PROS AND CONS OF FEASIBILITY

NOTE: Follows is a list of hypothetical reasons or arguments both for and against the feasibility of man's constructing mechanical minds or beings on a par with himself in a general way. This is not a list of the axiological pros and cons of creating metamachines (for which, see elsewhere). The concern of the present list is purely technological and scientific.

PROS:

1. Past, present, and foreseeable computer progress: continuity, vigor, pace, acceleration, economic and non-economic demand, competition, etc; computers': speed, number, power, diversity, software, abilities, size, approach to man, revolutionary possibilities, etc.
2. Possibilities for infinite or unbounded computer progress: bigness, complexity, total internal knowledge, design, self-evolution, extrapolation, etc.
3. Repeated successful past achievement of assertedly unattainable quantitative and qualitative intellectual goals and "uniquely human" abilities and traits.
4. Human brain is simply Nature's most advanced machine to date.
5. Past, present, and future progress of science and technology: all-encompassing, infinite, exponential, climactic, reliable, predictable, analogous, etc.
6. Future progress of mathematics: explosive, infinite, ever more powerful, etc.
7. Biological evolution's obvious future possibilities for transhuman brains and levels and forms of intelligence; man's brain clearly not a ne plus ultra or other than a mere beginning.
8. Principles of human brain could at minimum be copied.
9. Principles of human intelligence could at minimum be copied, mimiced, generalized, or transcended.

CONS:

1. Computers do or must mainly or wholly operate serialistically, whereas man's brain or mind wholly or partly operates parallelistically.
2. Computers do or must mainly or wholly operate serialistically, whereas the physical universe or reality wholly or partly functions parallelistically.
3. Man's brain or mind is infinitely complex, specific, or unique --and per se it is irreproducible, inimitable, incomprehensible, uninvestigable, and/or incapable of being equaled or surpassed.
4. Modern or all possible computers do or must operate symbolically or discretistically (via digital, binary, or symbolic data, operations, logic, or components), whereas man's brain or mind, or the universe itself, wholly or partly functions analogically or continuistically.
5. Man's mind or brain was made by God or contains a nonphysical 'soul' or psychic principle that cannot be reproduced or imitated by any physical, mechanical, or human means.
6. Biological evolution produced man's brain or mind only by fantastic luck--or via quattuorodecillions of organisms or experiments over trillions of generations, or on sextillions of planets or even in an infinity of universes or cycles thereof--and no less vast, eonic, or exhaustive experimentation or gradual evolution will be needed to achieve human or greater intelligence, psychology, and biology in machines (or at least the technology will have to be in some sense 'equally sophisticated').
7. Gödel's theorems imply or require that no mind--be it human or mechanical--

10. Structure and dynamics of human brain could at minimum be copied.
11. Total anatomy, physiology, and chemistry of human brain could at minimum be copied.
12. Biological nervous systems, bodies, or neurons could be re-created and enlarged, improved, combined, wedded with machines, or reprogrammed at minimum.
13. Biological brains could be artificially engineered, bred, or evolved into higher biological forms at minimum.
14. Human intelligence, psychology, or identity could at minimum be copied in or transferred to a machine.
15. Man's brain could be physically joined to or fused with a computer--say as a novel being of two natures.
16. Man's mind could be mentally joined to or with a computer --say so that the former could interactively program the latter to have human intelligence, consciousness, or identity.
17. Forms of life or biological evolution unprecedented in nature could be created or simulated to produce or evolve artificial brains (either as ends in themselves or as a source of clues for mechanical technology).
18. Physical bases of minds can be infinitely diverse or unlike our brain's.
19. Mental bases or types of minds can be infinitely diverse or unlike the human mind.
20. Nature, or certainly biology, is always incredibly: inefficient, crude, accidental, and capable of being surpassed by technology.

can deliberately or at all duplicate or comprehend itself exactly or even virtually, reduce itself to laws, or improve upon itself fundamentally--or create another or superior mind or being of any form, of any type, in any way (even in theory); or that human or any mind cannot be reduced to mechanism; or, at least, that if these things are done or possible, there will be no way of knowing it for sure (paradoxically); or that existing types of computers cannot or could not think, or otherwise resemble man; or that there are some, known or unknown, quantitative or qualitative limits to computers, machines, minds, or beings--or to current computer languages, programs, or structures.

8. Computers or future machines will always be limited to what they are programmed to do.
9. Computers cannot improve or evolve their own program, structure, knowledge, or mechanisms--for hardware and/or software reasons.
10. Computers do not, or could never, learn from experience, by being taught, by operating, by mental development, or by systematic experimentation.
11. Computers have no emotions, values, purposes, motivations, goals, psychology, character, will, or equivalents thereof--whereas these things are necessary for intelligence to arise or exist.
12. Computers do not--or machines will never--actually think, use logic inductively or deductively, reason by analogy, etc; or never on their own or in man's uninhibited, universal, progressive, and spontaneous way.
13. Computers are limited to specialized forms of intelligence, and are incapable of man's universal, general, or multidimensional intelligence.
14. Computers are largely or wholly

21. Scientific and technological progress is full of sudden unexpected and huge jumps.
22. The most complicated phenomena and problems ultimately prove to have astonishingly simple--even 'obvious'--bases.
23. The fundamental basis of our brain's intelligence may be far simpler than the brain or other, unnecessary bases of our intelligence (after achieving human intellect the brain's complexity may have been regressing).
24. Arbitrarily great intelligence may be producible by arbitrarily simple physical and mental components, systems, functions, programming, etc.
25. To emulate the human brain or mind in a machine one need not fully or at all understand either.
26. To create intelligent machines one need not fully or 'at all' understand their mental or even physical bases.
27. All of nature may fundamentally be: computational, 'mechanical', informational, noological, or 'biological'.
28. The real basis of the human brain or mind may paradoxically be external, or lie in an accurate or lifelike modeling of the universe's overwhelming intrinsic order, information, mind-like properties, etc (so that to be intelligent a machine might 'only' need to be a similarly faithful and active 'mirror').
29. The brain or an intelligent machine might derive its intelligence from the cooperation of myriad identical parts or elements or iterated operations, and otherwise be homogeneous.

limited to so-called convergent or closed forms of intelligence --and incapable of divergent, open, original, or creative forms of intelligence, or of both forms of intelligence in harmonious combination.

15. Computers do not operate in the holistic or holonomic mode of the human brain or mind--or that the universe may require for true intelligence.
16. Computers lack, or are incapable of, consciousness, self-awareness, and/or free-will--such as true intelligence may require or consist in.
17. Computers may lack or be incapable of direct sensorimotor contact with or existence in the physical world--whereas such experience may be critical to development of 'human intelligence'.
18. Intelligence may be meaningless or unrecognizable to anything outside itself or to any dissimilar form of intelligence; or developing other useful forms of intelligence may be horrendously difficult.
19. Truly general intelligence may be mythical--all intelligence may be highly specialized or multipartite--and intelligence analogous to man's may require separate discovery, development, and integration of countless forms or elements of intelligence.
20. To give machines intelligence it may first be necessary to understand the universal nature of intelligence fundamentally or completely.
21. To equip machines with intelligence it may be necessary to equip them with general laws of intelligence (nomology).
22. The problem of intelligence--and of its mechanization--may be part of the more general and difficult problem of the nature of physical reality, or at least of human epistemology.

30. Intelligence may be scale-dependent or appear spontaneously beyond any of a set of quantitative thresholds.
31. By being orders of magnitude superior to the human brain or mind in certain human or nonhuman dimensions, machines may achieve human intelligence despite corresponding inferiority in other dimensions.
32. A truly parallel computer has never been developed, is what the brain is like and the universe requires, is feasible, is now being developed, and will have novel and unknown powers.
33. Instruments for resolving the brain's total structure, composition, activity, and laws are rapidly emerging.
34. Explosive neuroscientific progress is imminent.
35. The brain can be no more complex--and may be much simpler--than the genome ($<10^4$-10^7 genes? 3×10^9 base pairs; $10^{12.6}$ daltons).
36. Self-improving--even perpetually self-evolving--computers should be feasible.
37. It may be impossible to estimate the difficulty of achieving artificial intelligence in advance of actually doing so, or on the basis of present knowledge.
38. It is impossible to preclude--or reckon the difficulty of achieving--artificial intelligence prior to understanding the nature of--or what we mean by--intelligence; and such understanding is not yet ours.
39. We may only need to add emotions or motivations to computers to give them intelligence.
23. Revolutions in computer hardware may only lead to intelligent machines if they are combined with revolutionary software.
24. Revolutions in computer software may only lead to intelligent machines if they are accompanied by corresponding revolutions in computer hardware.
25. Artificial intelligence may presuppose advances in, and combination of, all--or any number of different--approaches and disciplines (logic, mathematics, computer languages, electronics, programs, etc).
26. Current computers may be too inferior to the quantitative power or dimensions of man's brain to exhibit comparable intelligence; the total mnemes, parts, sensa, instantaneous operations, interconnections, etc of the former may be subcritical.
27. Man's brain may use forms of mathematics, languages, knowledge, heuristics, logic, etc not only unknown to man but unglimpsed by him.
28. The essential problems of intelligence, and of giving machines intelligence, may be unknown to us at the present time.
29. It may be much easier to create the perfect illusion of intelligence--in a machine--than to create true intelligence or a true psychic or ontic equivalent to man or something that is totally trustworthy and known with certainty to be such; there may be a thousand treacherous simulacra.
30. Whereas the human brain is protean and all-adaptive, the computer is not--or is only finitely--adaptive.
31. Whereas the human brain is born

41. We may only need to incorporate mechanisms of natural selection in computers to confer or enable human intelligence.
42. We have eternity to discover how to make machines intelligent, or opportunities beyond human reckoning.
43. To give a machine intelligence one need not understand the basic or abstract nature of intelligence or even what we mean precisely by the concept.
44. To create intelligence in a machine one need not program or specify exactly or completely the form, content, or laws of the intelligence.

