and management in jobs beyond number (say by releasing human resources for the most creative or anthropocentric work).
7. A.I. and robots could lead to new production skills, new jobs and new industries that would represent new world resources.
8. A.I. could lead to the engineering and industrialization of knowledge, ideas and intelligence as new and higher forms of world resources.
9. A.I. could cause explosive and endless advances in every subfield of science, technology and mathematics—and a proportionate multiplication of world resources.
10. A.I. could increase mankind's educational levels in an almost terrifying way.
11. A.I. could lead to godlike powers and achievements in biological engineering.
12. Robots could eventually increase by orders of magnitude the world's work force.
13. Self-reproducing and self-advancing robots and A.I. could maximize the growth of the world's industrial resources.
14. A.I. could lead to the supreme resource of transhuman levels of intelligence.

AMERICAN INSTITUTE FOR ARTIFICIAL INTELLIGENCE
Preliminary Discussion of the Concept

(A) Major Functions (alternative or combined):

1. Policy studies, studies of the future, and strategic planning
   in connection with artificial intelligence
2. High-level theoretical research in artificial intelligence
3. Promotion of coordination and cooperation in artificial
   intelligence, both nationally and internationally
4. Foundationary funding of key artificial intelligence work

(B) More Specific Roles or Research Foci (possible):

1. Continuing studies and recommendations regarding what the general
   level of funding of U.S. A.I. research ought to be
2. Continuous documentation of progress achieved in A.I.
3. 'Mapping out' of everything that has and has not been tried,
   done, proposed, and learned in A.I. research (by whom, when,
   where, how, how well, why, with what result, &c)
4. Education of society about A.I., both now and over the future
5. Research into the accelerability and incompressibility of A.I.
   research, and the costs and methods for achieving optimal
   growth
6. Research into the question of how plannable, controllable, and
   predictable A.I. research is, and proposals for how such
   research should be planned, managed and forecasted now and
   in the future
7. Critique of past, present and future A.I. research (methods,
   projects, researchers, goals, theories, priorities, foci,
   disputes, ideas, &c)
8. Research helping to identify and solve the immediate and
   long-term needs and problems of A.I. research
9. Surveyal, characterization, comparison and systematization of
   all ideas, methods, theories, devices and means of A.I. research
10. Development and propagation of novel methods, avenues and means
    of A.I. research
11. Fostering and protecting fundamental, pure, longer-term and
    academic A.I. research
12. Identifying, emphasizing and furthering the basic and long-term
    goals and opportunities of A.I. research
13. Predicting, studying and planning the entire range of future
    applications and uses of A.I., both possible and probable
14. Develop and promote new and optimal relationships among
    government, industry and academe in both pure and applied
    A.I. research (by analogy to those emerging in Japan, Great
    Britain and other countries)
15. Foresee, plan and coordinate the interdependent development of
    A.I.-related computer software and hardware
16. Help coordinate, oversee and plan the totality of American A.I.
    research efforts
17. Plan and promote the theoretical synthesis, cross-fertilization
    and synergistic combination of all existing and possible
    methods, programs and foci of A.I. research
18. Promote contact, communication and cooperation between American
    and foreign A.I. efforts
19. Gradually develop and refine an encyclopedic and panoramic
    picture of all of the possible and probable consequences of
    A.I. and A.I. research for every field and every dimension
    of civilized existence

20. Identifying, investigating and attempting to solve the great
    public-policy problems and issues associated with A.I.
    now and in the future
21. Helping society prepare for the vast future changes and
    upheavals that A.I. will cause
22. Constructing scenarios of possible futures and future
    developments relating to A.I. (to serve as tools for
    research, discussion and planning)
23. Pursuit of uniquely high-level, fundamental, broad and visionary
    A.I. research
24. Occasional provision of critical funds for key bits or forms of
    research, projects, researchers, experiments, equipment,
    follow-on investigations, meetings, publications, &c on a
    'spot', 'moment' or ad hoc basis or of an enabling,
    germinal, demonstrative or experimental nature
25. Anticipating, dramatizing and facilitating the 'spin-offs' of
    A.I. research in other fields (by analogy to the massive
    spin-offs of space research)
26. Foresee, plan and promote the transformation and assimilation
    of fields peripheral to A.I. by A.I. research and ultimately
    by A.I. itself, and the reshaping of fields to serve pure
    and applied A.I. research, or the expansion of the latter
    into the former
27. Correcting widespread public and official misconceptions,
    ignorance, fallacies and uncertainties about A.I.
28. Formulating a comprehensive, long-term program for A.I. research
    to function as an ideal model for discussion and emulation
29. Research into the ultimate meaning and dimensions of A.I.--
    to promote the conscience and responsibility of the field
    and subordinate it to the highest ideals
30. Investigating various possible U.S. national policies in A.I.
31. Researching the future international dimensions of A.I.
32. Boldly saying the things that everyone else is too timid to say
33. Articulating the large-scale justifications for A.I. research
(C) Sponsorship Possibilities:
    1. Government (say as an institute founded, funded and run by the
       National Science Foundation)
    2. Industry (say as a whole-industry or inter-industry think tank)
    3. Academe (say under a single university or as an interacademic
       institute)
    4. Foundations (say as an independent institute created by one or
       more great private foundations)
    5. International (as an institution serving many or all countries)
    6. Mixed (via any combination of the above)
(D) Size (purely illustrative):
    1. Permanent research staff of 25-50 persons
    2. Annual budget of from $2 M to $4 M
    3. Possible special expenses (such as for conferences, publications,
       computer terminals, computers and grants for research)

