

GRAMMATICAL METAPHOR IN ENGLISH SCIENTIFIC DISCOURSE

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Abstract. The article examines grammatical metaphor as one of the defining features of English scientific discourse. On the basis of systemic functional linguistics, the study analyzes the ideational and interpersonal types of grammatical metaphor, the role of nominalization in the construction of technical terms, the organization of information flow and the expression of causal reasoning, as well as its connection with objectivity and hedging. Disciplinary differences and the problems of rendering English grammatical metaphor in Uzbek are also discussed.

Keywords: scientific discourse, grammatical metaphor, nominalization, congruent realization, lexical density, information flow, interpersonal metaphor, hedging.

Scientific discourse differs from other types of discourse not only in its vocabulary but also, and perhaps more fundamentally, in its grammar. A reader who knows every term in a research article may still find it difficult to follow, because the meanings of the text are packed into grammatical structures that are rarely used in everyday language. Compare two ways of reporting the same event: the glass cracked because the pressure increased and the increase in pressure caused the cracking of the glass. The first sentence is typical of spoken language, where processes are expressed by verbs and logical relations by conjunctions; the second is typical of scientific writing, where processes are turned into nouns and the causal relation is expressed by a verb. M.A.K. Halliday described the second type of wording as grammatical metaphor and considered it the most important grammatical resource of the language of science [Halliday, Martin, 1993].

In systemic functional linguistics, every meaning has a congruent realization, that is, the most natural way of expressing it in grammar: participants are expressed by nouns, processes by verbs, qualities by adjectives and logical relations by conjunctions. Grammatical metaphor arises when a meaning is realized incongruently, by a grammatical class or structure that typically expresses a different kind of meaning [Halliday, Matthiessen, 2014]. Unlike lexical metaphor, which involves a transfer of meaning from one word to another, grammatical metaphor involves a transfer from one grammatical category to another, while the lexical content remains largely the same: increase and the increase, stable and stability, because and cause. Two main types are traditionally distinguished: ideational grammatical metaphor, which concerns the representation of experience, and interpersonal grammatical metaphor, which concerns the expression of modality and attitude.

The central mechanism of ideational grammatical metaphor in English is nominalization. Processes become things (they analyzed the data – the analysis of the data; the cell divides - cell division), qualities become things (the system is stable – the stability of the system; the solution is acidic – the acidity of the solution), and logical relations become processes or things (so – leads to, results in; because – the reason for, the cause of). Halliday has shown that this grammar did not appear by chance: it gradually developed in English scientific writing from the time of Isaac Newton and Joseph Priestley, as scientists needed

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linguistic means for constructing chains of reasoning in which the result of one step becomes the starting point of the next [Halliday, Martin, 1993].

The first function of grammatical metaphor in scientific discourse is the construction of technical terminology. A nominalized process can be treated as a stable concept, classified, measured and defined. Many basic terms of the natural sciences originated in this way: evaporation, condensation, diffusion, oxidation, transcription, mutation. Once a process has been turned into a thing, it can be further modified and subclassified, as in passive diffusion, facilitated diffusion and active transport. In this sense grammatical metaphor serves as a bridge between grammar and terminology: a process described in one clause becomes a term in the next sentence and finally a node in the taxonomy of the discipline. This mechanism complements lexical metaphor, which creates terms by transferring the names of familiar objects to new concepts, as in black hole or messenger RNA.

The second function is textual and concerns the organization of information flow. In scientific texts, a nominal group frequently summarizes what was said in the previous sentence and turns it into the theme, or point of departure, of the next one: the temperature of the sample was raised to 80 °C. This increase in temperature resulted in a significant decrease in viscosity. The nominalization this increase in temperature condenses the preceding clause into a single participant, links the two sentences and allows the author to say something new about it. Without it, the same argument would require long chains of clauses.