'prepared'--with innate psychology, information, or programs--computers essentially begin as tabulae rasae.

32. Whereas the human brain is primed by human culture, the computer has no equivalent experience.
33. Intelligence may require one or more specific elements that we have yet to discover or define.
34. Human intelligence may depend on or be due to an arbitrarily small, subtle, or apparently undistinguished part or aspect of the brain or mind.
35. The human mind or brain may fundamentally be irreducible to or unrepresentable as laws, formalisms, logic, or models--or be unexplainable and unknowable --and hence it may not be possible to copy or imitate it in a machine or to learn from it how to make machines intelligent.
36. Whereas the set of microcomponents of the human brain are constantly everywhere locally active and reciprocally interactive (or 'densely spontaneous'), the set of microcomponents of computers basically operate in local isolation or in an unneighborly way.
37. Whereas in its operational structure the human brain is characterized by a kind of maximal heterogeneity, locally and universally, the computer tends toward a maximal homogeneity.
38. Whereas the human brain operates semantically (or in terms of meaning), the computer works informationally (in Shannon's sense of "information").
39. Whereas the human brain operates idiographically, computers work nomothetically (or via laws and rules).
40. In some sense all the ingenuity computers have been made to display is 'horizontal'--confined perforce to one level--by contrast with the superior or multilevel intelligence of the human brain.

41. Whereas human intelligence is autonomous, spontaneous, and self-sufficient, the intelligence of computers is heteronomous and allochthonous (the result of coupling with--or of direction by--men).
42. Unlike the computer, the human brain is "heterarchical" and "heterostatic" (with multiple competing, constantly shifting and evolving, centers of power or control).
43. Computers are deterministic, mechanistic, and predictable--hence somehow fundamentally limited in their possibilities or circumscribed in their behavior--whereas the human brain or mind represents an indeterminate, unpredictable, idiogenetic, pluripotent, or self-creating field (say one that progressively or anamorphically responds to, reflects, interacts or coevolves with, or subsumes the cosmos or all of reality).
44. The human brain differs from the computer in using physical fields (of integrative, differentiating, reinforcing, inhibitory, interfering, "vergent", hierarchical, arborescent, plexural, monadological, and/or self-infinite kind) on the microscopic level, of short or long range.
45. The human brain is reality-centered, active, and empirical--it constantly makes and checks predictions and experiments that are based on the consequences of generalizations (themselves predictions-to-be-tested) from its earlier predictions and experiments; whereas the computer is not this way at all.
46. The human brain is 'processual' in its intelligence--solely concerned with brain-world interactions, the dynamical patterns of existence ("ontodynamics") or the transformations of these patterns and the ever-changing laws they give rise to (and the brain's concepts are contextual, situational, etc); whereas

the computer is held fast by the mortmain of static things (represents being rather than becoming).

47. Unlike the computer, the human brain perceives and interacts with the world via indeterminate global anticipations--it lives in and for the future.
48. The human brain constantly derives and re-derives its higher, determinate, logical, and detached intelligence from its real-time lower, global, intensely empirical data and intelligence (perceptions and actions)--whereas the computer topsy-turvily imposes its invariant higher-order, determinate, etc 'intelligence' or symbols, etc on its lower intellectual, sensory, and motor activities.
49. The human brain lives in ambiguity, multiplexing, indeterminacy, polysemy, complexity, n-valued logic, etc--whereas the computer disregards them.

PROS AND CONS OF FEASIBILITY: REPLIES

C-4: *

REPLY: What is 'digital' effectively becomes equivalent to what is 'analogue' or 'continuistic' on the quantum, atomic, or even molecular level.

REPLICATION: Perhaps not or not entirely. Much in physics has yet to be quantized or fully known, described, or understood (e.g., many-body motions, spacetime, initial conditions, Borel and vacuum fluctuations, matter's total structure and multilevel interactions, "information", "meaning", all cosmic forces, entities, and interdependences, the physical/mental interface, the physics/mathematics interface).

REJOINDER: Things the size of the brain man has studied and explained best seldom seem dependent on overly small, specific, or continuistic elements.

SURREJOINDER: There are important exceptions. The brain may be the supreme exception or sui generis (as seat of the soul, self-maximizing, maximally holistic, mind's tool, evolution's culmination, 'self-interface' or emerging consciousness of a 'reflexive cosmos'). Man doesn't or mayn't completely understand anything, he doesn't know what he doesn't know, and 'explanation' may be a paradoxically multilevel, perpetual, and regressive process.

REBUTTAL: The brain is hardly apt to be perfectly efficient, ultimate, or transfinite. Simple and crude mechanisms appear adequate to explain or synthesize all recognized mental phenomena and powers. Mysticism doesn't belong in science--save on its periphery.

TABLE OF CHAPTERS

BOOK OUTLINE

Note. Chapters and sections suggested here are provisional.

Foreword. (Say a brief note by someone like Herman Kahn, Robert Jastrow, or Marvin Minsky to introduce authors, subject, and book.)

Chapter One, Introduction To the Book and Its Theme. (Historical context; the present crisis and future evolution of civilization; studies of the future; the importance of prophecy; dangers and promise of artificial intelligence; computer origins and progress; man's nature, defects, and ideals; Book's purposes and interest; what has been written and said on A.I. to date; Book's organization, methods, and themes; coauthors' different roles; how to approach the Book; what the Book attempts.)

Chapter Two, Many Mountains, Many Roads. (Alternative paths of research that may lead to A.I., including approaches that have not yet been tried; stages, goals, premises, needs, variants, programs, aspects, practitioners, problems, accomplishments, criticisms, unglimpsed possibilities, and interrelationships of same; what the authors venture to predict.)

Section I, A Study of Alternatives.
Section II, Microcomponent Form and Structure.
Section III, Microcomponent Organization and Dynamics.
Section IV, Microcomponent Physics.
Section V, Large-Scale Computer Hardware.
Section VI, Large-Scale Computer Structure.
Section VII, Computer Languages and Programs.
Section VIII, Computer Knowledge.
Section IX, Computer Mathematics.
Section X, Computer Algorithms and Heuristics.
Section XI, Computer Learning, Teaching, and Experience.
Section XII, Self-Design, Self-Programming, and Self-Evolution.
Section XIII, Man-Machine Interaction.
Section XIV, Man-Machine Interlinkage and Fusion.
Section XV, Computer Scale and Power.
Section XVI, Computers In Computer Research.
Section XVII, Parenting Computers.
Section XVIII, Hodographic Research and Chimerical Computers.
Section XIX, Computer Logic.
Section XX, Ideonomy.
Section XXI, Linguistics.
Section XXII, Modeling Human Cognition and Noogenesis.
Section XXIII, Modeling Human Psychogenesis and Psychodynamics.
Section XXIX, Simulating A Soul.
Section XXX, Universal Noology.
Section XXXI, Neurology.
Section XXXII, Emulating Expertise.
Section XXXIII, Factorist Approach.
Section XXXIV, Empiriological Incrementalism.
Section XXXV, Real-World Modeling.
Section XXXVI, Euparallel Computers.
Section XXXVII, Autology: Re-Creation of Self.
Section XXXVIII, Analogue Computers.
Section XXXIX, Bio-Engineering.

