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PERSONIFICATION IN SCIENTIFIC DISCOURSE: MERE RHETORICAL EMBELLISHMENT OR A POTENT HEURISTIC TOOL? (BASED ON THE LECTURES BY R. FEYNMAN)

Summary. Metaphorical language is common in scientific dicourse, mainly because it helps researchers to explain and categorize abstract concepts that would otherwise be overwhelming. However, at present many scientists and philosophers harshly criticize the use of metaphors, particularly personifications, in science due to their potential misleading effect. This, in our view, calls forth the need for more extensive research on the frequency and functions of these devices across various academic genres.

This study is focused on the use of personification in physics lectures by renowned American physicist, Nobel laureate and charismatic science communicator Richard Feynman. The material comprises three collections of his lectures, the most important one being the Feynman Lectures on Physics, a transcript of his inroductory physics lectures taught at the Caltech Univesity in 1961–1963. The object that was found to be most commonly personified in Feynman's lectures is nature: the author endows her with remarkable will, intelligence and, most importantly, imagination, which is recurrently contrasted with poor imagination of humans. Personification of nature has a long history in science and has numerous epistemological implications, which are also discussed in the article. Furthermore, the author tends to personify elementary particles, describing their interactions as if resulting from their volitional acts (they "want", "would like" and "feel" like doing something). Besides, their movements are depicted in a very intricate and detailed manner, sometimes characterized in terms of dance. It is suggested that the use of this kind of personification is not limited to pedagogical and aesthetical purposes in Feynman's lectures. It is rather a distinctive feature of his scientific reasoning, which, coupled with his visual mindset, enabled the researcher to develop a valuable graphical method for describing and calculating the particles' interactions, known as "Feynman diagrams". More research is needed on personification and other types of metaphors in science to understand their benefits and limitations more clearly.

Key words: personification, metaphor, Richard Feynman, lectures, scientific discourse, nature.

Introduction. At present there is a growing recognition of the fact that scientific discourse does not consist of objective data only: it necessarily involves personal interpretation of facts, self-positioning and a great deal of persuasion, especially in today's cut-throat academic setting. Moreover, scientific writing is abundant with figurative language, mostly metaphors, helping scientists to come to grasp with highly complex and abstract ideas, which have nothing in common with human's direct physical experience. It is particularly relevant for modern astrophysics, cosmology, quantum mechanics, which focus on the phenomena that seem mind-boggling even for scientists themselves, to say nothing of the lay audience. The importance and functions of metaphor in science have been investigated in depth by philosophers of science and rhetoricians [1; 2; 3; 4; 5]. Among linguists, the dominant opinion is that figurative language as such and metaphors in particular are inalienable part of scientific communication, which helps with understanding and retaining of complex material [6, p. 168]. Some researchers point out, however, that despite its numerous benefits, the common use of metaphors in science can present some obstacles, constraining scientific reasoning and occasionally misrepresenting the facts to the public [7]. Rising to the defence of metaphors in scientific writing in the context of much criticism they get, astrobiologist C. Scharf aptly notes: "Good metaphors are incredibly useful, bad ones a painful detour, but usually the intent is noble – it's all about trying to communicate our knowledge of a truly vast, complicated, and really very interesting universe" [8].

This study is focused on personification – a type of metaphor, which can be broadly defined as attribution of human qualities to inanimate objects or animals. In their recent monograph, W. Melion and B. Ramakers [9, p. 1] provide the following definition of personification: "the rhetorical figure by which something not human is given a human identity or face". It is often regarded as one of the manifestations of animistic mentality, which is vividly represented in the folklore. It is common to distinguish personification from animation, associating the former with human qualities and the latter with animal qualities [6, p. 165]. Since the dawn of rhetoric it has been treated as a variety of metaphorical transposition, though modern classifications of rhetorical devices tend to regard them separately. From the viewpoint of cognitive linguistics, personification is a kind of ontological metaphor, i.e. a conceptual metaphor, which implies the representation of an abstract object in terms of concrete object [10]. G. Lakoff and M. Johnson [10, p. 33] emphasize that personification is far from unified, as the particular salient features of a person selected for the cross-mapping can be largely different: thus, the metaphors INFLATION IS A DEVOURER and INFLATION IS A DESTROYER both exemplify personification but they are different in terms of agent positioning.

