# A SHORT INTRODUCTION TO THE PRINCIPIA CYBERNETICA PROJECT

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*The Principia Cybernetica Project*

**Abstract:** This note describes a computer-supported collaborative project for the development of a complete system of philosophy. The system will address epistemology, metaphysics, and ethics, or the supreme human values. The aim is to move towards conceptual unification of the relatively fragmented fields of Systems and Cybernetics. Both the proposed philosophy and the implementation in the form of hypermedia and electronic mail networks, are based on the evolutionary principles of variation and natural selection. **Keywords:** cybernetics, culture, evolution, metasystem transition, networks, hypermedia, ethics, epistemology.

## I. Outline of the Project.

Principia Cybernetica is an attempt by a group of researchers to collaboratively build a system of cybernetic philosophy, addressing epistemology, metaphysics, and ethics, or the supreme human values. We intend to move towards conceptual unification of the relatively fragmented fields of Systems and Cybernetics through consensually- based philosophical development. Such a unification is proposed in the spirit of the original plans of the founders of the General Systems Theory. It is also in the spirit of Whitehead and Russell's Principia Mathematica. Where they reflexively applied mathematical principles to the development of the foundations of mathematics, in the Principia Cybernetica the objective is to reflexively apply cybernetic methods to the development of the foundations of cybernetics itself.

This philosophical system will not be developed as a traditional document, but rather as a conceptual network. A unit, or node, in the network can be a book, a chapter, a paragraph, a definition, an essay, a picture, a reference, etc. By linking nodes together, using several types of semantic relations, multiple hierarchical orderings of the network will be maintained, giving both readers and authors flexible access to every part of the system. The network will be implemented in a hybrid computer-based environment involving hypermedia, electronic mail, and electronic publishing. Such a system is intended to allow the dynamic development of a multidimensional system fully reflecting and incorporating the semantic relations inherent among the terms being explicated, and to unify and synthesize notations and terminology used in different traditions and disciplines (Joslyn, 1991).

Development of this philosophy is seen as a very long-term project involving many participants supervised by an Editorial Board. While traditional publication of parts or the whole of the network by individual authors or small groups will be made periodically, the project is seen as necessarily open- ended and developing, essentially a process or discourse among a community of researchers.

## II. Objectives of the Project.

\* For a group of researchers, perhaps not all geographically close, to collaboratively develop a system of philosophy, where philosophy is taken in the general sense of clear and consistent language about ideas and concepts;

\* To produce a system of philosophy that can develop dynamically over time, with continuing refinement and expansion;

\* For the system of philosophy to fully reflect and incorporate the semantic relations inherent among the terms being explicated, and to unify and synthesize notations and terminology used in different disciplines;

\* To support the process of argument and dialogue among experts toward the end of consensus at the level of the meanings of words and the relations among those meanings;

\* To support mathematical notation and the easy movement among natural language, formal language, and mathematics, and to support bibliographical and historical reference;

\* To allow researchers to develop or read the philosophical system in various orders and in various degrees of depth or specificity;

\* To support the publication of different stages of parts or the whole of the philosophical system and of various special-purpose documents, including dictionaries, encyclopedias, texts on a subject, reference pages, essays, dia- logues on a subject, or "streams of consciousness";

\* To allow the representation and utilization of knowledge in both its breadth and its depth.

## III. On Semantic Analysis and Consensus Building.

This project will aim at building consensus, not by normatively establishing a monolithic edifice, but through the explication of the various senses of terms. Careful semantic analysis will be done of words and concepts used in systems and cybernetics in the context of their historical development. While we hope that actual progress can be made through the elimination of incoherent or anachronistic usages, it may be that a simple listing of the various senses will be required. If one contributor asserts "P", and another "not P", and no further progress can be made, then in the worst case a kind of "null consensus" can be achieved by including "P or not P" in the project. For example, the concept of "information" is sometimes described as "high entropy", other times as "low entropy". At the very least the different conditions under which these usages arise should be described. At best one usage would be eliminated.