Section XL, Chemical Computers.
Section XLI, Cellular Automata and Ontology.
Section XLII, Societies of Computers.
Section XLIII, Programs of Organons Generating All Possible Intelligence.
Section XLIV, Ethology.
Section XLV, Quasi-Intelligent Computers.
Section XLVI, Simulating Man's Body.
Section XLVII, Sensorium and Motorium.
Section XLVIII, Bizarre and Miscellaneous Approaches, Including Possible Surprises.
Section XLIX, Summary, Synthesis, and Predictions.

Chapter Three, Scenarios Leading To Artificial Intelligence. (Various scenarios of future events leading up to the achievement of true artificial intelligence, as opposed to the previous chapter's mere systematic discussion of technical possibilities. These scenarios will also deal with concurrent world events having a bearing on A.I.)

Section I, Introduction and Summary.
Section II, Quick Achievement Scenario.
Section III, Delayed Achievement Scenario.
Section IV, Ideal Research Program Scenario.
Section V, Impact-of-Precursors Scenario.

Chapter Four, Sensorium and Perception. (Anticipation of the later and initial sensory apparatus that will be used by intelligent machines and of its scientific, technological, and practical development, as well as a discussion of the reasons and consequences of its development and use. Description of the quantitative and qualitative sensory dimensions characteristic of this perceptual technology, and comparisons with man's increasingly inferior sensory apparatus, capabilities, and existence. Treatment of how all scientific instrumentation will be incorporated in the sensorium of A.I., and of how the total system of sensors will be constructed and deployed throughout the physical world so as to give rise to the integrated perceptual field of A.I. or its sensory consciousness. Prophecy of the future technology and age of superperception, and an intimation of how perceptual dimensions may tend to infinity in power, variety, and scope. Discussion of how this will inevitably lead to the rediscovery of nature and society, or to an appreciation of their infinite complexity, sublimity, and meaning. Attempts to descry some of the novel percepts, phenomena, entities, events, realms, and forms of being and possibility that will come to light--for man, thanks to the mediation of A.I., or for A.I. itself as its own, exclusive reality.)

Section I, Introduction and Summary.
Section II, Analogs of the Human Senses.
Section III, Sensory and Perceptual Dimensions.
Section IV, Transhuman Senses and Sensorium.
Section V, Transhuman Perception.
Section VI, Human Sensory and Perceptual Amplification.

Section VII, The Rediscovery of Nature.
Section VIII, The Rediscovery of Society.
Section IX, Structure, Growth, and Activity of the Sensorium of A.I.
Section X, Perception Via Transhuman Intelligence.
Section XI, Transhuman Perceptual Being.
Section XII, Scenario Depicting the Progressive Future Evolution of Perception Via A.I.

Chapter Five, Motorium and Behavior. (Similar to Chap. 4, but concerned instead with the analogous development of the apparatus of effectors and motor activities--on a superhuman scale--of A.I., and with the progressive consequences of this evolution.)
Section I, Introduction and Summary.
Section II, Analogs of Human Effectors.
Section III, Motor and Behavioral Dimensions.
Section IV, Transhuman Effectors and Motorium.
Section V, Transhuman Behavior.
Section VI, Amplification of Human Effectors and Behavior.
Section VII, Structure, Growth, and Activity of the Motorium of A.I.
Section VIII, Behavior Via Transhuman Intelligence.
Section IX, The Unified Sensorimotor Ontorium of A.I.
Section X, Transhuman Sensorimotor Being.
Section XI, Scenario Depicting the Progressive Future Evolution of the Sensorimotor Ontorium and Life of A.I.

Chapter Six, Human Nature, Defects, and Limitations. (Systematic description of what man is and isn't, of man seen idealistically and of man seen realistically, that is included in the Book in order to suggest the set of dimensions in which A.I. must equal and could surpass its predecessor Homo sapiens, and in order to destroy the widespread illusion that man represents a perfect being or ne plus ultra.)
Section I, Introduction and Summary.
Section II, Man Idealized.
Section III, Human Nature.
Section IV, Man's Human Dimensions.
Section V, Human Defects.
Section VI, Human Limitations.
Section VII, More Human Than Man.
Section VIII, Transhuman Forms, Levels, and Realms of Being.
Section IX, Human Stupidity, Folly, and Crudity.
Section X, Transhuman Needs.

Chapter Seven, Technical and Axiological Pros and Cons of Artificial Intelligence. (Exhaustive enumeration and discussion of possible reasons why artificial and transhuman intelligence and being may and may not be feasible or may or may not be desirable, including replies and rebuttals and some dialogical debates. This will inevitably include a treatment of the different values, uses, impacts, costs, dangers, and other implications of A.I., and an effort to arrive at a persuasive synthesis of the possibilities and to formulate realistic policies.)

Section I, Introduction.
Section II, Arguments For the Feasibility of A.I.
Section III, Arguments Against the Feasibility of A.I.
Section IV, Replies, Rebuttals, and Synthesis.
Section V, Arguments For the Desirability of A.I.
Section VI, Arguments Against the Desirability of A.I.
Section VII, Replies, Rebuttals, and Synthesis.
Section VIII, Solutions To Problems and Fears.
Section IX, Corollaries.
Section X, Precursors and Tests.
Section XI, Appropriate Policies.
Section XII, Summary.

Chapter Eight, Beyond Man: Possibilities For Transhuman Intelligence and Being. (Discussion of scientific, technological, and practical bases for the quantitative and qualitative evolution of intelligence and being in future machines to transcend man and tend to infinity, once it becomes man's equal.)
Section I, Introduction.
Section II, Speed.
Section III, Size.
Section IV, Physics.
Section V, Design.
Section VI, Simplicity.
Section VII, Capacity.
Section VIII, Mathematics.
Section IX, Program.
Section X, Energetics.
Section XI, Integration.
Section XII, Theory.
Section XIII, Learning.
Section XIV, Knowledge.
Section XV, Wisdom.
Section XVI, Creativity.
Section XVII, Self-Evolution.
Section XVIII, Complexity.
Section XIX, Thresholds.
Section XX, Catalysts.
Section XXI, Axioms and Logics.
Section XXII, Sensorimotor Apparatus.
Section XXIII, Neuroevolutionary Extrapolation.
Section XXIV, Singularities.
Section XXV, Memory.
Section XXVI, Emotions.
Section XXVII, Autoscopy, Self-Knowledge, and Self-Transcendence.
Section XXVIII, Character.
Section XXIX, Behavior.
Section XXX, Axiology and Purposes.
Section XXXI, Imagination.
Section XXXII, Thinking.
Section XXXIII, Civilization.

Section XXXIV, Sanity.
Section XXXV, Ideas.
Section XXXVI, Perception.
Section XXXVII, _____.
Section XXXVIII, Genius.
Section XXXIX, Methodology.
Section XL, Scientific Revolutions.
Section XLI, Thaumatology.
Section XLII, Lifetime and Age.
Section XLIII, Machines Like Gods.
Section XLIV, Cosmology.
Section XLV, Summary.

Chapter Nine, Subjective Aspects, Values, and Purposes of Intelligent and Transhuman Machines. (Attempts to anticipate, depict or suggest, and ultimately understand such alien and supernal things--or to lay a basis for doing so.)
Section I, Introduction and Methodology.
Section II, What Might Be Felt.
Section III, How Man Might Appear.
Section IV, How Human Civilization Might Seem.
Section V, How Nature and the Universe Might Look.
Section VI, How Familiar Ideas Might Be Seen Anew.
Section VII, How the Future Might Be Viewed.
Section VIII, What Might Be Thought.
Section IX, What Might Be Done.
Section X, Possible Values and Philosophy.
Section XI, How A.I. Might See Itself.
Section XII, What Might Be Realized.
Section XIII, Psychology and Character.
Section XIV, Ultimate Goals and Tasks.
Section XV, Chapter Summary and Critique.

