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## **Development of communication science, computer science and cybernetics in the 1940s – 1950s**

**Abstract.** *This publication presents the emergence of the new sciences that are most important for today’s world: communication science, cybernetics, the theory of information, and the theory of the noosphere in the 1940s – 1950s. The purpose of this article is to analyze the total scientific achievements in Eurasia at the time of the Second World War. This was a bright phenomenon in the formation of new revolutionary theories. Works of Chicago-based and Frankfurt-based schools of thought, the theoretical concepts of T. Adorno, M. Horkheimer, H. Lasswell, P. Lazarsfeld, and other researchers laid the foundations of the communication science and contributed to the breakthrough in a number of the key subject areas. A system approach to and a comparative analysis of the causes and subsequent consequences of the achievements at that time for today’s world served as a methodological basis for a comprehensive consideration of large-scale studies of the past. The scientific novelty of this historic study consists in the interdependence and complementarity of the theoretical and practical achievements in the 1940s and rethinking of their importance in the structure of concepts in the 20<sup>th</sup> century. Industrial and military goals associated with the automatic management and communication processes required fundamentally new approaches and achievements. When World War II broke out, N. Wiener worked on these problems aiming at creating a computer, which pushed him to the idea that the principles of managing biotic and abiotic systems are the same and to the cybernetic concept development. In the mid-1940s, J. von Neumann built the first digital computer. In 1945-1947, A. Turing worked, as an inventor of “a universal machine”, on the “electronic brain” project and was the first to develop a number of programs for it. In 1942, C. Shannon published his work dedicated to the theory of information permitting a constellation of researchers to lay the foundations of the theory of communication. V. Vernadsky’s noosphere concept proposed in 1944 was particularly important. At present, the ideas of that period are gaining new importance as a basis for the single planetary management system.*

**Keywords:** *history of science; noosphere; theory of information; theory of communication; management*



## **Introduction**

The relevance of the management, information, and communication interaction in the 20<sup>th</sup> century science development history and an analysis of their role in the social evolution of the global civilization are triggered by transformation processes in many areas of society's life activities and crises occurring today. The processes of rethinking the nature and essence of communication in the public life, in the management of economic, social, and political activities launched in the second quarter of the 20<sup>th</sup> century resulted in fundamental scientific achievements in the 1940s and emergence of new sciences: theory of information, theory of communication, cybernetics, and theory of noosphere. An analysis of a particularly productive period of development of the communication science and management theories in the mid-20<sup>th</sup> century should contribute to the new rethinking of the past scientific ideas. This is necessary for better understanding today's crisis stage of the humankind development at the end of the first quarter of the 21<sup>st</sup> century.

The historical scientific heritage of the 20<sup>th</sup> century in the area of information, communications, and cybernetics was also described in the works of national researchers such as V. Ivanov, A. Kholod, L. Khomenko, V. Rezun, O. Zernetska, and others. Foreign researchers looking at that period and achievements of the thinkers of that time from today's perspective include N. Dergunova, O. Gnatyuk, M. Kuznetsov, A. Lerner, N. Luhmann, L. Matveeva, E. Wartella, F. Webster, M. Zavgorodnaya, and a number of other authors. However, this issue has not been adequately studied in a comprehensive and consistent manner.

Individual aspects of analyzes the role assessment and communication significance in state control systems in works and prominent representatives' statements of political thought from antiquity to the beginning of the twentieth century (in the 1920s – 1930s) (Kislov, 2019).

## **Object**

Reflect the processes of the communicology genesis, types and models of communications, sources and the basic paradigms of social communications, theoretical problems issues of different marketing communication integration and maintenance of an information exchange in communicative systems in the twentieth century to form the concept of how to turn communication into mass communication was formed into one of the key mechanisms forming state and public administration.

## **Research methods**

A system approach and a comparative historical analysis of research works that allowed making an information and technology revolution in the second half of the 20<sup>th</sup> century served as a methodological basis for a comprehensive study of the ideas and achievements of the thinkers working in the 1940s, which laid the foundations for the understanding of managerial, information and communication processes. A system analysis of research works of that period should contribute to the historical,

philosophic, and practical rethinking of the importance of works written in that period for the theoretical achievements in the second half of the 21<sup>st</sup> century.

