

## **THE ROLE OF INTERDISCIPLINARY SEMINARS IN THE DEVELOPMENT OF CYBERNETICS**

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**Abstract:** Interdisciplinary seminars have promoted the development of cybernetics. The most important of them were held in the USA, the UK and the Soviet Union. In this work we have collected and systematized information about the development of cybernetics.

**Keywords:** cybernetics, interdisciplinary seminars

### **1 INTRODUCTION AND PRELIMINARIES**

Cascade control belongs to the most efficient methods to improve performance quality in single loop in presence of unknown disturbances and noise or the controlled variable is nonlinear. Cascade control is therefore widely applied in power systems, heating, in chemical plants. It is well known that the performance quality in cascade control configuration depends on parameter tuning in each loop (Rivera,1986).

Recent methods for cascade control parameter design prefer conventional approach based on analysis and design in frequency domain. These conventional approaches use two-step design of control parameters. This paper presents a new approach of cascade PID controller design.

Discoveries are known to be made by cross-disciplinary researches. 60 years ago a founder of cybernetics Norbert Wiener (Fig. 1) wrote about it: «...the most fruitful areas for the growth of the sciences were those which had been neglected as a no-man's land between the various established fields».

Only scientist that knows at least 2 sciences are able to work in interdisciplinary area.



Figure 1: Norbert Wiener

In fact, a few centuries ago it was possible for some people to know all. With time, all systems have become more complex. Clearly, it is no longer possible for one person to keep up with developments in all fields. Specialization has become a necessity. One of perspective forms of research is interdisciplinary approaches. Now there are such interdisciplinary sciences.

Now a symbol of these interdisciplinary approaches is synergetics — interdisciplinary area of scientific researches, whose goal is to study of natural phenomena and processes on the basis of principles of self-organization systems.

But in the middle of the 20th century it was cybernetics. Cybernetics is the interdisciplinary study of the structure of regulatory systems, which is closely related to control theory and systems theory.

Cybernetics was defined by Norbert Wiener (Fig. 2) (Wiener, 1948) the father of cybernetic, in his book of that title in 1948.

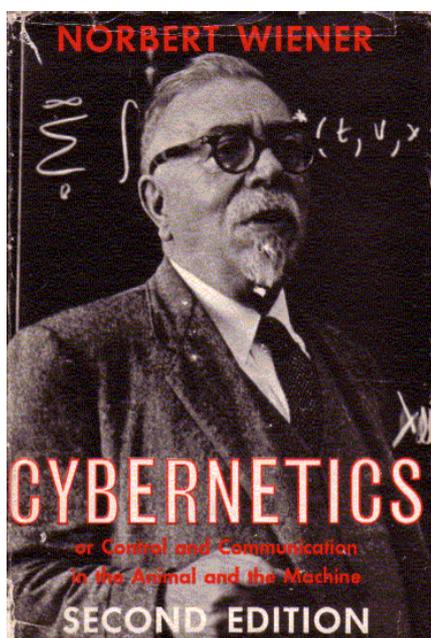


Figure 2: Russian and English second edition of “Cybernetics” by Wiener

What promotes appearance this science? First of all, these are interdisciplinary seminars. The most important of them were held in the USA, the UK and the Soviet Union (Pospelov and Fet, 1998).

## 2 THE SEMINARS IN THE USA

### The first seminar in the USA

The first seminar emerged in Princeton where mathematicians, neurophysiologists, engineers, computer engineers met. The seminar was founded by Arturo Rosenbluth and Norbert Wiener. The meetings were held monthly for 2 years (Wiener, 1956). More detailed information is presented in Table 1

Table 1: The first seminar in the USA

Place	Years
Princeton	1942-1944 (every month)
Questions	Participants
<ul style="list-style-type: none"> <li>• Science method;</li> <li>• Feedback;</li> <li>• Amount of information</li> </ul>	Norbert Wiener (mathematician), Arturo Rosenbluth (neurophysiologist), Julian Bigelow (ingeneer), Manuel Sandoval Valliard (physicist), Young scientists of Harvard Medical School
Heads	Support
Arturo Rosenbluth, Norbert Wiener	Work at different projects and in different organizations

The second seminar in the USA

The early meetings of the second seminar were held in New York in 1944. The group of psychiatrists, sociologists, anthropologists jointed the discussions of control problems (Wiener, 1956). This seminar had financial support. More detailed information is presented in Table 2.