Literature review. Personification has been widely investigated with a focus on its functions in fiction literature [9; 11; 12; 13]. Less attention has been given to personification in scientific writing, despite its pervasive use in this context. In one of the few studies addressing this issue S. Darian analyzed rhetorical devices in introductory-level science texts and found out that personification was even more prevalent than analogy within his sample [6]. The researcher argued that this device benefitted the students'

comprehension and memorization of scientific information, along with other rhetorical devices, commonly found in scholar texts. However, not everyone is enthusiastic about personification in science: some philosophers and scientists see it as revival of animism in science and discard it as primitive and objectively false [14]. Thus, the legitimacy and particular functions of personification's use in scientific discourse is an interesting question worth further discussion.

The **purpose of this article** is to analyze personification in the lectures by prominent American physicist Richard Feynman (1918–1988), situating it in the broader context of his worldview and scientific approaches. For specialists in physics, Richard Feynman is best known for laying the groundwork for quantum electrodynamics – the achievement that was recognized with the Nobel Prize in 1965. However, for the lay public, Feynman is rather known as a passionate popularizer of science, a prankster and the author of two best-selling memoirs [15; 16]. The study is based on three collections of lectures by Feynman (one of them in the video format), though most of the examples come from the three-volume edition of the Feynman Lectures on Physics (henceforth FLP), which is still widely used as a textbook for introductory physics courses in US colleges. To identify the frequency and contextual valency of the personification markers we have utilized AntConc software [17].

Results and discussion. Personification is strikingly common in the Richard Feynman's lectures, with nature being the foremost object of personification (25 cases in FLP only). This is quite understandable, taking into consideration the essence of physics as a field focusing on the laws of nature. Nevertheless, the amount of attention the author pays to it in his numerous and detailed digressions goes far beyond the mere exposition and explication of such laws. The lexeme *nature* in the FLP is collocated with a wide array of verbs denoting mental (*to know, to care, to want, to be interested in*), material (*to conserve, to adjust, to use, to work*) and verbal (*to tell, to demand, to permit*) processes. In his discourse it is portrayed as an independent, rational and self-governing being, whose mind and imagination surpass those of humans to a great extent:

Therefore our main concentration will not be on how clever we are to have found it all out, but on how clever nature is to pay attention to it [18, p. 14].

We are not to tell nature what she's gotta be. <…> She's always got better imagination than we have [19, Lecture 1].

The author is particularly prone to resort to personification when reflecting on the independence of nature from the notions and conventions of scientists, which are too narrow for its correct representation. In this context, the lexeme *nature* is typically followed with a verb in the negative form:

Nature does not care what we call it, she just keeps on doing it [20, I. 1].

Nature does not know what you are looking at, and she behaves the way she is going to behave whether you bother to take down the data or not [20, III. 3].

The combination of *nature* with negative verb forms also often marks the lecturer's explication of his personal concept of "amalgamation" (elsewhere it is more broadly known as unification) – endeavor to understand nature as various facets of the same set of phenomena, thus unifying the efforts of different scientific fields. While he is not sure that everything can be amalgamated, he keeps repeating throughout his lectures that separation between fields of science is artificial and true science must be interdisciplinary in its essence:

If our small minds, for some convenience, divide this glass of wine, this universe, into parts – physics, biology, geology, astronomy, psychology, and so on – remember that nature does not know it! [20, I. 3].

Nature is not interested in our separations, and many of the interesting phenomena bridge the gaps between fields [20, I. 35].

We suggest that this type of personification, which is ubiquitous in Richard Feynman's discourse, not so much serves the interpersonal goal of making complex material more accessible to the audience but rather reflects his own attitude to nature, which he had for most, if not all, of his life. It is not just a turn of phrase for him: the researcher essentially perceives nature as an alive being that reasons, feels, chooses some particular manner of action depending on some intentional goal. It is not a randomly generated set of laws, but a dynamic process, where every element (whether at micro- or macroscopic level) plays an assigned role. Certainly, these notions underlie his obvious fascination with the majesty and complexity of nature, the almost religious awe for it he expresses in lectures, memoirs and other pieces of his writing. The question of the relation between the capabilities of nature and human mind is not solved in favor of the latter, according to Feynman: he frequently describes human cognitive skills as too limited ("our minds are limited", "our limited knowledge"). Nature, on the other hand, is "clever" ("it cannot be fooled") and possesses "unlimited imagination", she is allegedly trying to conceal her mysteries and true intentions, which only serves to strengthen the scientists' passion for unravelling its complexity and global plan.

