

*Radetska S. V.,**PhD, Associate Professor,**Head of the Chair of Theory and Practice of Branch Translation**Kherson National Technical University*

POPULAR SCIENTIFIC LITERATURE AS A MEANS OF SCIENTIFIC KNOWLEDGE POPULARIZATION: LINGUISTIC ASPECTS

Summary. Scientific literature is a unique phenomenon that contributes to enhancing the overall scientific potential of society. According to different classifications, three branches are distinguished in popular scientific literature: literature for specialists in other fields of knowledge; literature for a wide range of readers; and popular works for schoolchildren. There are also three forms of popularization: general education, intra-scientific (satisfies the needs of professionals seeking to overcome the limits of narrow specialization within their field), and inter-scientific (satisfies the interdisciplinary interests of scientists).

One of the main goals of popular science publications is the formation of a scientific outlook in the reader. This ideological function involves presentation in popular science books of knowledge about natural science and the laws of nature, highlighting achievements in the development of theoretical sciences, which open up new perspectives on science, as well as new opportunities for scientific progress.

The main purpose, however, of popular science publications is to present a worldview designed for a wide range of readers. A popular work is characterized by accessibility, specificity, and simplicity (i.e. additional or technical knowledge is not required to read it). In order to interest the reader and facilitate the perception and memorization of the information presented in the text, the author of a popular science publication uses quotations, question sentences, explanations and characterizations of terms and scientific concepts, which introduce the reader to their practical use.

Popular scientific editions have their own specific verbiage, but which vary depending on the content, function(s), purpose, readership, and genre of the work. The purpose of this article will be to identify and characterize the main verbal and figurative means characteristic of popular scientific literature, and which promote its popularization (i.e. efficacy and accessibility).

Key words: popular scientific literature, verbal and figurative means, genres of literature, popularization of science, expression category, scientific outlook, popular science.

Formulation of research question. The knowledge of the surrounding reality since the inception of human society is a necessary condition for its self-development. The process of systematic accumulation of knowledge about the world and man began in ancient times.

Bringing knowledge to “the people” has long been the aspiration of those who have given themselves over to the service of science. Valuable historical sources indicate how the dissemination of scientific information was carried out in antiquity, such as letters written by Plato, Socrates, Epicurus, Cicero, Seneca, and other thinkers.

History knows the names of scientists who went to the scaffold for promoting new scientific ideas. Galileo Galilei almost paid with his life for his famous “Dialogue”. Written in an accessible, interesting, and vividly expressive form, the “Dialogue” not only testifies to the scientist’s desire to defend a new scientific view of the world, reject an outdated concept of the universe, prove the correctness of Copernicus’s views, but also demonstrates the author’s interest in bringing new scientific knowledge to a wider readership.

Nowadays, the socio-functional purpose of publications of “popular science” is to popularize scientific knowledge, as well as achievements in science, culture, technology, art, etc., among both specialists and non-specialists in those fields of science, culture, etc., related to that which the popular scientific publication belongs [9, p. 156].

A “popular” scientific work is characterized by its accessibility, specificity, and simplicity – additional knowledge is not required for reading it. However, in order to get the reader interested, and to facilitate the perception and memorization of the information presented in a popular science text, the author uses a variety of verbal and imaginative tools, which promote the scientific knowledge presented. This means of public enrichment is an opportunity to demonstrate why analyzing the linguistic tools most appropriate for effectively writing in popular science is an extremely **pressing issue** in modern linguistics.

Statement of objectives and research tasks. The main objective of this article is to identify the effective language tools used by authors of works in popular science to achieve the goal of communicating and promoting scientific knowledge among the general public.

Analysis of research publications. Majewski M.M. considers the popularization of science as an independent and important social sphere of activity, which has its goals, tasks, means, and scope [6, p. 11]. Accelerated rates of scientific information accumulation require its rapid processing by means of popularization. In the process of popularizing science, many media channels are involved: books, periodicals, radio, television, and the Internet. Popularizing science appears in both written and oral forms. In our article, we will focus on popular scientific texts in the written form (i.e. popular scientific literature in the form of popular scientific publications).

