

# Selected Quantitative Characteristics of Syntactic Structures in Contemporary Theoretical Scientific Texts Written in Czech

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## **Abstract**

The paper describes a selection of quantitative characteristics distinguishing the predicate in contemporary Czech theoretical scientific style. Our analysis of selected quantitative characteristics of the given sentence member aims to substantiate or refute differences among present-day theoretical scientific texts of various orientations. In order to achieve our targets, the research was based on a corpus of monological texts representing contemporary scientific communication written in Czech. The corpus thus includes team and authorial monographs, thematically divided into five fields recognised by the Czech Science Foundation (hereinafter GAČR). The completed frequential analyses support our claim that contemporary Czech theoretically scientific discourse avoids complicated sentence structures or complicated compound sentences, employing lucid and clearly organised syntax instead. The scientific information is condensed into longer simple sentences and shorter compound sentences, showing preference of not very complex, concise, often formalised expression. The styling of scientific texts into longer simple sentences and shorter compound sentences is typical of all researched groups of fields and is reflected in succinctness, coherence and general tendency to economy of expression resulting from the natural ambition to communicate the content in the most comprehensible way. Contemporary Czech theoretical scientific discourse conveys the specific content in a succinct, coherent, formalised and isolated manner. The analyses of selected quantitative characteristics of syntactic structure did not evidence in the corpus of professional communication written in contemporary Czech prominent processes of linguistic differentiation between individual groups of fields. More distinctive proportions were documented in the group of technical fields with mathematics in contrast with other fields. Mathematical discourse is typified, most distinctly in the whole corpus of differentiated texts, by concise and coherent expression.

**Key words:** style, linguistics, theoretical and scientific discourse, sentence, compound sentence, humanities and social sciences

The paper describes a selection of quantitative characteristics distinguishing the predicate in contemporary Czech theoretical scientific style. It was prompted by the contention that “the sentence structure in professional style shows considerable variations reflecting authorial individuality as well as the orientation and character of the thematically relevant scientific field” (Krčmová 2008, 216). Although in professional communication “many sentence features may be stylistically less conspicuous” (Těšitelová 1985, 99), compared e.g. to vocabulary, they do appear in professional style yet with lower intensity. Our analysis of selected quantitative characteristics of the given sentence member aims to substantiate or refute differences among present-day theoretically scientific texts of various orientations.

Through describing selected syntactic features within the corpus of contemporary theoretically scientific discourse, the paper's objective is to specify the processes of (linguistic) differentiation, namely the divergence of increasingly specialised fields (Kraus 1994, 15). We intend to identify "professional" (Daneš 1997, 74) differences among selected scientific fields as one of the factors affecting divergences in the development of contemporary scientific usage. The process of differentiation is now perceived as one of the most prominent aspects of contemporary inclinations of Czech professional style.

The stylistic features of theoretical scientific discourse comprise well-prepared, properly formulated, relatively complete, precise and clear public utterances, where the conceptual component prevails. Typically, in professional stylisation the emotional aspect of communication is suppressed. The innovative way of expression helps to deliver the knowledge and the relevant references more succinctly. Lacking aesthetic and persuasive functions, professional discourse rather strives for cognitive goals. The stylistically and emotionally neutral choice of expressions corresponds to Standard Czech usage, which in professional texts tends to be bookish.<sup>70</sup> The variability and specific quality of fairly diverse cognitive involvement naturally reflect the heterogeneity of scientific communication while conveying information in different human pursuits. The paper is focused on theoretically scientific style directed at the presentation of new knowledge, highly elaborate in form and content, and presuming a professional (erudite) recipient.

In order to achieve our targets, the research was based on a corpus of monological texts representing contemporary scientific communication written in Czech. The corpus thus includes team and authorial monographs, thematically divided into five fields recognised by the Czech Science Foundation (hereinafter GAČR) as: (1) technical sciences; (2) sciences of inanimate nature; (3) medical and biological sciences; (4) humanities and social sciences; (5) agricultural and biological-environmental sciences<sup>71</sup>. The terms "contemporary scientific communication - contemporary professional discourse" denote Czech monological scientific discourse produced in approximately the last ten years. Our preferred choice was team monographs where the influence of subjective stylistic factors is presumably reduced. The differentiation criterion based on horizontal classification was expected to produce a deliberately variegated text sample enabling us to substantiate or refute the contentions long shared by both the lay public and professionals, namely, that the examined specified targets of Czech written monological scientific utterances should (can) differ in particular fields, and further, that the most striking differences can be anticipated between sciences and "humanities".