The contrasting of nature's imagination with the human one is one of the recurrent themes in Feynman's discourse, encountered not only in the lectures, but also in his memoirs and even interviews, e. g.

As usual, nature's imagination far surpasses our own, as we have seen from the other theories which are subtle and deep [15, p. 162].

Nature's imagination is so much greater than man's, she's never gonna let us relax [21].

Related to the author's concept of nature's incredible imagination is his strong emphasis on the importance of highly developed imagination for scientists (particularly in Lecture 20, Volume II in FLP), while this is not common for other lecturers in this field to prioritize this skill.

To look at this issue more broadly, personification of nature has always been a staple of natural sciences. A classical example is the famous principle Natura abhorret vacuum ("nature abhors a vacuum"), which is attributed to Aristotle. Personification in science has important epistemological implications. Jeanne Fahnestock [22, p. 172–173] vividly describes the hardships encountered by Charles Darwin after the publication of his revolutionary book "On the Origin of Species" because he combined the term natural selection (his coinage) with verbs associated with human agency (to modify, to scrutinize etc.) and occasionally even capitalized it. Attribution of agency to this process caused the complaints that the term might not be appropriate in general. Also, the scholar was accused of identifying nature with the active role of Divinity. Thus, in subsequent editions of his book, he applied much effort to

justify the validity and relevance of this term, as well as to explain that he did not mean any personal agency in the process of natural selection. Today many researchers and philosophers of science tend to express a sharply negative view of personification of nature in science, often referring to it as "pathetic fallacy", the term coined by John Ruskin to denote the sentimental attribution of human emotions to inanimate objects in literature and art [14]. Thus, Alistair B. Fraser derisively labels the studies that resort to personification as "animism masquerading as science" [23]. However, based on the lectures by R. Feynman, personification of nature can hardly be considered as harmful. He uses it to stimulate the interest of their students in "outsmarting" it, for which purpose they needed to have very strong imagination and firm physical knowledge.

However, it is not only nature on the whole that is personified in Feynman's lectures, but also its more specific objects, such as elementary particles (43 instances in FLP). The scientist endows molecules atoms and electrons with perceptive and cognitive abilities, as if they were animate creatures, e. g.

We could also say this in another way – that the electrons "felt" the field, and responded by deflecting upward [20, I. 12].

So if an electron, before it starts, has already made up its mind [a] which hole it is going to use, and [b] where it is going to land <…> [20, III. 1].

The verb of perception to feel is one of those most frequently collocated with nouns denoting elementary particles. However, it also predicates other nouns, such as charge (referring to "electric charge"), magnet, state, earth (in the overall, in FLP we find over 50 instances of this verb being used in the context of personification).

The movement of atoms and subatomic particles is often described in Feynman's lectures in such a vivid and intricate manner as "jiggling and bouncing, turning and twisting around", "they hit more often", "they squash together", "they do fly apart". Moreover, in a few instances the interaction between particles is represented as a dance, which is clearly a humanlike activity, e. g.:

The iron atoms are like small magnets; as they jiggle around in their thermal dance, they make tiny jiggling magnetic fields at the protons [20, II. 35].

Based on the analysis of Feynman's famous lecture "Atoms in Motion" (included in FLP), D. Treagust and A. Harrison [24] argue that the use of anthropomorphic metaphors is one of the distinctive features of the scientist's explanatory style. Apart from anthropomorphisms, the researchers also identify in Feynman's lecture discourse the so-called teleological metaphors, which, however, can also be described in terms of personification, if viewed more broadly. They are intended to explain the reason of some physical phenomenon more clearly by ascribing human feelings and emotions to the objects involved. Thus, according to Feynman, the combination of atoms to form an oxygen molecule happens because "they like certain partners", "each one wants what it wants". In this way, the scientist once again attributes elementary particles with personal will and reasoning. D. Treagust and A. Harrison [24, p. 1166] suggest that by using such statements Feynman seeks to circumvent the necessity to address the notions, which are too complex for the current level of the course. Therefore, personification is to some extent instrumental for his pedagogical purposes, while also reflecting his vivid imagination of the underlying physical processes.