The subject matter of a popular scientific publication can include everything related to science and research: results of scientific research; the scientific field in which particular studies are conducted; a particular object of study; scientific problems (tasks), the purpose and methods of research; the conditions under which research is conducted, and the equipment and materials used;

the facts that form the basis of the study (science), including the data from observations and experiments, discoveries, inventions, theories, laws, hypotheses, etc. [7, p. 198].

When so describing the possible subject matter of popular scientific publications, we can refer to the words of N.G. Chernyshevsky: "... Popular books re-coin a heavy ingot of gold, smelted by science" [10, p. 429]. The general subject matter of popular scientific publications can be very broad. It is determined by the needs and objectives of society, as well as the interests and demand of readers. The purpose of popular scientific publications is to promote the foundations and achievements of science, technology, culture, and the results of applied activities, among a wide mass of readers.

As for the functional properties of popular scientific publications, they are also rather diverse. The most important function of a popular scientific book or magazine is to promote the accessibility of scientific knowledge. By promoting scientific knowledge in an educational way, a scientist can convey to the masses a new awareness of science and acquaints them with the new latest scientific developments, contributing to and improving their levels of education and critical thinking. Scientific knowledge spiritually enriches the reader of a popular scientific book, awakening further cognitive interest, contributing to the development of his or her creative initiative – and finally, bringing it into knowledge [4, p. 255]. Examples of scientific developments that made a special impact on our understanding of the objective reality of our world, through their mass popularization and dissemination, include Darwin's theory of natural selection, Mendeleev's periodic law and the doctrine of Pavlov's conditioned reflexes [3, p. 85].

Presentation of materials with justification of obtained results. Popular scientific substyle contains the basic features of academic science writing, such as the logic of the presentation of information, clarity of composition, the use of complex syntactic constructions, a large number of references, and the use of technical terms and abstract vocabulary; but at the same time, popular publications have their own inherent linguistic characteristics. The specificity of specific language of popular scientific texts is determined by its aim to address a wide range of readers, the potential accessibility of the information described within it to be presented as "understandable". Presenting information in such an understandable way is largely achieved by the fact that in most popular scientific texts, the proof of scientific facts is carried out not through a description of mental operations and formulas, but through the emotionality of the examples and illustrations [5, p. 221].

The following sections will discuss stylistic features of the popular scientific linguistic substyle. The intrinsic stylistic features of the popular scientific linguistic substyle include "accessibility, simplicity, concreteness, [and] clarity, which are combined with admiration, artistic imagery, expressiveness, and emotionality" [6, p. 44]. Reading and learning scientific data in popular books can thus make it easier to understand technical terms and names. Explanations of scientific concepts and special expressions should not only include a brief description of the concept, but also use descriptive language to make the reader familiar with its application. For example: "A second example is the placebo effect – long thought to be without a physiological basis. If a sugar pill is administered to someone experiencing pain, that person reports a lessening of the pain if told the placebo will help" [11, p. 2].

Further, the technique of authorial indentation is widely used in popular scientific literature, which pauses the flow of information to

add dynamism and emotionality to the text. For example: "*I noted earlier that as many as half a million cells might be generated per minute, on average, for the first four months of gestation in humans. How and when does this happen?*" [11, p. 2]. To provide more insight for and to make contact with the reader, the author of a popular scientific work can also use the technique of asking questions, which can activate the mental activity of the reader by facilitating a perception of practical application of the presented information. For example: "I noted above that virtually all neurons are generated by about birth or certainly by six months of age. Thus, what underlies the remarkable growth of the brain in the first three to five years of life?" [11, p. 2].

We have also found that additional features of the popular scientific linguistic substyle are dynamism, imagery, concreteness, and subjective-objective character of a statement, which characterizes its lexical, phraseological, morphological, and syntactic originality. In addition, we cannot but mention the widespread use of the means of vibrant and colorful imagery (in particular, metaphors, epithets, comparisons, peripherals), as well as a wealth of forms and meanings of verbs.