### **Results and discussion**

By 1940, all the preconditions based on a deep analysis of the role, methods, and technique of the propaganda, ways of the society development and management were available for the formation of a complex of new research areas. There were good conditions for the emergence of sciences that later changed the humankind development course: communication science, computer science, cybernetics, and the general theory of management. Two fundamental areas, two paradigms were formed to generalize a diversity of approaches to studies of the phenomenon of communication and communicativeness of human societies for decades to come. These scientific areas were defined as structural and functional, sociocultural ones. H. Lasswell, who proposed a concept of “indoctrination” (Lasswell, 1948), was one of the originators of the former. Earlier, in 1944, P. Lazarsfeld along with B. Berelson and H. Gaudet proposed a theory of a two-level flow of information (Lazarsfeld, Berelson, Gaudet, 1944). The researchers of the sociocultural area, based on socio-psychology, reduced the social role of communication to its utilitarian understanding as a system fulfilling its pragmatically preset functions. The theoretical justifications of this concept were developed a decade later.

In the 1940s, the Rockefeller Foundation offered to fund the projects involving the study of the media’s impact on the electors’ choice by engaging in these activities many researchers who had emigrated from Europe. Diverse and disparate works and data obtained in that area were generalized by P. Lazarsfeld, who determined the ways and methods of the efficiency of the media’s communicative activities.

In 1941, T. Adorno started working on the “critical theory of society” at the Social Research Institute and, in 1942, jointly with M. Horkheimer, set out to develop the central theme of its work: criticizing the manipulative nature of technology used by the mass culture to form mental and behavioral stereotypes of a consumer society’s ordinary members. In 1944, the first mimeographical book by M. Horkheimer and T. Adorno “Dialectic of Enlightenment” titled “Philosophical Fragments” was published in the USA. The book was published in 1947 in Amsterdam bearing its full title (Kuznetsov, 2011, p. 21).

This book was the brightest work of the Frankfurt school. At present, it is still estimated to be one of the classic philosophic works of the 20<sup>th</sup> century. In their book “Dialectic of Enlightenment”, the authors provided a brief and schematic exposition of a wide and multifaceted complex of philosophic ideas, describing a crisis situation prepared for the western culture and civilization in the 20<sup>th</sup> century (Horkheimer, Adorno, 1997). An analysis and a tough verdict of the civilized project of five centuries was based on the specific communicative strategy consisting both in the way of structuring the text of the work not corresponding to the generally acceptable standards of such treaties and in a special type of the discourse used, which appeals to the creative thinking of readers and rules out any mentor dictate. This was a sort of a

message and warning aimed at the next generations, i.e. the present-day society, about the problems that arose and continue arising as a result of the information and communications technology development (Kuznetsov, 2011, p. 41; Jensen, Craig, Pooley & Rothenbuhler, 2016).

Research of mass communication processes was particularly on the rise in the mid-1940s. This is when the conceptual understanding of communication based on the model methodology proposed by H. Lasswell in the early 1940s was established and developed. His formula published in 1948 and consisting of five elements modeling the process of communication exchange from the communicator to the recipient (audiences) includes the concept of efficiency (process efficiency) (Kislov, Romanenko & Chaplay, 2018, p. 9).

This component defining the practical communication efficiency asked questions that could be answered by cybernetics, a new science back then. American researcher and mathematician N. Wiener was its founding father. As World War II broke out, N. Wiener, guided by designing engineer V. Bush, participated in the creation of a computer for a ballistic analysis and gun control. This made him focus on the general issues of automatic management and principles of functioning of negative feedbacks in the automatic regulation systems. Work on these issues pushed him to the idea that the principles of managing biotic and abiotic systems are the same and to the cybernetic concept development. This subject area was also contributed by the theoretical work of A. Turing dedicated to the “universal machine”, published in 1937. N. Wiener’s famous book “Cybernetics: Or Control and Communication in the Animal and the Machine”, published for the first time in 1948, gave rise to revolutionary events in the world of science and caused deep changes in the view of the world (Wiener, 1983). Later, N. Wiener’s cybernetic concept was stated in his book “Cybernetics and Society”. N. Wiener’s ideas about the essence of information and entropy, their role in organization systems, the role of feedback as an optimization basis of the communication process had a direct impact on the later works that led to the creation of full-scale theories of information and communications.