The third function is the expression of reasoning within the clause. In congruent language, causal and other logical relations are realized between clauses by conjunctions such as because, so and if. In scientific discourse, they are frequently realized within a single clause by verbs (cause, lead to, result in, contribute to, depend on), prepositions (due to, as a result of, in the presence of) or nouns (cause, effect, consequence, factor). The sentence prolonged exposure to ultraviolet radiation leads to the degradation of the polymer presents the causal relation as a process linking two abstract participants. This allows the strength of the relation to be graded: a writer may choose between causes, leads to, contributes to and is associated with, depending on how certain the evidence is.

A direct linguistic consequence of these functions is the high lexical density of scientific writing. Halliday measured lexical density as the proportion of lexical (content) words to the total number of words or clauses and showed that written scientific English is considerably denser than spoken English, because more lexical items are packed into fewer clauses [Halliday, 1989]. D. Biber and B. Gray have confirmed this tendency on corpus data and have demonstrated that over the last century academic English has shifted from a clausal to a phrasal style of complexity, with an increasing use of nominalizations, attributive nouns and prepositional phrases as noun modifiers, as in the cell membrane permeability measurement results [Biber, Gray, 2016]. Such structures are highly economical, but they make the logical relations between their components implicit and therefore place a considerable burden on the reader.

The fourth function is related to the impersonality and objectivity of scientific discourse. Nominalization makes it possible to omit the agent of a process: in the analysis of the data revealed a strong correlation, it is not stated who carried out the analysis, and the result is presented as following from the data rather than from the actions of the researcher. Interpersonal grammatical metaphor works in a similar direction. Instead of the congruent modal verb, as in this mechanism may explain the results, an author can use an objectified expression of probability: it is possible that this mechanism explains the results, or there is a possibility that.... These choices are closely linked with hedging: by objectifying or

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subjectifying modality, the writer controls the degree of commitment to a claim and the extent to which the claim is presented as personal opinion or as established knowledge [Hyland, 2005]. K. Hyland emphasizes that the choice between such forms differs across disciplines, with the humanities and social sciences making more explicit use of the author's voice than the natural sciences [Hyland, 2000].

At the same time, grammatical metaphor has its costs. The most frequently mentioned of them is the difficulty of scientific texts for non-specialists and novice readers, who must unpack nominalizations to understand who did what and why. Another problem is ambiguity: a nominal group such as the growth of the population of bacteria can be interpreted in more than one way, since the nominalized form does not specify tense, aspect or agent. Halliday and Martin point out that the grammar of science, which makes scientific knowledge possible, also makes it less accessible and can create a barrier between experts and the general public [Halliday, Martin, 1993]. For this reason, popular science texts and textbooks tend to use more congruent wording than research articles, which shows that the density of grammatical metaphor depends on the genre and the addressee.

The study of grammatical metaphor is also important from a contrastive perspective. In Uzbek scientific texts, nominalization is realized mainly by verbal nouns with the suffixes -sh/-ish and by abstract nouns with -lik, as well as by compound verbs such as tahlil qilinadi and amalga oshiriladi [Qo'ng'urov, Begmatov, Tojiev, 1992]. However, long English nominal groups with several premodifiers have no direct structural equivalent in Uzbek and are usually rendered by genitive constructions or by subordinate clauses: the cell membrane permeability can be translated as hujayra membranasining o'tkazuvchanligi. When translating English scientific texts into Uzbek, the translator therefore often has to partially unpack grammatical metaphors, and when Uzbek researchers write in English, they need to master the nominal style expected by international journals.

To sum up, grammatical metaphor is not a stylistic decoration but a systemic feature of English scientific discourse that reconstrues experience as a world of abstract things and relations between them. It performs terminological, textual, logical and interpersonal functions: it creates technical terms, organizes information flow, expresses reasoning within the clause and regulates the author's commitment to claims. Its density varies according to the discipline, the genre and the addressee, and its analysis is essential for understanding how scientific knowledge is constructed and communicated in English, as well as for translating scientific texts into Uzbek.

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