Unlike texts of the academic scientific style, where the use of impersonal sentences is accepted, narration in the popular scientific linguistic substyle can employ the first person singular and plural. For example, these tenses can act in the texts as a **means of dialogue**: "**We** shall come back to this notion late" [11, p. 48]. Also: "As **I** noted earlier, many neural systems are involved in language, so lesions in other parts of the brain can also cause language deficits" [12, p. 60].

In order to attract the reader's attention to certain features of a presented subject, the author can also use **paraphrase** – a figure of speech, which replaces the name of an object with a description of it, often indicating essential and/or characteristic features [1, p. 104]. Paraphrases often contain metaphors, evaluative vocabulary, epithets, and perform an aesthetic function. For example: "This **brilliant invention** is a product of Newton's **mature years**: It apparently has no antecedent in his published or unpublished writings (Shapiro, 1980)" [14, p. 3]. "*Це блискуче відкриття є результатом років зрілості Ньютона: про це очевидно не згадується у жодних опублікованих та неопублікованих працях*" [переклад автора]. Here, the phrase "mature years" is a euphemism used for the purpose of softening the directness of expression.

Perhaps one of the most common techniques an author uses to interest the reader is **making comparisons**. Often through an analogy with phenomena and objects likely familiar to the reader that the author manages to popularize particular scientific phenomena. For example: "In the case of the foveal cones, the packing geometry is regular enough to produce moiré patterns that **look like zebra stripes**" [14, p. 76].

The use of **rhetorical questions** can also make the text vivid and emotionally expressive. Rhetorical questions confirm or deny any claim, and are grammatically presented by interrogative sentences. For example: "And what do I say? I have my own learned-in-the-trenches advice after a year of re-landscaping our backyard..." [13, p. 1]. Further, accumulation of the same syntactic units creates **gradation**. For example: "What about the adult brain? How hardwired is it? Once it is injured, is recovery possible or are we stuck with just what was there before the injury? Recent studies suggest that the adult brain is much more plastic than was long believed,

but how much plasticity can there be? What about the influence of genes on behavior? How do genes and behavior relate? This contentious subject has generated volumes...” [11, p. 11].

Spoken vocabulary also facilitates the simulation of casual, personally-addressed informal language. The use of “slangy” words, along with scientific vocabulary, brings shades of emotionality and imagery into the popular scientific text. For example, “At nine months of gestation, the brain overall looks quite adult, but it has far to go” [11, p. 10]. The use of common vocabulary in popular text helps the author to clearly explain technical scientific phenomenon and promote scientific knowledge. For example: “We see motion all around us. **Leaves fall; waves break; heavenly bodies move.** What causes motion? The answer is interaction. Interaction **makes the world tick**” [12, p. 1]. Sometimes, for expressiveness, and to capture the reader's interest, authors may occasionally use words that are saturated with usual expressiveness. We can return to the following example: “I have my own **learned-in-the-trenches advice** after a year of **re-landscaping** our backyard...” [13, p. 1].

The use of metaphor in popular scientific works, as opposed to academic scientific works, does not come from the use of any particular scientific terminology, which is typically devoid of expression, but from the use of impersonation, “which consists in the transfer of human properties to abstract concepts and inanimate objects, manifested in the valence of nouns” [1, c. 103]. For example: “Better understood is the electromagnetic interaction. **It** underlies atomic structure and chemical reactions, thus **giving** us light and fire. **It is responsible** for almost all the happenings in our daily life” [13, p. 1].