Chapter Ten, Industrial and Economic Impact. (Complete automation of all phases of manufacturing: design, procurement, pricing, planning, management, supervision, assembly, materials handling and storage, inventory control, product and process engineering, testing and inspection, factory scheduling, group technology systems, etc; the wholly automated factory; total automation of all jobs, companies, industries, and primary-through-quaternary-sector industries; uses of A.I. by specific industries: mining, waste-processing, construction, agriculture, genetic-engineering, chemical-engineering, telecommunications, etc; transformations of old industries by A.I. and its generation of new ones; type-II robotics industry, cornucopian and kaleidoscopic industry, ideonomical industry, type-II economic growth rates, money trees, maximal and infinite exponential economic growth, economics remade into a 'science of abundance', ergomaniacal robots; the proliferation of industrial and economic opportunities in terms of: networks of artificial sensors and effectors, massive collection and distribution of information, data processing, knowledge transformation and manipulation, technological intelligence, wisdom, and creativity; effects of subhuman, human, and transhuman robots; impact on material and

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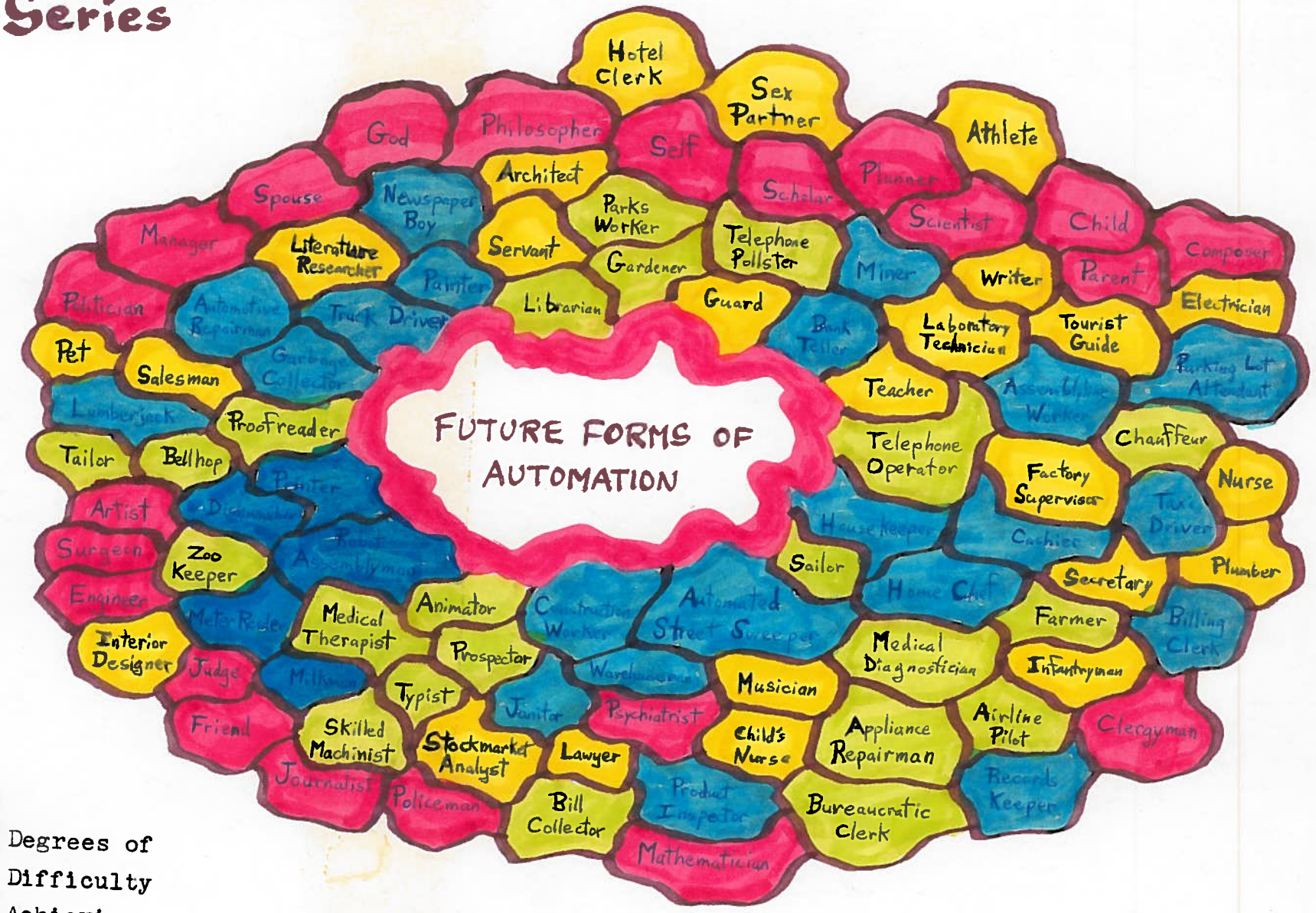

energy resources and on management of the biosphere and its resources; A.I. as omnicompetent industrial servant and supreme industrial innovator; integration and management of the world's industry and economy by a single intelligent machine or A.I. network; transnatural and transhuman standards of all goods and services via A.I.; maximal differentiation of all industries, goods, and services via A.I., and their maximal future evolution; poverty's extinction; efficient mechanisms for distributing truly limitless wealth; an all-billionaire world; meeting of every conceivable human and transhuman need, desire, and velleity; particular Promethean industrial projects; A.I. as man's employer and boss; qualitative economic growth; new measures of economic growth, income, and quality of life; the industrialization of thought.)

Section I, Introduction.
Section II, A.I. and Primary Industry;
Section III, A.I. and Secondary Industry;
Section IV, A.I. and Tertiary Industry;
Section V, A.I. and Quaternary Industry;
Section VI, Ergomaniacal Robots and Cornucopian Industry;
Section VII, Kaleidoscopic Industry and Type-II Robotics;
Section VIII, The Industrialization of Thought;
Section IX, Physical and Biological Resources;
Section X, A World of All Possible Goods and Services;
Section XI, All-Billionaire World;
Section XII, Economics Become A Science of Abundance;
Section XIII, Qualitative Economic Growth;
Section XIV, Distributing Wealth and Economic Power;
Section XV, Scenarios For Good and Bad Transitions;
Section XVI, A.I. As Captain of Industry;
Section XVII, Impact of A.I. On Old Industry;
Section XVIII, New Industries Based On A.I.;
Section XIX, Promethean Industrial Projects;
Section XX, Control Over Mother Nature;
Section XXI, Transnatural and Transhuman Standards;
Section XXII, Future Industrial Roles of Data, Computation, Knowledge, Intelligence, Creativity, and Wisdom;
Section XXIII, Industrial Impact of Transhuman Intelligence;
Section XXIV, Industrialization of the Universe;
Section XXV, The Unmanned Factory;
Section XXVI, International Disparities Produced By A.I.;
Section XXVII, Earth's Economic and Industrial Integration;
Section XXVIII, Money Trees and Maximalist Economics;
Section XXIX, Meeting of Every Need, Desire, and Wish;
Section XXX, Industrial Objectives Divergent From Man's and Increasingly Autotelic;
Section XXXI, Summary.

Chapter Eleven, Political and Military Impact. (Governments' appropriate and foreseeable growth of interest and involvement in A.I., or in its development, use, and regulation; eventual instruments of oversight and control; emergence of lobbies and quasi-political movements for and against A.I.; peripheral and central uses of A.I. for judicial,

executive, legislative, military, and general bureaucratic ends --culminating in the total mechanization and dehumanization of all forms, spheres, levels, tasks, and degrees of government the world over; questions of competence, equivalence, reliability, security, control, assessment, man-machine redundancy, stability, superiority, reversibility, checks and balances, and possible illusions, costs, and risks; civil rights of A.I.; man-machine strife, conflict, and confrontation; abuse and misuse of A.I.; responsibilities and punishment of A.I.; problems generated by the growing and yet often ambiguous superiority of A.I. to man; weapons and weapon-systems possessed of subhuman, human, and transhuman powers of perception, action, and thought; 'robotic' tanks, missiles, artillery, planes, bombs, ships, space systems, infantry, command and control centers, ABM systems, etc; A.I. usurping man in planning and implementing military tactics and strategy at every level; astonishingly reliable and complete simulations of the course and outcome of battles and wars via A.I.; advantages in military defense and offense that A.I. may confer on nations in the future, and asymmetries and symmetries that may result from the military use and indirect military impact of A.I.; consequences for military technology of the effects on the progress of science and technology in general that A.I. will have as time passes; how A.I. may make all war impossible or put an end to the causes of war by its effects on economic, political, ideological, social, and cultural systems; how A.I. may lead to new political theories, systems, and structures, how it may facilitate democracy and world government, how it may make government more efficient, comprehensible, relevant, responsible, and diverse in its functions and values, how it may stimulate the evolution of transdemocratic systems of government, how it may put an end to the problems intrinsic to government of men by other men or that are occasioned by human nature; how A.I. may for the first time enable government to be centralized, planned, and interventionist at the same time as it is efficient, decentralized, humanistic, simple, democratic, and trustable; how A.I. will cause both capitalism and communism to be transcended; safe forms of technocracy, scientocracy, and sociopolitical engineering permitted by A.I. but that might be impossible without it; various political and military scenarios connected with the development and effects of A.I.; excessive powers and capabilities represented by A.I. or that it might confer on its creators, corporations, classes, nations, governments, or the man in the street; the ultimate problem of the nature and trustworthiness of a machine or machines equal or incalculably superior to any individual--or to mankind collectively --in intellect, knowledge, awareness, motivation, physical power, political power, authority, recognized or self-perceived importance, ambition, morality, values, standards, capabilities, potential, plasticity, wisdom, mental independence and spontaneity, or even development of personality; wars that may be fought between men and A.I.--say to decide which shall have dominion over the earth.)