Table 2: The second seminar in the USA

Place	Years
Mexico , the USA (MIT)	1944-1950
Questions	Participants
<ul style="list-style-type: none"> <li>• Cardial conduction;</li> <li>• Clonic tremor;</li> <li>• Sound device for deaf;</li> <li>• Brainwave</li> </ul>	Norbert Wiener (mathematician), Arturo Rosenbluth (neurophysiologist), Garcia Ramos (medic, physiologist), Manuel Bayreuth (physicist), Napoles Gandara (mathematician), Jerome Wiesner (ingeneer)
Heads	Support
Arturo Rosenbluth, Norbert Wiener	MIT, Institute of cardiology, Rockefeller Foundation

The third seminar in the USA

The most important and longest seminar in the USA is the seminar financed by Josiah Macy Foundation. The main activity was directed to study brain function and nervous system activity by the group of scientists from MIT and Institute of Cardiology is headed by Wiener and Rosenbluth. Social sciences were involved too (Williams, 2006).

Warren McCulloch headed the seminar (Fig. 3). He is a psychiatrist, and a mathematician, and a philosopher, and a neurophysiologist.

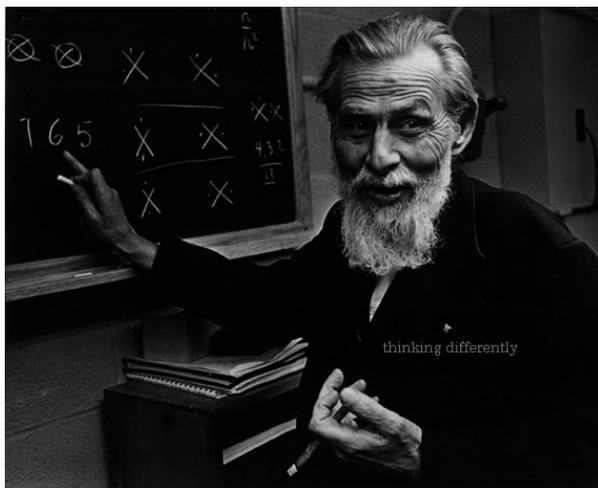


Figure 3: Warren McCulloch is a head of the third seminar in the USA

Information about this seminar is presented in Table 3.

Table 3: The third seminar in the USA

Place	Years
The USA	1946-1953 (every month)
Questions	Participants
<ul style="list-style-type: none"> <li>• Feedback channel;</li> <li>• self-regulating systems</li> </ul>	Warren McCulloch (psychiatrist), Gregory Bateson (anthropologist), Margaret Mead (ethnographer, culture expert), Kurt Lewin (linguist, artificial intellect), Norbert Wiener (mathematician), Arturo Rosenbluth (neurophysiologist)
Leads (heads)	Support
Warren McCulloch (psychiatrist, mathematician, philosopher, neurophysiologist)	Josiah Macy Foundation

Just like other seminars, the atmosphere of the meetings was informal and friendly (Fig. 4) (Williams, 2006).



Figure 4: The third seminar in the USA

### 3 THE SEMINAR IN THE UK

Information about the American seminars you can find from some sources. But information about the British seminar Ratio Club is known to small circle of scientists. Further information there is in the paper by Owen Holland, Phil Husbands (Holland and Husbands, 2008).

This seminar was held from 1949 to 1958 mainly in London. The full membership list was: Ross Ashby, Horace Barlow, John Bates, George Dawson, Tom Gold, Jack Good, Edmund Hick, Victor Little, Donald Mackay, Turner McLardy, Pat Merton, John Pringle, William Rushton, Harold Shipton, Donald Sholl, Eliot Slater, Alan Turing, Albert Uttley, Grey Walter, John Westcott, and Philip Woodward.