Nodes of the project will be in one of the following categories:
* Consensus Nodes: Ideas held in common by the contributors and the Editorial Board.
* Individual Contribution Nodes: Further development of the ideas expressed in the Consensus Nodes at greater depth. This development need not be held consensually by the contributors and Editors, but should be similar in spirit and style to the Consensus Nodes.
* Discussion Nodes: Including defence or criticism of the consensus or individual contribution nodes and development of other ideas.

## IV. An Evolutionary Philosophy.

The organizers have in mind not only a process of development of a cybernetic philosophy, but have also established a strong basis for the content of such a philosophy (Turchin, 1977; 1981; 1991; Heylighen, 1991). A philosophical system is seen as a clearly thought out and well-formulated, global "world view" (Weltanschauung), integrating the different domains of knowledge and experience. It should provide an answer to the basic questions: "Who am I? Where do I come from? Where am I going to?". The proposed philosophy is based on the process of evolution which generates subsequent levels of complexity out of more simple components, through the trial-and-error mechanism of variation and selective retention. It includes:

### IV.1. A Process Metaphysics.

Our ontology starts from elementary actions or processes, rather than from static objects or particles. Relatively stable "systems" are constructed by such processes through the mechanism of variation and selection. This leads to the spontaneous emergence of more complex organizations during evolution: from space-time and elementary particles, to atoms, molecules, crystals, DNA, cells, plants, animals, humans, and human society and culture. Events of emergence are the "quanta" of evolution. They lead to the creation of new systems with new identities, obeying different laws

and possessing different properties. In such systems, the behaviour of the whole depends on the behaviour of the parts (a "reductionistic" view), but the behaviour of the parts is at the same time constrained or directed by the behaviour of the whole (a "holistic" view).

A fundamental type of emergence is the "meta-system transition"(Turchin, 1977; Heylighen, 1991c), which results in a higher level of control while increasing the overall freedom (variety) and adaptivity of the system. Examples of metasystem transitions are the emergence of multicellular organisms, the emergence of the capacity of organisms to learn, and the emergence of human intelligence.

### IV.2. A Constructivist, "Metacognitive" Epistemology.

Knowledge is understood as consisting of models that allow the adaptation of a cybernetic system to its environment by anticipation of possible perturbations. Models function as recursive generators of predictions about the world and the self. Models are not static reflections of the environment, but dynamic constructions achieved through trial-and-error by the individual, the species and/or the society. They are both subjective, in the sense of being constructed by the subject for its own purposes, and objective, in the sense of being naturally selected by the environment: models which do not generate adequate predictions are likely to be later eliminated. There is no "absolutely true" model of reality: there are many different models, any of which may be adequate for solving particular problems, but no model is capable of solving all problems. The most efficient way to choose or to construct a model which is adequate for the given problem is by reasoning on a metacognitive level, where a class of possible models can be analysed and compared. This requires a metasystem transition with respect to the variety of individual models.

### IV.3. An Evolutionary Ethics.

The fundamental "good" is the continuation of the process of evolution, avoiding evolutionary "dead ends" and general extinction. Natural selection entails survival as the essential value. Although the death of organisms is necessary for biological evolution, it is no longer necessary for cultural evolution. Hence the maximisation of survival leads to the striving toward immortality. It also leads to the desire of actualizing the human potential, to maximally develop the knowledge, intelligence and wisdom which may help us to secure survival for all future contingencies. We contend that humanity is in the process of a new metasystem transition, leading to a yet higher level of evolution: the human "superbeing" or "metabeing". Such a being(s) may become "cybernetically immortal": what would survive is not so much the biological material of their bodies, but their cybernetic organization, which may be embodied in organic tissues, electronic networks, or other media. The main problem of an evolutionary ethics is to reconcile the goals of survival on the different levels: the level of the individual (personal freedom), the society (integration of individuals), and the planet (survival of the world ecology as a whole) (Turchin, 1981; Heylighen, 1991a).

## IV.4. Some Preliminary Ideas.

The general philosophy that we have sketched can be made more concrete in the form of a few statements, in the style of a "Manifesto" (cf. Turchin & Joslyn, 1990).

Freedom and Control: Freedom is a fundamental property of things. Natural laws act as constraints on that freedom; they do not necessarily determine a course of events. A system is controlled when its freedom is constrained by another system.