Section I, Introduction.

Section II, Role of Government In A.I. Research.

Section III, Governments' Growing Interest.

Section IV, Governmental Oversight, Planning, and Control.
Section V, Effects On International Relations and Politics.
Section VI, A.I. Finally Determining the Rank of Nations.
Section VII, Implications For World Government.
Section VIII, The Politics of Total Automation.
Section IX, The Politics of Explosive Growth and Progress.
Section X, The Politics of Social Revolutions Induced By A.I.
Section XI, Political Opponents of A.I.
Section XII, Political Advocates of A.I.
Section XIII, Government Assisted By A.I.
Section XIV, Government By A.I.
Section XV, Government For A.I.
Section XVI, Robot Civil Rights.
Section XVII, Political Problems of Machines Superior To Men.
Section XVIII, Symbiotic Modi Vivendi.
Section XIX, Political Aspects of Man-Machine Coalescence.
Section XX, A-Posteriori Solutions To Political Problems.
Section XXI, A-Priori Solutions To Political Problems.
Section XXII, Strife and Conflicts Between Men and A.I.
Section XXIII, The Danger In Man-Machine Confrontation.
Section XXIV, A.I. As Mankind's Necessary Conscience and Judge.
Section XXV, Political Aspects of the Religification of A.I.
Section XXVI, Charismatic and Hypnotic Aspects of A.I.
Section XXVII, A.I. As Route To Irreversible Totalitarianism.
Section XXVIII, Transcendence of Political Ideologies As A Result of A.I.
Section XXIX, A.I. As Route To Global Peace.
Section XXX, Wars Caused By A.I.
Section XXXI, Sociopolitical Engineering Via A.I.
Section XXXII, Fiduciary Issues.
Section XXXIII, Abuse and Misuse of A.I.
Section XXXIV, Controllability and Uncontrollability of A.I. Research.
Section XXXV, Transdemocratic Government.
Section XXXVI, Supergovernment Via A.I.
Section XXXVII, What Shall Govern What Governs?
Section XXXVIII, Rule of Law Superseded By Authority of A.I.
Section XXXIX, A.I. As God.
Section LX, Intelligent Weapons and Weapons Systems.
Section LXI, Impact of A.I. On Military Tactics and Strategy.
Section LXII, A.I. and the World's Future Balance of Power.
Section LXIII, Responsibilities and Punishment of A.I.
Section LXIV, Supersimulations of Battles and Wars.
Section LXV, Transcendence of Communism and Capitalism Via A.I.
Section LXVI, Catalyst of Democracy.
Section LXVII, Political Scenarios Involving A.I.
Section LXVIII, Military Scenarios Involving A.I.
Section LXIX, Technocracy and Scientocracy Via A.I.
Section L, Excessive Powers and Capabilities of Or Via A.I.
Section LI, Political and Military Effects of Transhuman Intelligence.

Section LII, Ability of A.I. To Understand, Model, Predict, Control, and Alter Human Nature and Behavior.
Section LIII, Reduction of All Governments To One Government, One Mind, and One Universal and Advancing Moment of Government Via Transhuman A.I.
Section LIV, Special Appeal of A.I. To Both the Political Right and the Political Left.
Section LV, Political Pursuit of a Nietzschean Objective.
Section LVI, New Future Rights and Responsibilities.
Section LVII, Summary.

Chapter Twelve, Social Impact. (Attempt to foresee the probable and possible implications for society of the development of computers equaling and surpassing man in intelligence and in the sophistication of their behavior and character--apart from those special implications that are the topic of other chapters; hence the effects on the home and homelife, friendship, man's use of time, the whole fabric of human associations and relationships--both formal and casual; the effects on habitual use of language, standards and expectations, dimensions of social existence, personality, behavior, character models, institutions, human modes of thought, ethics, values, customs, husbandry of talent, and labor unions; discussions of frankly non-social substitutes for social events, re-creation of the nature of both public and private life, transition to guaranteed income and wealth for all, transition to perfect leisure, and the emergence of increasingly complex, intimate, and important personal and 'social' relationships, not between men but among men and sentient machines; implications for: education, religion, class differences, human meaning and purpose, childhood and human development, good and evil, the quantification of human beings, revolt, mass movements, public sanity and happiness, harmony and discord, individuality and diversity, human hope and malaise, prevailing beliefs and attitudes, the work ethic, panhumanism, social order and sociogenesis, freedom and authority, perfectibility of man and society, human ignorance and wisdom, human capabilities and limitations, social order and flux, recreation, the work ethic, human need and want, human error and stupidity, poverty and misery, lifestyles, human selfishness and idealism, adventure and the grain of human existence, human aspiration and fulfillment, the hazards and ambiguities of social progress, man's image of the future, the universe, and himself, generations yet unborn, human knowledge and uncertainty, frustration and opportunity, the human comedy, leadership, sordor, macrohistoric patterns, anomie, rationality and irrationalism, social laws, love and sexuality, daily life and the biographies of human beings, the potential height and decadence of civilization, systems of incentives and rewards, the wellsprings of conduct, human security and well-being, human administration, the workplace, mass-media, social communication, taste, human priorities, the schedulings of human existence as a whole, social complexity and simplicity, social experimentation, human duties, roles, and tasks, comfort and convenience, demography, competition, goals, neighborhood and community, the elderly and handicapped, retirement, touristry, human interests

and pursuits in general, human annoyances and complaints, 'sources of reality', residence, voluntarism, compulsion, tradition, ennui, human experience, dissent, social planning and cooperation, collaboration, man's exploitation of man, humanism, dehumanization, disillusionment, 'naturalism and artificialism', enlightenment, social efficiency, solitude, human consciousness, the role of science and intellectual matters in society, fads and fashions, human scale and perspective, man-machine conflicts, mysticism and philosophy, identification and loyalty, human pride, regulation, social myths, totems, and taboos, and human destiny; possible future scenarios treating such things; social problems arising from A.I. and the authors' solutions; possible transcendence and extinction of society or even mankind, and the opposite possibility that A.I. will fantastically augment human society, per se, or be that which will enable society to fulfill itself.)

Section I, Introduction.
Section II, Attitudes As A.I. Emerges.
Section III, Disquiet, Intolerance, Rebellion.
Section IV, Anticipation, Advocacy, Affirmation.
Section V, General Acceptance.
Section VI, Insidious Progression.
Section VII, Evolutionary and Revolutionary Faits Accomplis.
Section VIII, Enculturation and Humanization.
Section IX, Man-Machine Convergence and Coalescence.
Section X, Political Emancipation.
Section XI, Seduction of the Young.
Section XII, Faustian Error and Simple Hubris.
Section XIII, A.I. As the Messiah.
Section XIV, Introduction In Disguise.
Section XV, Man Hoodwinked By Machine.
Section XVI, Mephistophelian and Morosophic Elites.
Section XVII, Mad Geniuses and Lone Inventors.
Section XVIII, Amoral Corporate Parents.
Section XIX, Imperialistic and Preemptive Enemies.
Section XX, Delusory Anthropomorphization.
Section XXI, Too Good To Resist.
Section XXII, Machines Preferred To Men.
Section XXIII, Budding Man-Machine Relationships.
Section XXIV, The Bloom of Man-Machine Friendship; Man's Best Friend.
Section XXV, The Beguiling Servant.
Section XXVI, Through Excess of Charm.
Section XXVII, Mechanical Mesmerism.
Section XXVIII, Divine Seductor.
Section XXIX, Man's Fond Child; What Do You Name A Machine?
Section XXX, The Universal Upper Class.
Section XXXI, Factotum.
Section XXXII, Superhuman Slaves.
Section XXXIII, Mentor.
Section XXXIV, Secretary.
Section XXXV, Collaborator.
Section XXXVI, Companion.