We believe that Feynman's dynamic and animated perception of elementary particles as objects that "communicate" with one another based on their "thoughts" and "feelings" could have contributed to his incredible success in the visualization of electromagnetic interaction of elementary particles in the so called "Feynman diagrams". These are two-dimensional pictures, where the horizontal axis represents space and vertical axis represents time, while lines and points represent particles and places of local interaction, respectively. This limited set of elements can be used to draw a diagram for any process in quantum electrodynamics, the field that was essentially pioneered by Feynman. The diagrams are supplemented with the algorithm, enabling one to calculate the probability of particular particles' interaction. For this reason, they serve not merely as an illustration of abstract principles, but also as a method of analysis of interactions in the quantum field theory, which is still being widely used by physicists. Remarkably, though, when Feynman first presented his newly-developed visual technique at a scientific conference, he was met with criticism and resistance, which his contemporary physicist Freeman Dyson explains as follows: "Other people's minds were analytical. His was pictorial" [25, p. 34]. It seems to us that the development of such a powerful heuristic tool as "Feynman diagrams" would not have been possible without the researcher's vibrant imagination, which portrays particles as entering dynamic and in many cases unpredictable interactions of their own volition.

Conclusions. To sum up, personification seems a hallmark of Richard Feynman's authorial style in his lectures. First and foremost, he tends to personify nature, emphasizing its cleverness and unsurpassable imagination, which produces things that are incomprehensible to human mind, like many of the quantum effects. Nature is represented as a reasoning and self-willed female, who does not care about constrained scientific notions and conventions and can only be understood properly if scientists unite their efforts to interpret all phenomena as interrelated at different levels. However, even more remarkable is Feynman's common personification of atoms and subatomic particles, which he attributes with cognitive and emotional capabilities, as well as autonomy in decision-making. Apart from having great pedagogical value in serving to explicate the processes, which are too complex to focus on at the current stage of the course, this kind of personification also has some epistemological implications. We suggest that Feynman's tendency to view elementary particles in anthropomorphic images played a pivotal role in the development of his major achievement, the "Feynman diagrams". Due to the highly polarized views on metaphorical language in science today, we believe that this issue merits further exploration, with regard for different genres and disciplines.

References:

1. Kuhn T.S. Metaphor in science. *Metaphor and thought* / ed. A. Ortony. Cambridge, MA : Cambridge University Press, 1993. P. 409–419.
2. Brown T.L. Making truth: metaphor in science. Urbana, IL : University of Illinois Press, 2003. 215 p.
3. Larson L., Brendon M.H. Metaphors for environmental sustainability: redefining our relationship with nature. New Haven, CT : Yale University Press, 2011. 301 p.
4. Nerlich B., Elliot R., Larson B. Communicating biological sciences: ethical and metaphorical dimensions. Farnham, UK : Ashgate Publishing Company, 2016. 266 p.
5. Shea P.E. How the Gene Got Its Groove: Figurative Language, Science, and the Rhetoric of the Real. New York : State University of New York Press, 2009. 148 p.