N. Wiener’s cybernetic ideas, achievements of H. Lasswell, P. Lazarsfeld, and other researchers concerning the communications modeling encouraged new ideas of the nature of information, laid the foundations of the computer science and the communication science. The theory of information was founded by American engineer and researcher C. Shannon, who relied on practical works dedicated to the improvement of means of communication, coding and decoding during World War II. According to C. Shannon, information in hardware and software is a message transmitted in the form of signs. In his theory of information, these are not just messages, but only those that change or reduce significant uncertainty. In C. Shannon’s opinion, information means “removed uncertainty”. His pragmatic approach made it possible to use quantitative methods of calculating information transmitted by means of communication (communication channels), which received its terminological definition in the European languages back in 1928, when

R. Hartley introduced this scientific term as a quantitative measure of messages. This was an artificial model restriction of the information phenomenon concept for the sake of its practical usage in studying means of communication. C. Shannon published his works while working at the Bell System mathematical laboratory in 1941–1957. He published his major works dedicated to the theory of information and communications in 1942-1949 (Shannon, 1948). He introduced the concepts of “bit” and “entropy”, presented other fundamental definitions and mathematical formulas, proposed ideas still forming today’s communications technology. C. Shannon’s statement that “information is information, but not energy or matter” later pushed the humankind to become fully aware of this fundamental phenomenon of nature. And then the picture of understanding management and communications would be clearer and more accurate (Shannon, 1963).

In 1942, the Palo-Alto (a small town near San Francisco) school focusing on communications was formed. Its activities relied on N. Wiener’s circular model of communications considered in terms of various social sciences. From the perspective of this approach adopted by this school consisting in the same role of the information receiver and sender (recipient and communicator) in the joint circular communication process, this school’s researchers proposed the following hypotheses: concerning the driving force of communications; the logic of communications (the succession of messages and dependence between the elements of the communication system). It was also found out that communications as a verbal act are opposed by communications as a permanent social process covering various types of activities (speech, gesture, look, etc.).

E. Hall, one of the most important representatives of this school, continued and developed the ideas of the 1940s. In 1954, E. Hall and G. Trager published their work titled “Culture as Communication: A Model and an Analysis”, which summarized the first results of studying the behavior and communications of people of various cultural backgrounds launched in the USA back in 1947. It introduced the term “intercultural communication” for the first time. In their studies, the authors proved that it is the basis of human relationships and interactions (Trager & Hall, 1954). E. Hall discovered a link and interaction between culture and communications and proved that different cultures can be compared based on the grounds that are common for all the cultures. Later he developed the basics of proxemics – an area of science focused on the space and time phenomenon in communications. He studied the impact of tools of labor and other factors on their coherence and compatibility with the perception of messages of the media and means of communication (Hall, 1959) These works are particularly valuable for analyzing today’s political discourse in Ukraine.

In 1935, prominent English mathematician A. Turing engaged in research work according to the mathematical logic, which led him to the idea of the famous abstract “Turing Machine” described in 1936-1937. Work on the “machine-concept” allowed him to articulate the algorithm concept and be considered one of the founding fathers of the computer science. Over a period from 1939 to 1945, he worked at the

Communications Department of the Foreign Office of England. Having found out that new computers were actually created based on the principles of his “universal machine” without being directly familiarized with his research works, he got employed by the National Physics Laboratory. Later, A. Turing engaged in the development, engineering, and use of “electronic brain” in management: ACE, a huge automatic computer, and was the first to develop a number of programs. Afterwards, he focused on the training of “thinking machines” and development of mathematical support in engineering computers at the University of Manchester (Lerner, 1967, p. 183).

In the mid-1940s, J. von Neumann, one of the most universal intellects of the 20<sup>th</sup> century, created the first digital computer and published, in 1944 along with O. Morgenstern, the first systematic fundamental study dedicated to management in conflict situations: “Theory of Games and Economic Behavior”. Later, J. von Neumann worked on plausible problems of development and evidence of the capacity of quite sophisticated automatic management systems to reproduce themselves and even synthesize more sophisticated systems. He justified a possibility of “synthesizing reliable organisms from unreliable components” by introducing structural excessiveness. With these works, J. von Neumann opened new areas in cybernetics and in the general theory of management (Lerner, 1967, p. 247).