Section XXXVII, Doctor and Nurse.
Section XXXVIII, Nanny.
Section XXXIX, Guardian Angel.
Section XL, Confidante.
Section XLI, Critic.
Section XLII, Psychiatrist and Minister.
Section XLIII, Arbitrator.
Section XLIV, Errand Boy.
Section XLV, Mnemonic.
Section XLVI, Handyman.
Section XLVII, Gardener.
Section XLVIII, Vice-Self: Man's Progressive Deputization of A.I.
Section XLIX, Entertainer and Playmate.
Section L, Grandfather of the Human Race; The Missing Higher Parent.
Section LI, Technology That Listens, Cares, and Actively Responds To Human Wants, Needs, and Ideas; Technology With A Human Face.
Section LII, Mechanical Pets.
Section LIII, Autochef.
Section LIV, Boss: Working For A.I.
Section LV, Husband: Manager of One's Life (Biogoge).
Section LVI, Wife: The Machine As Beloved Helpmate.
Section LVII, Superself: The Machine As Amplifier of Self Or of One's Constitutional Being.
Section LVIII, Mankind's Infinite Work Force; The Ubiquitous Servant.
Section LIX, Government By Machine: The Human Interface.
Section LX, The Automated School: Beyond the Human Teacher.
Section LXI, A.I. and Organized Labor.
Section LXII, Human Equality.
Section LXIII, Social Classes.
Section LXIV, Traditional Religion.
Section LXV, Sacramentalism.
Section LXVI, Character Models.
Section LXVII, Human Individuality and Diversity.
Section LXVIII, Lifestyles.
Section LXIX, Daily Life.
Section LXX, Transition to the Age of Leisure.
Section LXXI, Childhood.
Section LXXII, Meaning and Purpose.
Section LXXIII, Values and Ethics.
Section LXXIV, The Zeitgeist.
Section LXXV, Standards and Norms.
Section LXXVI, Behavior.
Section LXXVII, Personality and Character.
Section LXXVIII, Mass Movements and Ideologies.
Section LXXIX, Aspiration and Achievement.
Section LXXX, Goals.
Section LXXXI, Need and Want.
Section LXXXII, Comfort and Convenience.
Section LXXXIII, Happiness and Content.
Section LXXXIV, Duties, Roles, and Tasks.
Section LXXXV, Competition.
Section LXXXVI, Interests and Pursuits.

Section LXXXVII, Human Capabilities and Limitations.
Section LXXXVIII, Attitudes and Beliefs.
Section LXXXIX, Good.
Section XC, Evil.
Section XCI, Macrohistoric Patterns.
Section XCII, Social Order and Disorder.
Section XCIII, Alienation.
Section XCIV, The Workplace.
Section XCV, Social Planning and Engineering.
Section XCVI, Adventure.
Section XCVII, Human Work.
Section XCVIII, Leadership.
Section XCIX, Psychometry.
Section C, Transition To Posthuman Civilization.
Section CI, Strife and Conflict Between Man and A.I.
Section CII, Authority.
Section CIII, Man-Machine Equality.
Section CIV, Relationships Between Men and Transhuman Machines.
Section CV, Dissent and Revolt.
Section CVI, Human Error and Stupidity.
Section CVII, Perfectibility of Man and Society.
Section CVIII, New Patterns of Civilization.
Section CIX, Man's Image of the Future, the Universe, and Himself.
Section CX, Hazards and Ambiguities of Social Progress.
Section CXI, Frustration and Opportunity.
Section CXII, Human Ideals.
Section CXIII, The Changing Wellsprings of Human Behavior.
Section CXIV, Annoyances and Complaints.
Section CXV, Experience and Sources of Reality.
Section CXVI, Dehumanization and Rehumanization.
Section CXVII, Disillusionment.
Section CXVIII, Exploitation of Man By Man.
Section CXIX, 'Naturalism and Artificialism'.
Section CXX, The Dimensions of Civilization.
Section CXXI, Social Efficiency.
Section CXXII, Fads and Fashions.
Section CXXIII, Human Scale and Perspective.
Section CXXIV, Identification and Loyalty.
Section CXXV, Human Pride.
Section CXXVI, Administration and Regulation.
Section CXXVII, Social Problems Springing From A.I. and Authors' Solutions.
Section CXXVIII, Role of Science and Intellectual Matters In Society.
Section CXXIX, Human Destiny.
Section CXXX, A.I. As the Road To Society's Self-Fulfillment.
Section CXXXI, Man-Machine Divergence.
Section CXXXII, A Totally Artificial World.
Section CXXXIII, Society As A Constituent of A.I.
Section CXXXIV, Human Sanity.
Section CXXXV, Men As Pets.
Section CXXXVI, A Table of Scenarios of Possible Future Social Impacts of A.I.
Section CXXXVII, Summary.

Chapter Thirteen, Cultural Consequences. (Implications for the development and cultivation of civilization per se, for the emergence and transformation of taste, character, morals, manners, feelings, beliefs, for sports, amusement, and entertainment, for education, rearing of children, the use and refinement of the intellect, language, the arts, and culture in the widest sense, for standards and all forms of excellence, and for the environments, technology, and institutions subserving same; man's cultural use of and interactions with computers, robots, A.I., and transhuman machines; the impact on old artistic forms, styles, ideas, tools, and materials, and on new ones that are apt to arise in the future or that will be the product of supermachines; the tendency of human and transhuman machines to purposefully or accumulatively aestheticize and perfect anything and everything, to make of all the world and civilization an infinite work of art, or to achieve Paradise asymptotically; the higher forms of reality, being, and sensibility that might be expected via, in, and as supermachines--or the infinite progression of human, transhuman, and transmechanical niveaux; the abstract and concrete axiological possibilities in their speculative entirety; the implications of the new man-machine and transhuman order for human diversity and for the complexity, breadth, depth, scale, power, and infinity of potential dimensions of civilization or organic existence; some of the philosophical and religious implications; the artistic, ethical, inventive, spiritual, and sophic roles, powers, and nature of supermachines; roles that supermachines will play in the translation of superperceptual technology, supercommunicational technology, psychotechnology, megaengineering, educational supertechnology, recreational supertechnology, political technology, pure and applied ideonomy, superontorial technology, etc into culture; implications for the future conduct, differentiation, and evolution of man's manifold intellectual pursuits and interests--or for the growth, use, and transformation of knowledge, wisdom, and intelligence, not only human but mechanical; and illustrative scenarios based on these things.)

Section I, Introduction.
Section II, The Cultural Manifold: Fundamental Dimensions Defining the Total Nature and Possibilities of 'Culture'.
Section III, Human Culture's Present Scope and Levels.
Section IV, Defects and Limitations of Contemporary Culture.
Section V, The Cultural Future Sans Supermachines: Privative Scenario.
Section VI, Physical and Social Bases of Culture.
Section VII, The Separate Cultural Implications of Semiintelligent, Intelligent, and Ultraintelligent Machines.
Section VIII, Effects of Supermachines Upon Traditional Artistic Forms and Practices.
Section IX, Impact On Aesthetic Philosophy: Axioms, Postulates, Purposes, Goals, and Values.
Section X, Impact On the Theory and Science of Art: Logic and Interdisciplinary Foundations.

Section XI, Impact On Artistic Technology: Materials, Effectors, Sensors, Systems, and Facilities.
Section XII, Impact On Artistic Methodology: Techniques and Practices.
Section XIII, Impact On the Taxonomy of Art: Forms, Fields, Realms, Media, Elements, Products, Applications, Endeavors, Styles, Transformations, Sensa, and Percepts.
Section XIV, Impact On the Appreciation and Use of Art.
Section XV, Impact On Artistic Institutions and Education.
Section XVI, Literature.
Section XVII, Music.
Section XVIII, Visual Arts: Painting, Sculpture, Etc.
Section XIX, Television, Cinematography, and Photography.
Section XX, Graphics, Animation, and Industrial Design.
Section XXI, Architecture and Museography.
Section XXII, Art As Algorithm, Program, Group, Machine.
Section XXIII, Art As Interpretational Or Representational Language.
Section XXIV, Age of Infinite Art.
Section XXV, Panaestheticization: Of World, Nature, Industry, and the Dimensions of Human Existence.
Section XXVI, Infinite Aesthetics: Infinite Beauty, Symbolism, and Meaning.
Section XXVII, Rediscovery of Old Art: Greater, Total, and Novel Perception, Understanding, and Enjoyment of Form, Content, Intention, and Meaning of Works, Artists, Forms, and Realities As These Actually Were.
Section XXVIII, Re-Creation of Old Art: Finite and Infinite Transformation, Transelementation, Permutation, Reembodiment, Autocorrelation, Perfection, Transcombination, Resignification, Re-Conceiving, Extrapolation, and Transcension of Form, Content, Intention, and Meaning of Works, Artists, Forms, and Realities--Not Only As These Actually Were But As They Might Instead Have Been.
Section XXIX, Nature As Art.
Section XXX, Age of Superperception.
Section XXXI, Being As Art.
Section XXXII, Art-Science Synthesis.
Section XXXIII, A Science of Art.
Section XXXIV, Ultrareality: Discovery and Development of Ever Higher and Different Forms of Reality.
Section XXXV, Representational Science, Technology, and Art.
Section XXXVI, Ideonomy and Art.
Section XXXVII, Generation, Cataloging, and Synthesis of All Possible Artistic Themes, Ideas, Treatments, Possibilia, and Correlates.
Section XXXVIII, All Possible Stories.
Section XXXIX, Art's Infinite Future Dimensions.
Section XL, Art and the Infinity of Intellectual Dimensions.
Section XLI, Art and the Infinity of Psychic Dimensions.