The Ratio Club was a “cybernetic dining club”, because the atmosphere was informal with drink and dinner. The Ratio Club and its membership have exerted the most powerful influence on the development and spread of cybernetics ideas in Britain in the post-war years. The club have also exerted direct influence not only on its member, but on own works. The Ratio Club stimulated the introduction into biology of cybernetic ideas, and in particular of information theory.

Seven members – Barlow, Gold, Merton, Pringle, Rushton, Turing, Westcott – became Fellows of the Royal Society. They influenced on each other it bore fruits. Below a single unique photograph of the club members is presented (Fig. 5).



Figure 5: The Ratio Club

Information about the Ratio Club is systematized and presented in Table 4.

Table 4: The Ratio Club in the UK

Place	Years
England	1949-1958 (every month)
Questions	Participants
<ul style="list-style-type: none"> <li>• Biological orientation;</li> <li>• artificial intelligence;</li> <li>• probability, statistics, information theory;</li> <li>• self-regulation</li> </ul>	John Bates (neurologist), Ross Ashby (psychiatrist), Grey Walter (neurophysiologist, robotics engineer), Donald Mackay (вычислительные устройства), Horace Barlow (neuropathologist), Alan Turing (computer engineer)
Leads (heads)	Support
John Bates (neurologist)	

#### 4 THE SEMINAR IN THE SOVIET UNION

Struggle for cybernetics in the Soviet Union was very fierce. There were both argent supporters and opponents.

Alexey Andreevich Lyapunov led the struggle. By rights, he is considered a founder of cybernetics of Russia.

In the Soviet Union cybernetics was called «reactionary pseudo-science». But Alexey Andreevich carried out explanatory work, held lectures and discussions about truth content of cybernetics.

Lyapunov involved in cybernetics many eminent specialists. He united many interesting and talented people around this science. He involved in work scientists of all fields of science. But he studied not only cybernetics but many natural-science disciplines. He attempted to outline the scope of cybernetics. In 1996 Alexey Andreevich Lyapunov was awarded a medal «Computer Science» for the contribution to cybernetics by IEEE (The Institute of Electrical and Electronic Engineers).

In the 1950s «Cybernetics meetings» were held at Lyapunov’s flat in Moscow. He organized a cybernetic seminar in the Faculty of Mechanics and Mathematics at MSU. It was the first interdisciplinary seminar in the history of Russian science. For 19 years there were 141 meetings. Below is shortened information about the seminar in the Soviet Union (Table 5).

Gradually, the negation of cybernetics changed into an acknowledgement. In the late 1950s cybernetics became a recognized popular direction of science with a wide range of problems. For these years in the Soviet Union many scientific departments connected with cybernetics were opened.

Table 5: The seminar in the Soviet Union

Place	Years
Moscow (MSU, квартира А.А. Ляпунова), Urals (Миасс)	1954 --1973 (141 meetings for 19 years)
Questions	Participants
<ul style="list-style-type: none"> <li>•Conditional and unconditional reflexes;</li> <li>•Genetics;</li> <li>•Machine translation;</li> <li>•Automation of programming;</li> <li>•Modeling</li> </ul>	A.A. Lyapunov (cyberneticist) H.B. Timofeev-Ressovsky (geneticist), A.P. Ershov (программист), M.G. Gaase-Rapoport (historian of science), Students and graduate students of MSU
Leads (heads)	Support
A.A. Lyapunov (programming, mineralogy, biology, astronomy)	Public funds

So, cybernetics became an influential field of Russian and world science.

## 5 CONCLUSION

So,

- we have collected and systematized information about the development of cybernetics,
- we used rare information about a 'cybernetic dining club' (the British interdisciplinary seminar) the Ratio Club,
- we have represented studied information in the form of a presentation and an electronic learning book. It can be recommended for use by students and masters in «The History of Cybernetics» and in «Computer Science» courses.

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