Without disparaging the merits of N. Wiener, C. Shannon, A. Turing, J. von Neumann, and their followers, it should be emphasized that some main provisions of management theories had previously been developed for many years, and some ideas even for centuries. Ideas of creating computers were proposed by B. Pascal and G. Leibniz in the 17<sup>th</sup> century. Ch. Babbage proposed a project of a universal programmable computer in 1833, which was a more developed prototype of modern computers. The theory of regulation by J. Maxwell and the theory of feedback systems by I. Vyshnegradsky began to be developed in the 1860s – 1870s. In the 20<sup>th</sup> century, their ideas were used in the theory of automatic management of production systems. At the same time, there were proposals to develop a general theory of management, but it still continues to be fully formed even today.

During the aforementioned period, American and European science of social management was limited to the principles and provisions stated in the early 20<sup>th</sup> century by F. Taylor, H. Fayol, H. Ford, H. Emerson, and other authors. H. Fayol’s book “General and Industrial Management”, published in France in 1916, focused on the main ideas and principles of administrative management of human societies. Attempts to bring together the disparate industry-related theories of machine, production, and social management as a single concept made before the mid-1920s continued into the mid-20<sup>th</sup> century as well.

The nature of comprehensive planetary management of human activities and natural processes was described in the noosphere concept proposed by national research and erudite V. Vernadsky. It is articulated in his last works as a philosophic, scientific, and political testament to humankind. V. Vernadsky believed that his model concept developed in 1936-1943 pointed to the natural spontaneous process

that will help progressive humankind get the final victory in its struggle for planetary management. V. Vernadsky's final article "A Few Words about the Noosphere" was published in 1944, although a number of scientists from many countries around the world got familiar with V. Vernadsky's ideas in 1938 (Vernadsky, 1944). The general scientific community learned about the concept of noosphere only after the publications starting from 1965 (Halyna Shvetsova-Vodka, 2018).

Back then and even decades later, the noosphere concept was narrowed as it was considered in strictly abstract scientific terms. V. Vernadsky's main idea, according to which progress in history aims at uniting humankind under general planetary management or at the noosphere as a future unity of the human organization in the rational efficient structure harmonically coexisting with the biosphere, was practically ignored. According to the philosopher, noosphere will be quite real and unavoidable when all the components for the general management of the global civilization management are at hand. However, the authors interpreting the theoretical art heritage of this researcher and erudite missed the communicative components of real transition to the noosphere clearly emphasized in V. Vernadsky's final research work.

These conditions began to be really implemented by the modern civilization in the 21<sup>st</sup> century. There is still a long way of evolution to fully achieve them. Taking into account V. Vernadsky's paradigm, it is clear that the global civilization should overcome the system crisis by starting with the management structures of international, continental, and national levels based on fundamental changes in the main paradigm of the human society development on Earth. This can be possible only by taking into account the conceptual principles and conditions of gradual and consolidated development of the practical noosphere – transition from the availability of a certain quantitative composition of the "homo sapiens" to the "sphere of the global civilization intelligence synthesized with the biosphere".

Under the influence of the said scope of research works that opened new areas in human activities, some American and western European universities set up departments of communications, theory, and practice of management, where they developed methods of training specialists for such spheres, introduced academic courses, including those dedicated to communications and communications technology. Many researchers were then involved in open-end research into new areas of cybernetics, computer science, semiotics, and communication science, which justified a new or particular understanding of the nature of communications and management.

## **Conclusions**

The main ideas and achievements of researchers studying the nature of information and communications processes and management in the 1940s proved to be a real fundamental scientific and technological event that triggered deep changes in many world view paradigms. They had a significant impact on the practical activities in various industries of the global economy. Practice proved and enhanced

the general importance of achievements of those years, which became real as a result of past developments, practical war-time demands, intensification of current developments and concentration of better intellects and promoters of advanced scientific ideas for this purpose. A possibility of relatively free self-development and originality of interactions within informal research schools provided to researchers additional conditions for successful breakthroughs in the area of most progressive sciences predetermining the development of an information and technological revolution.