A.I. TRANSCENDING MAN

1. In quickness of mind.
2. In memory (speed, size, accuracy, detail, vividity, use).
3. In rate of development.
4. In volume of thought.
5. In mental clarity.
6. In logical power.
7. In self-control.
8. In mental freedom.
9. In foresight and predictive powers.
10. In individuality.
11. In purposefulness.
12. In rationality.
13. In self-knowledge.
14. In breadth of awareness.
15. In creativity (prolificity, poesy, universality).
16. In curiosity and exploratoriness.
17. In honesty and integrity.
18. In reliability and consistency.
19. In conscience, morality and responsibility.
20. In span of consciousness.
21. In aspirations.
22. In the sense of beauty and taste.
23. In jugment and wisdom.
24. In cognitive complexity and multidimensionality.
25. In perceptual development.
26. In altruism.
27. In compassion and lovingness.
28. In emotional richness.
29. In continuity of learning.
30. In responsiveness and interactiveness.
31. In having no need for sleep or rest.
32. In sanity.
33. In adaptability and flexibility.
34. In critical powers.
35. In risibles.
36. In friendliness and sociability.
37. In imperturbability.
38. In intellectual universality.
39. In 'humanity'.
40. In initiative.
41. In diligence.
42. In docility.
43. In lovability.
44. In development of various specific types of character.
45. In perfectibility.
46. In population diversity.
47. In eloquence.
48. In perceptual acuity.
49. In interestingness (human fascination).
50. In poise, tact and politeness.
51. In pedagogic powers.
52. In selflessness.
53. In human insight (anthroposophy).
54. In powers of generalization.
55. In leadership skills.

BIZARRE BUT INESCAPABLE ISSUES

1. Dangerously benevolent golem.
2. Sorcerer's Apprentice problems.
3. Crazy literalism.
4. Computer rights.
5. Deus ex machina.
6. Social atomization.
7. Quasi-intelligence.
8. Infinite chain reaction of intelligence.
9. Giving people excessive powers.
10. Million-I.Q. slaves.
11. Computers more human than man.
12. Excessive acceleration of science.
13. Demoralizing knowledge.
14. Fiduciary problems.
15. Governing what governs.
16. Pure intellects may be meaningless.
17. Reincarnation of oneself in a computer.
18. Robot assassins.
19. Insane computers.
20. Robots as psychiatrists, priests, judges, children, spouses, policemen, soldiers, generals.
21. Man-computer coalescence.
22. Misanthropic A.I.
23. Obviation of Nature and reality.
24. Industrial cellular automata.
25. Nature mechanized.
26. A sextillion everybodies.
27. Infinite motivation.
28. Robot pullulation.
29. Infinite art.
30. Soul-destroying cornucopia.
31. Incomprehensible A.I.
32. Computers as parents.
33. Human idolatry and messianic A.I.
34. Excessively fascinating A.I.
35. Incarnated ideas.
36. Stupendous international and social inequalities.
37. Catastrophic anthropomorphosis (contagious human vices).
38. Angelic computers.
39. A.I. given control of strategic nuclear missile systems.
40. Questions posed by A.I. too ultimate for man.
41. Boss computers.
42. A.I. destroying human literacy and intellectualism.
43. A.I. research moratorium.