Metasystem Transitions: When a number of systems become integrated so that a new level of control emerges, we say that a metasystem has been formed. This is a "metasystem transition". Metasystem transitions are not solely directed by the internal structure or logic of a system, but must always arise partially from causes outside the system and the inherent freedom of the system.

Human Intelligence: Psychological function can be understood fundamentally in terms of desires and beliefs, or goals and knowledge, both of which are hierarchically organized representations. Human intelligence results from a metasystem transition that allows the organism to control the formation of associations of mental representations, producing imagination, language, goal-setting, humor, arts and sciences.

Social Integration through Linguistic Models: Human intelligence precipitated a further, currently ongoing, metasystem transition, the integration of people into human societies. Human societies are qualitatively different from societies of non-human animals because of language, which serves the dual functions of communication and modeling.

Social Evolution: The emergence of society marks the appearance of a new mechanism of evolution: conscious human effort instead of natural selection. The variation and selection now takes place in the human brain, and becomes inseparable from the willed act of the human being.

Global Integration: The ethics of cybernetics compels us to act to maximize the potential for continued evolution. Thus we should act to preserve the species and the ecosystem, and to further the growth of existing societies towards the formation of an integrated world society and the ecological unification of the biosphere under human control.

Human Super-Organisms: We foresee integration of people into "human super-beings" whose human constituents will communicate through the direct connection of their nervous systems. Such metasystems will be evolutionary selective, in that they will have advantages for survival in an evolving environment.

Ultimate Human Goals: Ultimate human knowledge is science. But since an essential property of human intelligence is people's ability to control their goal-setting, the ultimate human freedom is to choose our highest goals, our "meaning of life", and our ethics. Historically, the desire for immortality has been the driving force of civilizations.

The Will to Immortality: The deaths of organisms are necessary for biological evolution, but not for cultural evolution. Since the newest mechanism of evolution is inside individual people, the will to immortality is now not only desirable, but also evolutionarily demanded. Since ultimate goals cannot be derived, only chosen, it is not possible to justify the will to immortality as the ultimate goal for people, or to assert it as dogma, as traditional religions do. Rather it must be the free, creative act of each individual.

## V. Form and Content.

The proposed philosophy, constituting the content of the project, and the conceived hypermedia/email implementation, constituting the form of the project, are in fact closely connected. Both are constructive, in the sense that they start from "primitive" systems from a variety of origins (nodes containing expositions written by diverse participants), which are brought into contact (email conversations with a central place where messages are kept in store), connected (semantic links), and selectively stabilized, so as to retain those combinations which define a new, more integrated system.

When constructing a cybernetic philosophy the fundamental building blocks that we need are ideas: concepts and systems of concepts. Ideas, similarly to genes, undergo a variation-and-selection type of evolution, characterized by mutations and recombinations of ideas, and by their spreading and selective reproduction or retention (Moritz, 1990ab). The basic methodology for quickly developing a system as complex as a cybernetic philosophy would consist in supporting, directing and amplifying this natural development with the help of cybernetic technologies and methods.

It will require, first, a large variety of concepts or ideas, provided by a variety of sources: different contributors to the project with different scientific and cultural backgrounds. Second, we need a practical tool for representing and manipulating these concepts: the computer. Third, we need a system that allows the representation of different types of combinations or associations of concepts. Fourth, we need selection criteria, for picking out new combinations of concepts, that are partly internal to the system, partly defined by the needs of the environment of people that are developing the system. Finally, we need procedures for reformulating the system of concepts, building further on the newly selected recombinations, with the help of the concepts of emergence, and especially of metasystem transition.

One way to implement this kind of structuring and restructuring of concepts in a hypermedia system is based on the concept of "relational closure" of a network of concepts (Heylighen, 1991bc).

## VI. Management of the Project.

The project will be managed by a Board of Editors, currently: Valentin Turchin (Computer Science, City College of New York, CUNY, USA), Cliff Joslyn (Systems Science, SUNY-Binghamton, USA), and Francis Heylighen (Free University of Brussels, Belgium). They are actively looking for like-minded researchers to share in that responsibility. The Board is responsible for implementation of the system and the collection and development of the material. Similar to a journal, it may rely on an Editorial Advisory Board, and other associated editors, referees, and contributors.

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