### References

- Hall, E. T. (1959). *The Silent Language*. Garden City, N.Y.: Doubleday & Company.
- Horkheimer, M., & Adorno, T. W. (1997). *Dialektika Prosveshcheniya. Filosofskie fragmenty [Dialectic of Enlightenment. Philosophical Fragments]*. Moscow, St. Petersburg: Medium, Juventa [in Russian].
- Jensen, K. B., Craig, R. T., Pooley, J., & Rothenbuhler, E. W. (2016). *The International Encyclopedia of Communication Theory and Philosophy*. (Vols. 1-4). Malden, MA: Wiley. DOI: 10.1002/9781118766804
- Kislov, D. V. (2019). Establishment of scientific research in communication studies in the 1920s – 1940s. *Istoriia nauky i tekhniki – History of science and technology*, 9(1 (14)), 99-108. [https://doi.org/10.32703/2415-7422-2019-9-1\(14\)-99-108](https://doi.org/10.32703/2415-7422-2019-9-1(14)-99-108).
- Kislov, D. V., Romanenko, E. A., & Chaplay, I. V. (2018). *Marketingovye kommunikatsii v publichnom administrirovanii [Marketing Communications in Public Administration]*. LAP Lambert Academic Publishing [in Germany].
- Kuznetsov, M. M. (2011). *Opyt kommunikatsii v informatsionnuyu epokhu. Issledovatel'skie strategii T. W. Adorno i M. Maklyuena [Communication Experience in the Information Age. Research Strategies by T. W. Adorno and M. McLuhan]*. Moscow: IFRAN [in Russian].
- Lasswell, H. (1948). *The structure and function of communication in society*. L. Bryson (Ed.), *The communication of ideas*. N.Y.: Harper and Brothers, 37-51.
- Lazarsfeld, P., Berelson, B. and Gaudet, H. (1944). *The People's Choice: How the Voter Makes up his Mind in a Presidential Campaign*. N.Y.: Columbia University Press.
- Lerner, A. Ya. (1967). *Nachala kibernetiki [The Beginnings of Cybernetics]*. Moscow: Nauka [in Russian].
- Shannon, C. E. (1948). A Mathematical Theory of Communication. *Bell System Technical Journal*, 27(3), 379-423.
- Shannon, C.E. (1963). *Raboty po teorii informatsii i kibernetike [Works on the Theory of Information and Cybernetics]*. Moscow: Publishing house of foreign literature [in Russian].
- Shvetsova-Vodka, H. (2018). Uchennia pro Noosferu yak pidstava rozvytku nookomunikolohii [The noosphere doctrine as the basis for the development of



noocommunology]. *Ukrainskyi zhurnal z bibliotekoznavstva ta informatsiinykh nauk – Ukrainian Journal of Library Science and Information Science*, 2, available at : <http://librinfosciences.knukim.edu.ua/article/view/152533> (accessed 15 November 2019). <https://doi.org/10.31866/2616-7654.2.2018.152533> [in Ukrainian].

Trager, G. L. & Hall, E.T. (1954). *Culture as Communication: A Model and an Analysis. Explorations: Studies in Culture and Communication*, N.Y., 3, 137-149.

Vernadsky, V. (1944). *Neskolko slov o noosfere [A few words about the noosphere]. Uspekhi sovremennoj biologii – Advances in modern biology*, 18(2), 113-120 [in Russian].

Wiener, N. (1983). *Kibernetika, ili upravlenie i svyaz` v zhivotnom i mashine. 1948-1961 [Cybernetics or Control and Communication in the Animal and the Machine. 1948-1961]*. Moscow: Nauka [in Russian].

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### **Формування комунікативістики, інформатики та кібернетики у 1940 – 1950 роки**

**Анотація.** У статті розглядається процес становлення комунікативістики, теорії інформації, кібернетики та теорії ноосфери як комплексу нових наук в 1940-1950 роки. Метою статті є аналіз подій, коли в умовах Другої світової війни особливо виразним періодом для формування нових революційних наукових теорій стали США. На основі наробок вчених Чиказької та Франкфуртської шкіл, теоретичних праць Т. Адорно, П. Лазарсфельда, Г. Лассуелла й багатьох інших вчених до 40-их років було закладено ґрунтовну базу для швидкого й широкомасштабного прориву в багатьох галузях знань і, насамперед, у тих, що були пов'язані з проблемами управління у машинних і людино-машинних середовищах, а також у технологіях комунікації на основі радіо та перших телепередач. Методологічною основою для комплексного розгляду широкомасштабних досліджень того часу став системний підхід і порівняльний аналіз причин та майбутніх наслідків від досягнень тих років для сучасності й подальшого розвитку ХХІ сторіччя. Наукова новизна цього історичного дослідження полягає у комплексному показі взаємообумовленості та взаємодоповнюваності теоретичних і практичних розробок 40-х років для новітнього переосмислення їх значення в структурі концепції глобального управління, до створення якого підійшло людство перед початком 20-х років ХХІ сторіччя. З початком Другої світової війни Н. Вінер під керівництвом В. Буша бере участь у розробках електронної обчислювальної машини для