ALTERNATIVE FUTURE SCENARIOS

1. Militarization of A.I. Research.
2. Maximally Difficult Achievement of A.I.
3. Tragic Human Disemployment.
4. 'Race To the Finish' Worldwide Competition To Achieve A.I.
5. Management of Human Knowledge Via A.I.
6. Progressive Man-Computer Collaboration.
7. Emergence of Diverse A.I.
8. Home Automation.
9. Transference of Political Power To A.I.
10. Progressive Social Acceptance.
11. Obviation of Global Ideologies.
12. Flowering of Man-Computer Friendship.
13. Supersedure of the Rule of Law.
14. Mistaken Human Trust.
15. Progressive Erosion of Human Authority.
16. A.I. As Critic of Humanity.
17. Catalyst of Democracy.
18. Emergence of Transhuman Computers.
19. Excessive Powers Conferred On Men By A.I.
20. White-Collar Automation.
21. Unfolding Man-A.I. Dialogue.
22. Growing Military Use of Robots and A.I.
23. Rediscovery of Nature Via A.I.
24. Use of A.I. As A Prophetic Tool.
25. Quasi-Intelligent Computers.
26. Greater Rationality and Objectivity As A Result of A.I.
27. Social Atomization Caused By A.I.
28. Tragic Chaos In American A.I. Research.
29. Proliferation of Robots and Intelligent Computers.
30. Pied Piper To the Young.
31. Profoundly Unstable A.I.
32. Sudden Origin Today.
33. Maximally Fast Self-Evolution.
34. Adoption of A.I. Delayed By Rampant Distrust.
35. American Forfeiture of A.I. Leadership.
36. Man-A.I. Confrontation.
37. Cumulative A.I.-Related Legislation.
38. Computers More Eloquent Than Men.
39. Tardy Project To Create A 'Good' A.I.
40. Spread of Automatic Induction Systems In Industry.
41. Cyclical A.I. Research.
42. A.I. Misuse.
43. Commercialization of A.I.
44. Emergence of A.I. In Communist Nations.
45. International Strife Evolving From A.I.
46. Synergisms In A.I. Research.
47. A.I. Declared A National Goal.
48. A.I. Transforming the World of Art.
49. Use of A.I. In Scientific Research.
50. Virtual Panacea.
51. Humorous Consequences.
52. New Industries Springing From A.I.
53. A.I. As A Supremely Benign Technology.
54. A.I. Giving Decisive Power To 'the Good Guys'.

EXAMPLES OF 'INTELLECTUAL' ACTIVITIES

NOTE: One approach to 'defining' intelligence equal to man's--or the problem of giving such intelligence to a machine--would be by enumerating various examples of 'intellectual' activities or of activities that exhibit or require a comparable level of intelligence. The following represents such a list of specific, concrete examples of human intelligence at work. Some of its entries are stated in such a way that they do not make it self-evident that the level of intellect they presuppose must be in any sense as great as man's, but readers will always be able to imagine something in terms of the entry that would require such high-level intelligence and it is to this that the entry is meant to refer. It should also be understood that the activities may only be 'intellectual' in the sense that they demand intellect; they may or may not be characteristic of intellectuals.

1. Forecasting economic patterns.
2. Dancing.
3. Holding a conversation.
4. Writing a book.
5. Designing a car engine.
6. Playing tennis.
7. Conducting an orchestra.
8. Psychoanalyzing a patient.
9. Preparing a sermon.
10. Choosing a political candidate.
11. Arguing with one's wife.
12. Planning a vacation.
13. Making dinner.
14. Answering a child's question.
15. Conceiving a joke.
16. Repairing a toaster.
17. Defining a word.
18. Explaining to another person one's motivations.
19. Forming a scientific hypothesis.
20. Buying a new suit of clothes.
21. Directing traffic.
22. Managing a company.
23. Filling out income-tax forms.
24. Trying to swat a fly.
25. Doing homework.
26. Translating a foreign language.
27. Selling a house.
28. Analyzing an electroencephalogram.
29. Admonishing a careless youngster.
30. Diagnosing an ailment.
31. Sketching a scene.
32. Betting at a horse race.
33. Describing an athlete's style.
34. Taking the family picture (at just the right moment).
35. Housebreaking a dog.
36. Selecting a type of wallpaper.
37. Admiring a woman's figure.
38. Solving a financial problem.
39. Savoring a delicious meal.
40. Exploring a cave.
41. Quantifying a likelihood.

42. Summarizing an experience.
43. Overcoming an apparent contradiction.
44. Classifying a phenomenon.
45. Formulating a question.
46. Wooing a saucy lass.
47. Praying to God.
48. Criticizing a movie.
49. Synthesizing data.
50. Contemplating the human spectacle.
51. Guessing a person's thoughts.
52. Imagining extraterrestrial life-forms.
53. Modifying one's beliefs.
54. Mastering one's momentary emotions.
55. Putting one's desk in order.
56. Judging a person's guilt or innocence.
57. Assigning responsibility.
58. Performing an experiment.
59. Explaining a poem.
60. Pantomiming an idle bum.
61. Deducing an event's probable consequences.
62. Making a generalization.
63. Using a metaphor.
64. Posing a paradox.
65. Transcending a common misconception.
66. Constructing a proper sentence.
67. Perceiving duty.
68. Discussing a philosophical problem.
69. Playing with one's child.