However, the use of particular and appropriate **terms** is an integral feature of any scientific text – popular or otherwise. In this case, a term is “a word or phrase of a special (scientific, technical, etc.) language that is created (received, borrowed, etc.) to accurately express special concepts and designate special subjects” [2, p. 288]. Terminology can bring simplicity and clarity to a popular work. The technical vocabulary included in works of popular science is divided according to the scope, conceptual content, and characteristic features of the object being described through general scientific terminology. It encompasses such specialized vocabulary as “niche” words and inter-industry terminology. Terminological vocabulary can be very informative, so its use can thus be an opportunity for conciseness and accuracy of presentation. However, the introduction of terms in a popular text should always be motivated by accessibility, as the abuse of highly specialized vocabulary (e.g. niche words) and the overuse of professional terminology deprives the language in popular texts of such simplicity and understandability. For example: “From a relatively few undifferentiated cells in the young embryo, all of the neurons and glial (supporting) cells arise” [11, p. 1].

As for the syntax of popular science texts, it can be quite diverse. For clarity of expression and perceived literacy, many authors resort to the use of simple sentences. For example: “What causes motion? The answer is interaction” [11, p. 1]. Although popular scientific literature often contains technical information in need of simpler explanation, so as to be better understood by the average reader, the author can still use complex sentences with different types of subtleties and separate references. For example, complex sentences with cause-and-effect relationships can actually contribute to simplifying the presentation of technical scientific information. For example: “Female brains, on average, are slightly smaller at all

ages, probably because women tend to be somewhat smaller than men” [11, p. 10].

Personal and non-personal sentences are used to describe phenomena and facts in popular science works. For example: “**It is the best quantum blueprint** of the world we have, excluding gravitation” [12, p. 179].

While popular scientific literature clearly has something in common with traditional academic scientific publications, it also shares linguistic features with fiction. It is similar to fiction in that it allows for the use of spoken vocabulary, metaphorical imagery of expressive-evaluative means, and the manifestations of the author's individuality and subjectivity. Like fiction, popular science can contain emotional and aesthetic information. However, if imagery in a work of fine art is a sign of its style, in works of popular science, imagery is used **appropriately** to demonstrate already formed thought [8, p. 186]. In a work of popular science, a particular image can be replaced without any loss of progress in the scientific presentation of thought.

The logic of the presentation of the material, the clarity of the composition, the authenticity of scientific facts, and the richness of terms and abstract vocabulary, all come together in popular scientific works, as in academic scientific publications. Both present critical intellectual information. In the case of popular scientific literature, such a combination of stylistic means and information is not a departure from its academic origins, since in the popular scientific linguistic substyle, the norms of scientific writing serve to support effective popularization – namely, the promotion of science, an independent and important social sphere of activity with goals, objectives, tools, and scope. Popular science explains, specifies, and provides scientific information to a wide audience of thinkers. It is designed for a wide range of readers, for whom no additional knowledge in a particular field will be needed to discover and learn about the great scientific wonders of our world.

Conclusions. In conclusion, we would like to note that the most fundamental means of the popularization of scientific knowledge continues to be the publication of books (and other print materials) on popular science. In a broad sense, a popular scientific book is a publication containing accessible information about theoretical and/or experimental research, while also intending to popularize and promote the foundations and achievements of science and technology, as well as the results of experiments.

The popular scientific style of narration is characterized by a pronounced use of figurative and expressive language. Linguistic understanding of the figurativeness of speech is based on the use of words in a figurative meaning. For example, the widespread use of paraphrase in popular scientific works can be explained by the author's desire to draw the reader's attention to those features of the depicted objects or phenomena that are most important in a cognitive sense to the scientific subject. The use of analogy and comparison affects the possibility of popularizing complex phenomena by basing such in terms of modern reality. In particular, comparisons help to explain scientific terminology to the average reader.

Simplicity and clarity in popular science publications are closely related to the use of specific terminology. The use of particular terminology in popular scientific works depends on characteristics of the audience, such as education and age. Elements of conversational style are also widely used to make the texts more accessible. A tendency toward colloquial construction and the use

of dialectical grammatical constructions are characteristic of colloquial speech. In the end, this wide variety of linguistic and stylistic means, and their role in the popularization of science, present significant difficulties for any translator of popular scientific literature, and require a breadth of professional and creative abilities. **The aim of our future research** will be to determine the most equivalent and adequate ways of translating language tools used in popular scientific texts, so as to attract readers' attention around the world to available and cutting-edge scientific information and discoveries!

