

Philosophical approaches towards sciences of life in Early cybernetics

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ABSTRACT

Given the theme of *Biocomp2007* on "Competition and Cooperation in the Biosciences", I would consider useful to draw an historical view of the early developments of cybernetics in the USA, during World War Two and the aftermath of the war, focusing specifically on the different philosophical approaches towards the sciences of life, operating in the backstage. It is my belief that this history contains indeed lots of aspects requiring an in-depth study, dealing with the always hard-to-define epistemological approaches and also with records at times sunk into oblivion if not unknown at all.

During the war the main steps of Cybernetics were represented by Wiener's *Memorandum* on digital computer of 1940, the work on anti-aircraft systems and the article *Behavior, Purpose and Teleology* [10]. A more obscure period (1943-45) followed, in which Wiener came back to computing studies, became familiar with McCulloch-Pitts work on neuronal nets (1943), and also carried out a lesser known activity as an advisor to help von Neumann in computing researches. Such an itinerary comes to a synthesis with the meeting organized by Wiener and von Neumann at Princeton, on January 1945 [7]. So at that time one would have been able to consider the constitutive path towards cybernetics in fact concluded, at least in the sense of the subtitle of Wiener's book of 1948 [11], a science or – rather – a "research program" [4] on "control and communication in the animal and the machine".

Actually there were also differences between Wiener's cybernetics and the von Neumann's ones. The former was keener toward a sort of generalized control and communication engineering, stochastically reviewed and including living systems; the latter (who would have always preferred to use the term "automata theory") dedicated himself to computer science and logical models. But they both believed that the key was in information and that it could be possible to extend their technological ideas to living organisms when considered as systems elaborating information. There is a very important letter of 1946, from von Neumann to Wiener, in which one can reckon how precociously cybernetic ideas were able to inspire molecular biology, considering the cell as a system elaborating information.

There were also several theoretical difficulties, as the letter itself showed. A series of conferences organized by Macy Foundation of New York (1946-50), appeared the ideal place where these problems could be dealt with. Instead, these conferences increased the amount of theoretical problems. Here the group of Princeton 1945 met together with another group of scientists: Gestalt psychologists, social scientists considering relational aspect, and a biologist such as George E. Hutchinson, maybe the closest man to Vernadsky's way of thought in America in those years. They hoped to clarify mutual causal phenomena in society and in biological systems by means of cybernetics and the notion of feedback [5].

The earliest conferences, in particular, in 1946 and 1947, sixty years ago, were very exciting but also rather tumultuous. The officials of Macy Foundations spoke of "problems of communication", and in general the differences in training between "hard" and socio-human scientists seemed to explain these difficulties. But the stumbling-block was more likely represented by the different epistemologies which were operating in the "backstage": "methodological individualism" and "methodological collectivism", following Popper's terminology [8]. In fact the participants to Princeton 1945 were all more or less "methodological individualists", and this was true notwithstanding the presence in that group of physiologists, a kind of scientists traditionally keen to welcome organicist ideas. In fact Rosenblueth was above all interested in the nervous system and found a perfect partner in Wiener's ideas on communication. Things would have likely taken a completely different path with a physiologist like Lawrence J. Henderson [7].

The difference becomes just clearly perceptible if we compare the title of Wiener's book to the one chosen by the curators of the official proceedings of Macy Conferences: "Cybernetics, Circular Causal, and Feedback Mechanisms in Biological and Social Systems" [9]. To understand the problems arising from the encounter

between the two epistemologies it's useful to pay attention in particular to the meeting on 'Teleological Mechanisms', which took place on October 21 and 22, 1946, under the aegis of The New York Academy of Sciences. A collateral meeting which had been thought on purpose to study circular causality. We need to integrate the official proceedings [3] with other materials such as the manuscript of the "Preprinted abstracts" [1], including never published papers (the Bateson's, Lazarsfeld's and von Neumann's ones) or papers completely rewritten as in the case of the Wiener on "Self-correcting and goal-seeking devices and their breakdown" [1], whose original version has been published only in 1985.

Wiener in fact preferred to substitute it with a long paper on his idea of cybernetics as a generalized communication engineering. After Wiener, the neuro-surgeon William Livingston spoke on "The vicious circle in Causalgia," followed by the ecologist George Hutchinson on "Circular causal mechanisms in ecology". The Hutchinson's long paper, whose final title is "Circular causal systems in ecology", presented two main approaches to ecology: the Biogeochemical one (he spoke on different self-regulatory mechanisms in relation to the Carbon Cycle in Biosphere and Phosphorus Cycle in Inland Lakes) and the Biodemographic one (he spoken on sigmoid curve of saturation and the prey-predator models).

During the Sixties, M. Maruyama [6] sustained that early cybernetics had neglected positive feedbacks and mutual causality. This in some sense is true. But that meeting shows how several scientists agreed with the importance of those notions. McColl himself, author of the most influential handbook on automatic controls of that period didn't object at all to that application. Wiener, on the other hand, didn't appear then very enthusiastic about the application of cybernetics out of the nervous system. Why? Partly he feared the advent of an illiberal social-engineering. But he didn't appear keen on the application of cybernetics to ecology either. This position seems to depend on his choice to privilege informational feedbacks compared to those in which matter and energy are most important. And Hutchinson's paper had clearly pointed out the importance of matter and energy in circular causal phenomena in ecology. Probably just a definite reflexion about the differences between the two kinds of feedbacks had helped a more definite comprehension of cybernetic problems in general. Notwithstanding these difficulties the two philosophical views began to cohabit in cybernetics, as clearly shown also by Wiener's last works.

Keywords: Cybernetics, organicism, Macy Conferences.

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