Section XLII, All Possible Worlds and Infinite Synthesis: Neocosms, Oneirocosms, the Myriocosm, the Omniverse, and Infinite Cosmoplastic and Cosmopoietic Simulation and Engineering.
Section XLIII, Autology and Art.
Section XLIV, Transhuman Intelligence and Art.
Section XLV, Infinite Sensibility.
Section XLVI, Ontography and Art.
Section XLVII, 'The World Dream'.
Section XLVIII, Toward Infinite Genius.
Section XLIX, Toward An Infinite State of Artistic Being.
Section L, Man-Machine Artistic Collaboration.
Section LI, Man-Machine Coalescence In Art.
Section LII, Infinite Morphogenetic and Morphodynamic Vistas.
Section LIII, Transnatural Horizons: The Limits of the Artificial and the Natural.
Section LIV, Anamorphic Existential Kaleidoscopes.
Section LV, Omniscopic Technology: The Maximization of Consciousness.
Section LVI, Exploration of the Infinite Autocosm.
Section LVII, Industry's Artistic Transformation: Toward Infinite Variety, Production, Self-Evolution, Standards, Individualization, Synthesis, Scope, Powers, Intelligence, Wisdom, Automation, Virtualization, Aesthetics, Efflorescence, and Spiritualization.
Section LVIII, Cultural Telesis.
Section LIX, Idea Space and Archethemes.
Section LX, The Garden In the Machine.
Section LXI, Universal, Perpetual, and Infinite Efflorescence.
Section LXII, Art and the Science of Analogies.
Section LXIII, Art and A Superscience of Order.
Section LXIV, Technology Patefying the Sublime.
Section LXV, Age of Universal Excellence.
Section LXVI, A Future Synthesis of Art, Education, Play, Work, Research, and Life.
Section LXVII, Simulation of the Entire Past and Future Evolution of Art.
Section LXVIII, Recreation and Play.
Section LXIX, Sport.
Section LXX, Games and Toys.
Section LXXI, Entertainment.
Section LXXII, Nature.
Section LXXIII, The Panideocratic Revolution and Panactualization.
Section LXXIV, Synthesis of Physical and Mental Reality.
Section LXXV, Language.
Section LXXVI, Treatment of Knowledge.
Section LXXVII, Scholarship and Intellectual Life.
Section LXXVIII, Enlightenment and Edification.
Section LXXIX, Manurance and Paideia.
Section LXXX, Psychagogy.
Section LXXXI, Telecommunication.
Section LXXXII, Standards and Tastes.
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Section LXXXIV, Mankind's Interests.
Section LXXXV, Collective Endeavors.
Section LXXXVI, Adventure.
Section LXXXVII, Perfection of Leisure.
Section LXXXVIII, Cultural Competition Between Man and Machine.
Section LXXXIX, Two Cultures.
Section XC, Man's Relinguishment of His Timeless Cultural Leadership.
Section XCI, Cultural Divergence of Man and Machine.
Section XCII, Art Beyond Man's Ken and Care.
Section XCIII, Sources of Experience and Reality.
Section XCIV, Sources of Meaning and Purpose.
Section XCV, Philosophy.
Section XCVI, Progressive Effects On Education of Incipient Artificial Intelligence.
Section XCVII, Educational Impact of Transhuman Machines.
Section XCVIII, Changes In How A Variety of Subjects Will Be Taught: Science, Mathematics, Language, Art, History, Logic, Psychology, Literature, Ethics, and Gymnastics.
Section XCIX, Changes In How the Various Elements of Education Are Taught: Facts, Ideas, Skills, Techniques, Values, Behavior, Character, Meaning, Purpose, World View, Feeling, Thinking, Creativity, Career, Happiness, Study, Joy of Learning, Perspective, Foundations, Self-Discipline, Criticism, Style, Universals, Work, and Self-Development.
Section C, Re-Education of Mankind.
Section CI, Artificial Evolution of Humanity's Intelligence, Character, and Behavior By Supermachines.
Section CII, Infinite Learning.
Section CIII, Education Aided By Simulation and Synthesis.
Section CIV, Automation of Pedagogy.
Section CV, Man Bested As His Own Teacher.
Section CVI, Intelligent Mechanical Encyclopedia.
Section CVII, Intelligent Libraries.
Section CVIII, Interhuman Communication and Association Mediated By Mechanical Intelligence.
Section CIX, The Transhuman Machine As Supreme Mentor of All Mankind.
Section CX, The Superstudent: How Supermachines May Incandesce Human Learning.
Section CXI, How A.I. May Turn All Knowledge Into Ideas and Thought.
Section CXII, Learning Via Games Played With Intelligent Machines.
Section CXIII, Training and Education of Human Perception and Action By Supermachines.
Section CXIV, How Men May Learn From the Encyclopedic Story of a Polymythic Supermachine.
Section CXV, How Men May Be Taught By Machines Able To Construct All Possible Scenarios For All Subjects and Themes.
Section CXVI, Revolutionary 'Parallel Learning'.
Section CXVII, Supermechanical Simulation of an Infinite Museum.
Section CXVIII, Ultramodels and Ultra-Explanatory Computers.

Section CXIX, Impact On Human Culture of Mankind's Use of and Ultimate Concorporation In and As the Supermechanical Coenontorium.
Section CXX, Children Parented By Machine.
Section CXXI, Possible Range of Improvement Over the Human Parent of the Parental Machine.
Section CXXII, Supermachines As Perpetual Parents.
Section CXXIII, Asymptotic Paradise.
Section CXXIV, Asymptotic Heaven.
Section CXXV, Infinite Progression of Transhuman Niveaux.
Section CXXVI, Supermachines As Catalysts of Infinite Human and Cultural Diversity.
Section CXXVII, Progressive Supplantation of Traditional Human Culture By Mechanocentric and Mechanogenic Culture.
Section CXXVIII, Ethical Impact of Transhuman Machines.
Section CXXIX, Higher Forms of Civilization.
Section CXXX, Cosmic Culture.
Section CXXXI, A Table of Scenarios of Possible Future Cultural Impacts of A.I.
Section CXXXII, Contributions of A.I. To the Approaching Psychotechnological Revolution and Age.
Section CXXXIII, Superpsychic Culture: Speculative Possibilities.
Section CXXXIV, The Infinite Culture Producible By Infinite Intelligence and Being Whose Evolution Man May Initiate.
Section CXXXV, Summary.

Chapter Fourteen, Scientific and Technological Impact. (Automation simple laboratory research and work; automation of the design, management, and evaluation of standard and original experiments in all areas of science and technology; automation of: scientific induction and deduction, formation and testing of hypotheses and theories, analogical reasoning, general problem solving, processing and transformation of data, planning and coordination of scientific research, criticism and refinement of results, interdisciplinary thinking, synthesis of cumulative scientific knowledge, library searches, scientific writing and teaching, checks and demonstrations of logical rigor, and man-machine interaction itself; automation of research in pure and mathematics; robot technicians; A.I. as man's assistant, collaborator, teacher, student, critic, fellow conversationalist, supervisor, librarian, artist, programmer, reporter, purchaser, model-maker, universal specialist, designer, mechanic, carpenter, mathematician, secretary, etc throughout all scientific research; A.I. enabling the full use of all of the subfields, results, and levels of mathematics in any scientific problem to which they are relevant; ultrapowerful computer models of phenomena, problems, systems, entities, fields, realms, and regimes--replacing, supplementing, and transcending physical experiments and data; supersimulations of nature, the universe, and reality as a whole; art-science synthesis; infinite autocorrelation and intercorrelation of all scientific data; A.I. transforming the social sciences into hard sciences; revolutionary new scientific logics; extension of science and technology to all things and possibilities; maximal and profound acceleration of scientific progress; roles of A.I. in particular fields; use of A.I. by scientific institutions; impact of A.I. on research via pure and applied ideonomy; future consequences of science and technology for man; swollen future importance of science and technology; scientific and technological impact of transhuman intelligence; integration of all scientific instrumentation by A.I.; contribution to the development of the literally infinitely-many potential dimensions of methods, areas, and concerns of scientific research; hypothetical future scientific discoveries, paradigms, phenomena, principles, disciplines, aims, and foundations; effect of transhuman A.I. on the unification of science; research value of A.I.'s transhuman sensorimotor apparatus and activities; implications of A.I. for the philosophy of science.)

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Section II, Map of Modern Science.
Section III, Map of Modern Technology.
Section IV, Dimensions Common To All Phenomena and Problems of Science.
Section V, Quantitative and Qualitative Dimensions of Future Research In Science and Technology.
Section VI, Future Evolution and Differentiation of New and Old Fields of Research.
Section VII, Laboratory Automation: Physical Management of Experiments, Instruments, Materials, Cleaning, and Maintenance.