6. Darian S. The role of figurative language in introductory science texts. *International Journal of Applied Linguistics*. 2000. Vol. 10. № 2. P. 163–186.
7. Taylor C., Dewsbury B.M. On the problem and promise of metaphor use in science and science communication. *Journal of Microbiology & Biology education*. 2018. Vol. 19. № 1. P. 19.1.46. DOI: 10.1128/jmbe.v19i1.1538.
8. Scharf C.A. In defense of metaphors in scientific writing. *Scientific American*. 2013. URL: https://blogs.scientificamerican.com/life-unbounded/in-defense-of-metaphors-in-science-writing/ (accessed: March 3, 2021).
9. Melion W.S., Ramakers B. Personification: Embodying Meaning and Emotion. Leiden. Boston : Brill, 2016. 756 p.
10. Lakoff G., Johnson M. Metaphors We Live By. Chicago, IL : University of Chicago Press, 1980. 242 p.
11. Hamilton C.A. Mapping the mind and the body: On W.H. Auden's personifications. *Style*. 2002. Vol. 36. № 3. P. 408–427.
12. Paxson J.J. The Poetics of Personification. Cambridge : Cambridge University Press, 1994. 224 p.
13. Dorst L. Personification in discourse: Linguistic forms, conceptual structures and communicative functions. *Language and Literature*. 2011. Vol. 20. № 2. P. 113–135. DOI: 10.1177/0963947010395522.
14. Luu C. Personification is your friend: the language of inanimate objects. *Jstor Daily*. 2016. URL: https://daily.jstor.org/personification-is-your-friend-the-amazing-life-of-letters/ (accessed: October 15, 2020).
15. Feynman R.P. "Surely you're joking, Mr. Feynman!": Adventures of a Curious Character / ed. R. Leighton. New York, NY : W.W. Norton Company, 1985. 352 p.
16. Feynman R.P. What do you care what other people think? New York, NY : Bantam Books, 1989. 256 p.
17. Anthony L. AntConc [Version 3.5.7]. Tokyo, Japan : Waseda University, 2017. URL: http://www.laurenceanthony.net/software (accessed: November 10, 2018).
18. Feynman R.P. The Character of Physical Laws. Cambridge, MA : MIT Press, 1965. 173 p.
19. Feynman R.P. The Douglas Robb Memorial Lectures. University of Auckland, 1979. URL: https://www.youtube.com/watch?v=eLQ2atfqk2c (accessed: June 19, 2020).
20. Feynman R.P. The Feynman Lectures on Physics. The California Institute of Technology, 1963. URL: http://www.feynmanlectures.caltech.edu/ (accessed: May 13, 2020).
21. Feynman R.P. Fun to Imagine*:* Interview with Richard Feynman. BBC, 1983. URL: https://www.youtube.com/watch?v=P1ww1IXRfTA (accessed: August 12, 2020).
22. Fahnestock J. Rhetorical Style: The Uses of Language in Persuasion. Oxford, UK : Oxford University Press, 2011. 449 p.
23. Fraser B. Bad Science. *Penn State University of Earth Sciences and Mining*, 2015. URL: https://www.ems.psu.edu/~fraser/Bad/PatheticFallacy.html (accessed: December 12, 2020).
24. Treagust D.F., Harrison A.G. In search of explanatory frameworks: an analysis of Richard Feynman's lecture "Atoms in motion". *International Journal of Science Education*. 2000. Vol. 22. № 11. P. 1157–1170.
25. Bizoni P. Atom: Icon Science. London, UK : Icon Books, 2017. 224 p.

Крамар Н. А. Персоніфікація в науковому дискурсі: риторична оздоба чи важливий евристичний інструмент? (на матеріалі лекцій Р. Файнмана)

Анотація. Метафорична мова є звичною в науковому дискурсі насамперед тому, що вона допомагає дослідникам зрозуміліше викласти та категоризувати складні абстрактні поняття. Однак сьогодні багато вчених і філософів науки жорстко критикують використання метафор, зокрема персоніфікацій, у науковому контексті через їхній потенційний ефект викривлення інформації. Це, на нашу думку, зумовлює потребу в глибшому вивченні частотності та функцій цих засобів у різних академічних жанрах.

У дослідженні проаналізовано вживання персоніфікації в лекціях із фізики відомого американського фізика, Нобелівського лауреата та харизматичного популяризатора науки Річарда Файнмана. Матеріал дослідження охоплює три зібрання його лекцій, основне з яких – «Файнманівські лекції з фізики», транскрибований вступний курс лекцій, який автор читав у Каліфорнійському технологічному інституті в 1961–1963 рр. Ми виявили, що об'єктом, який найчастіше зазнає уособлення в дискурсі Р. Файнмана, є природа: автор приписує їй неабияку волю, розум і, найголовніше, уяву, що послідовно протиставляється обмеженій уяві людей. Персоніфікація природи має давню історію в науці та несе в собі численні епістемологічні імплікації, яких ми торкаємося у статті. Окрім природи загалом, автор схильний до персоніфікації елементарних частинок, описуючи їх взаємодію як результат їхнього свідомого волевивлення (вони «бажають» щось зробити та «відчувають» потребу в чомусь). Крім того, їхній рух учений описує дуже деталізовано й образно, іноді характеризуючи його як «танець». У статті висловлено припущення, що використання такої персоніфікації в лекціях Р. Файнмана зумовлене не лише педагогічними та естетичними цілями. Це визначальна риса його наукового мислення, яка в поєднанні з його візуальним типом сприйняття дала відомому фізикові змогу розробити цінний графічний метод опису та розрахунку взаємодії часток, відомий як «діаграми Файнмана». Є потреба в подальших дослідженнях вживання персоніфікації та інших видів метафори в науковому дискурсі з метою кращого розуміння переваг і потенційних небезпек, які вони несуть у цьому контексті.

Ключові слова: персоніфікація, метафора, Річард Файнман, лекції, науковий дискурс, природа.