балістичних розрахунків та управління артилерійським вогнем і це змушує його приступити до досліджень загальних основ автоматичного управління та принципів від'ємних зворотних зв'язків у системах автоматичного регулювання. Ця робота призвела Н. Вінера до ідеї про єдність принципів управління в живих і неживих системах, що у свою чергу дало поштовх до формування кібернетичної концепції. На цьому підґрунті теоретичні піонерські розробки А. Тюрінга про принципи побудови "універсальної машини", описаної ним ще у 1937 р., були як ніколи доречні. В середині 40-х років Дж. фон Нейман побудував першу цифрову електронну обчислювану машину, а А. Тюрінг з 1945 по 1947 роки на чолі групи співробітників розробив проект "електронного мозку" та першим підготував ряд програм і розпочав роботи з навчання електронних машин. К. Шенноном було закладено наукові засади подальшого розвитку теорії інформації й теорії комунікації, що дало потужний поштовх науковим дослідженням на багато десятиліть потому. Особливе значення має виникнення основ теорії ноосфери В. Вернадського, яка тільки в ХХІ сторіччі набуває розуміння у поєднанні з комунікативістикою та загальною теорією управління. Цей комплекс основ нового наукового світобачення був вирішальним у процесі розвитку інформаційно-технологічної революції та становленні інформаційного суспільства у другій половині ХХ сторіччя. У наш час наукові ідеї того періоду стають теоретичною основою єдиної загальнопланетарної системи управління.

**Ключові слова:** історія науки; ноосфера; теорія інформації; теорія комунікації; управління

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### **Формирование коммуникативистики, информатики и кибернетики в 1940 - 1950 годы**

**Аннотация.** В данной публикации представлено становление наиболее актуальных для современности новых наук: коммуникативистики, кибернетики, теории информации и теории ноосферы в 1940-1950 годы. Целью статьи является анализ событий, когда в условиях развернувшейся на просторах Евразии Второй мировой войны особенно ярким периодом для формирования новых революционных научных теорий стали США. Работы Чикагской и Франкфуртской научных школ, теоретических концепций Т. Адорно, П. Лазарсфельда, Г. Лассуэлла и других ученых заложили к этому времени хорошую основу для мощного прорыва в ряде ключевых отраслей знаний и в общем цивилизационном мировоззрении. Методологической основой для комплексного рассмотрения широкомасштабных исследований того

времени послужил системный подход и сравнительный анализ причин и грядущих последствий достижений тех лет для современности и ближайшего будущего XXI века. Научной новизной данного исторического исследования является показ взаимообусловленности и взаимодополняемости теоретических и практических разработок 40-х годов для нового осмысления их значимости в структуре концепции общепланетарного (ноосферного) управления, к разработке которого подошло человечество к началу 20-х годов XXI века. Производственные и военные задачи, связанные с автоматическим управлением в машинных и человеко-машинных средах, с коммуникационными процессами, использующими радио и первые телепередачи, требовали принципиально новых подходов и разработок. С началом Второй мировой войны Н. Винер под руководством В. Буша принимает участие в работе над созданием электронной вычислительной машины для баллистических расчётов и управления артиллерийским огнём и это вынуждает его заняться общими вопросами автоматического управления и принципами функционирования отрицательных обратных связей в системах автоматического регулирования. Работа над этими проблемами приводит Н. Винера к идее о единстве принципов управления в живых и неживых системах, к разработке начал кибернетической концепции. В русле этого направления была также теоретическая работа А. Тьюринга по “универсальной машине”, опубликованная в 1937 г. В середине 40-х годов Дж. фон Нейман строит первую цифровую электронную вычислительную машину, а в 1945-1947 годах А. Тьюринг с соратниками работает над проектом создания “электронного мозга” и первым готовит ряд программ, приступив к “обучению” электронных машин. В 1942 г. К. Шеннон публикует работу по теории информации, в дальнейшем целой плеядой исследователей разрабатываются основы теории коммуникации. Особое значение имеет выдвижение в 1944 г. концепции ноосферы В. Вернадского. В настоящее время комплекс научных идей, выдвинутых в 40-е годы, обретает новое значение для формирования основ единой общепланетарной системы управления.

**Ключевые слова:** история науки; ноосфера; теория информации; теория коммуникации; управление

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