References:

1. Arnold I.V. Stylistics. Modern English: A Textbook for High Schools. 4th ed., Rev. and add. Moscow : Flint: Nauka, 2002. 384 p.
2. Akhmanova O.S. Dictionary of linguistic terms. Moscow : Sov. Encyclopedia, 1969. 608 p.
3. Valgina N.S. Theory of the text. Schoolbook. Moscow : Logos, 2003. 280 p.
4. Krupskaya N.K. Speech at the VIII All-Union Congress of the Komsomol. *Krupskaya N.K. Ped writ.* In 10 volumes. Moscow : APN of the RSFSR, 1959. V. 5. 255 p.
5. Kutuzova G.I. Interdisciplinary communication in the training of foreign students. SPb. : Polytechnic. University, 2008. 378 p.
6. Mayevsky N.N. Features of the popular scientific style : dis ... kand., filol., nauk : 10.12.01. R n / a, 1978. 307 p.
7. Milchin A.E., Cheltsova L.K. Reference book of the publisher and author. Moscow : Olympus, 1998. 687 p.
8. Rusanivsky V.M. Mova i hour: Development of functional styles of modern Ukrainian literature. Kyiv : Naukova Dumka, 1977. 235 p.
9. Stefanov S.I. Advertising and printing: the experience of a dictionary. Moscow : Gella-print, 2004. 320 p.
10. Chernyshevsky N.G. Selected philosophical works. Moscow : Politizdat, 1978. 807 p.
11. Dowling John E. The great brain debate. Washington D.C. : Joseph Henry Press, 2004. 179 p.
12. Huang K. Fundamental forces of nature : The story of Gauge Fields. New Jersey : World Scientific, 2007. 265 p.
13. Marken B. A small thinker. *Design.* Apr 2006. P. 10.
14. Shevell S. The science of color. 2nd Ed. London : OSA, 2003. 325 p.
15. Thompson P. The voice of the past. New York : Oxford University Press., 2000. 368 p.

Радецька С. В. Науково-популярна література як засіб популяризації наукових знань: лінгвістичні аспекти

Анотація. Наукова література є унікальним явищем, яке сприяє підвищенню загального наукового потенціалу суспільства. Згідно з різними класифікаціями в науково-популярній літературі виділяються три гілки: література для спеціаліста з інших областей знань; література для широкого кола читачів; науково-популярні твори для школярів. Виділяють також три форми популяризації: загальноосвітню, інтранаукову (задовольняє професійні потреби спеціалістів, які прагнуть подолати межі вузької спеціалізації в межах своєї науки) та інтернаукову (задовольняє міждисциплінарні інтереси вчених).

Однією з головних цілей науково-популярного видання є формування наукового світогляду читача. Світогляд на функція передбачає виклад у науково-популярній книзі природничо-наукових знань і законів природи, висвітлення досягнень у розробці теоретичних проблем, що відкривають нові перспективи науки і на її основі – нові можливості прогресу виробництва.

Головною метою науково-популярного видання є формування світогляду, який розрахований на широке коло читачів. Науково-популярний твір характеризується доступністю, конкретністю та простотою, тому для його прочитання додаткові знання не є обов'язковими. Аби зацікавити читача та полегшити сприймання та запам'ятовування інформації, викладеної в науково-популярному тексті, автор під час написання твору використовує авторські виступи, запитальні речення, надає пояснення термінам та науковим поняттям, характеризує поняття і знайомить читача з його застосуванням.

Науково-популярні видання мають свої певні словесно-образні засоби, які залежать від змісту, функцій, цільового призначення, читацької аудиторії, жанру твору. Метою нашої статті буде саме визначення та надання характеристики основним словесно-образним засобам, які є характерними для науково-популярної літератури і сприяють її популяризації.

Ключові слова: науково-популярна література, словесно-образні засоби, жанри твору, популяризація науки, категорія експресії, науковий світогляд.