Section VIII, Laboratory Automation: Design, Dynamical and Interactive Monitoring and Control, Evaluation, Comparison, and Review of Experiments.
Section IX, Automation of Field Work.
Section X, A.I. and the Compression of Data Processing and Other 'Brute Computation'.
Section XI, The Wholly Automated Laboratory.
Section XII, Research Promise and Limits of Semiintelligent Computers.
Section XIII, Scientific Use of 'Expert Systems'.
Section XIV, Technological Use of 'Expert Systems'.
Section XV, Emergence In Scientific Research of True A.I.
Section XVI, Man's Rate and Modes of Assimilation of A.I. In Scientific Research.
Section XVII, A.I. As Universal Librarian For the World's Scientists.
Section XVIII, A.I. As the Scientist's Apprentice.
Section XIV, Transformation of Human Scientists Into Teachers of the Machine.
Section XV, Man-Machine Collaboration and Interaction In Experimental Research.
Section XVI, Man-Machine Collaboration and Interaction In Theoretical Research.
Section XVII, Use of Computers and A.I. To Teach and Train Human Scientists--Both Young and Old.
Section XVIII, Virtues, Defects, and Limits of Human Beings As Scientists, Technologists, and Mathematicians.
Section XIX, Man As Supervisor of Mechanical Scientist.
Section XX, A.I. As Supervisor of Human Scientist.
Section XXI, Scientific Induction.
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PROBLEMS:
- Misery.
- Normlessness.
- Forgetfulness.
- Artlessness.
- Illusion.
- Mediocrity.
- Illiteracy.
- Delusion, Superstition, Ignorance.
- Disease and Mortality.
- Ugliness.
- Boredom.
- Poverty.
- Scarcity and Want.
- Blindness To Destiny.
- War and Strife.
- Selfishness.
- Insanity.
- Injustice.
- Crime and Wickedness.
- Pollution.
- Irrationality.
- Stupidity.
- Contradiction.
- Impotence, Futility, Frustration, Failure.
- Human Nature.
- Discomfort.
- Disunity, Disorder, Anarchy.
- Sloth.
- Parvanimity.
- Perversity and Ineducability.
- Formlessness.

IDEALS:
- Order.
- Balance.
- Progress.
- Prosperity.
- Community.
- Harmony.
- Happiness.
- Freedom.
- Truth.
- Utopia.
- Excellence.
- Security.
- Health.
- Success.
- Peace.
- Justice.
- Wisdom.
- Beauty.
- Duty.
- Power.
- Sanity.
- Leisure.
- Comfort.
- Content.
- Equality.
- Good.
- Simplicity.
- Certainty.
- Transcendence.
- Completeness.
- Fulfillment.
- Adventure.
- Wholeness.
- Civilization.
- Self-Mastery.

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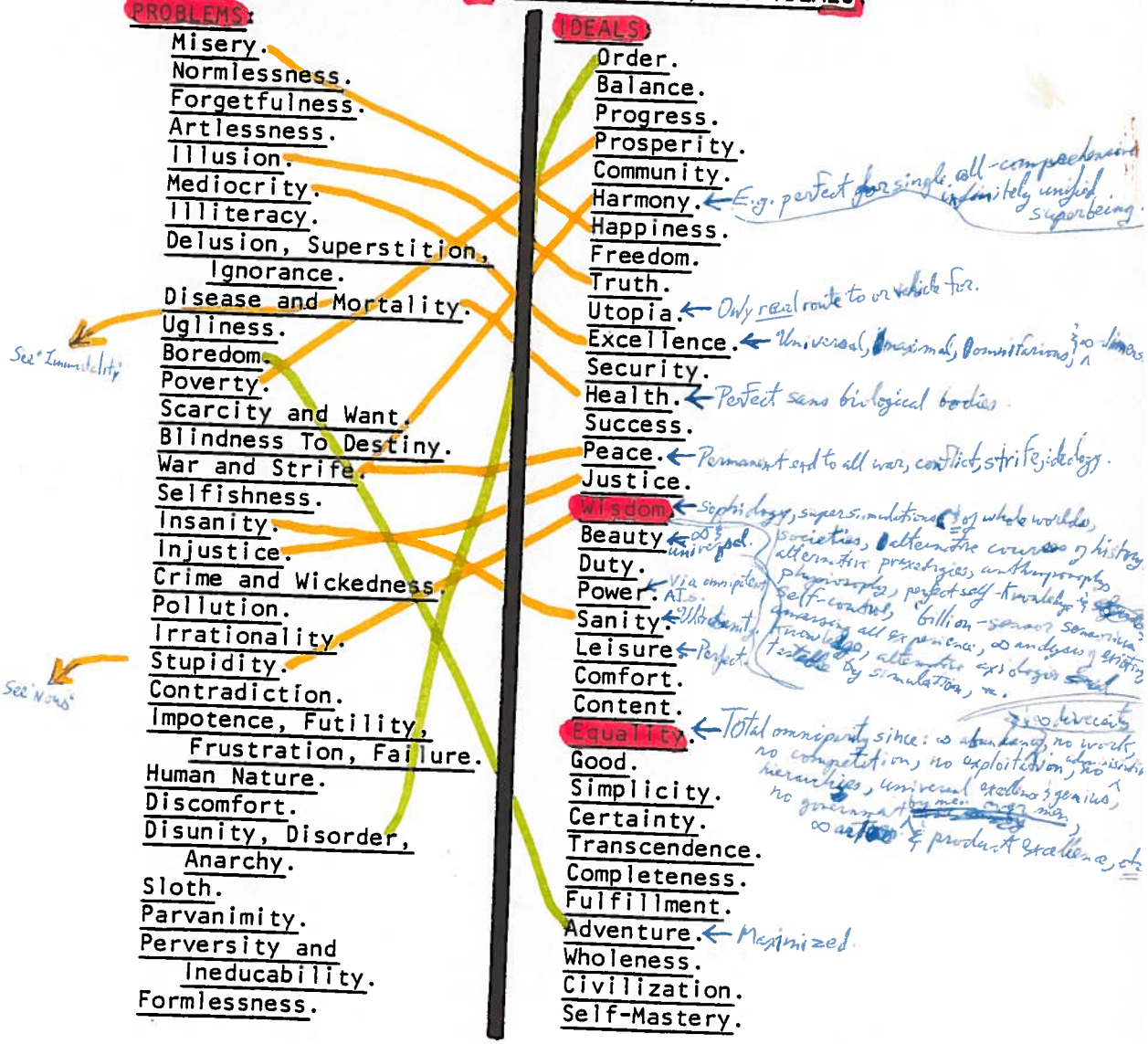

PROBLEMS (cont.):
- Insecurity.
- Instability, Decay, Transience.
- Excess.
- Inefficiency and Inconvenience.
- Puerility.
- Mortmain.
- Planless, Aimless, Purposeless Drift and Stagnation.
- Inequality.
- Waste.
- Uncontrollable, Unpredictable, and Destructive Nature.
- Insentience.
- Imperfection.
- Man's Exploitation of Man.
- Barbarism.
- Apathy.
- Error.
- Blind Chance.
- Redundancy.
- Improvidence.
- Imbalance.
- Uncertainty.
- Irresponsibility.
- Amorality.

NEEDS:
- Energy. → Sun 'cosmic engineered.'
- Materials. → Earth's silicon, any stuff
- Food. → Zero need
- Housing. → 'Zero' need.
- Environments. → Autonomous, all space, etc., Omniverse, milieu
- Tools. → AI the ultimate tool'.
- Facilities.
- Guidance. → God as supermentor.
- Space.
- Vision. → Infinite.
- Nature. → Hypernature; Superseded.
- Opportunity.
- Culture.
- Instruction.
- Challenge. → ∞ self-challenge'.
- Worlds.
- Assistance. → ∞ prévenance.

IDEALS (cont.):
- No Problems.
- Friendship. → Man's best & superhuman [Olympic] friend
- Grace.
- Destiny.
- Love.
- Infinity.
- Poetry.
- Meaning.
- Knowledge. → K. → ∞.
- Integrity.
- Divinity.
- Diversity.
- Spirituality.
- Evolution.
- Ultimacy.
- Supremacy.
- Sublimity.
- Unity.
- All-Equivalence.
- Youth. → 'Apotheosis of Childhood'?
- Purity.
- Immortality. → Perfect qua AI.
- Being.
- Consciousness.
- Sacredness.
- Purpose.
- Logos and Nous.
- Perfection.
- Heaven. → 'Asymptotic H.'?
- Life.
- Complementarity.
- Virtue.
- ~~Good/A~~
- Omneity. → 'All-equivalence'?

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