The chosen monographs include theoretical, specialised or even scholarly texts. Since a scholarly text is not strictly delimited and easy to define, the term *vědecký/é* is used in compliance with the Czech Science Foundation nomenclature to differentiate particular fields. When the ambiguous terms (*technical*) sciences; *scholarly (style)*; *scientific (communication / discourse/ text*; etc. are used in a text, their vagueness is within the context of professional style reduced

<sup>70</sup> The description is based on the concept of professional style (Krémová 2008, 208–215).

<sup>71</sup> Particular monographs are hereinafter designated by abbreviations mentioned in the bibliography.

and replaced by such terms as *(technical) sciences; theoretically professional (style); theoretically professional (communication /discourse /text)*. The researched materials comprise 12 monographs divided into five groups of thematically related fields consisting of 24,000 words in total. In the sample, each monograph is represented by an extract consisting of 2,000 words, divided into two parts – a 1,000-word extract from the first chapter and a 1,000-word extract from the third concluding chapter. Partial samples were excerpted separately and subsequently averaged out to the final value, first for the given monograph and then for a particular group of fields. The described procedure was chosen to minimise the impact of such stylistic factors as the authorial subject and the specific quality of a particular chapter, e.g. the first/ last chapter, with the aim of gaining the most representative sample for the syntactic structure analysis of each team monograph. The sentence is simply conceived as a unit with “a certain morpho-syntactic structure and a semantic structure” (Karlik 2016); the compound sentence is denoted as “a syntactic combination of two finite sentences” (ibidem). In this paper, the measured length of a simple sentence, a complex sentence, and a single sentence in a compound sentence is the length from period to period; the unit is a word as a graphic entity.

The most frequently used quantitative parameter of the sentence being its length, our research focuses on an analysis and mutual comparison of the length between the simple sentence and the compound sentence. The linear dimension as a basic quantitative parameter of the sentence is affected by a number of factors. The sentence length reflects, for example, the linguistic system potentialities; the theme and its content; the concrete norms of a particular field of science. It can also be influenced by individual (authorial) stylistic peculiarities and textual composition. The shortest simple sentences in the corpus were found in technical fields with mathematics (11.39 words); followed by medical and biological fields (15.26 words); sciences of inanimate nature (16.13 words); social sciences and humanities (18.61 words); agricultural and environmental fields (18.96 words). The longest compound sentences appear in social sciences and humanities (18.84 words); and in agricultural and biological-environmental fields (30.72 words). As for the length of simple and compound sentences, individual groups of fields followed in the same order. The shortest simple sentence and the shortest compound sentence was excerpted in technical fields with mathematics; in medical and biological fields; by contrast, the longest simple sentence and the longest compound sentence are documented in social sciences and humanities; and in agricultural and biological-environmental fields. There is mutual correspondence between quantitative values of the simple sentence and the compound sentence. In other words, the findings for the simple sentence are statistically corroborated also for the compound sentence.

In the defined groups of fields, the collected data on the average length of simple and compound sentences reveal similarities, i.e. not only in the groups of fields with similar content, but even, for example, in the opposed “sciences” and “humanities”. The differences are barely noticeable and in this quantitative characteristic fail to corroborate the processes of differentiation among the delimited groups of fields. In view of variability and inhomogeneity of the examined units, particularly

in compound sentences, the homogeneous results across the researched groups of fields are interesting findings confirming in this partial parameter long-term stability of theoretical scientific style. Major differences are found only in technical fields, including mathematics, featuring shorter simple sentences and shorter compound sentences as well. The absolutely shortest simple and compound sentences in the corpus occur in the monograph written in mathematical sciences, where the average compound sentence length is only slightly greater than the average simple sentence length in the whole corpus of scientific texts. In mathematics, its high degree of abstraction and the ensuing necessity to employ symbolic notations results from the highest conciseness and coherence of expression. The mathematical text has an unambiguously formal structure, consisting, as a rule, of an axiom; a definition; a proof formed by a sentence, a lemma and a consequence; and further of also notes and an example. The average length is not reached by simple and compound sentences in the monograph produced in information and communication technologies. In contrast, the longest simple and compound sentences appear in the monographs produced in social sciences and humanities as well as in agricultural and biological-environmental fields. The average length of simple sentences in these groups of fields is greater than the average compound sentence length in the monograph written in mathematical sciences. The longest simple and compound sentences in the corpus are found in the monograph produced in art history from social sciences and humanities, where the length of simple sentences is enhanced more than in other groups of fields by secondary sentence elements and parentheses. Infrequent digressiveness of the text is, together with higher incidence of secondary elements, reflected in more complex structure of this text, compared to the other monographs in the corpus.

The data on the length of simple and compound sentences is slightly distorted by the fact that frequency analysis is based on the linear sentence dimension consisting of grammatical words. So as to express relations and meanings or to elucidate facts, professional communication does not employ solely linguistic means but also graphical devices or scientific language. Quantitative analyses in this paper do not comprise units of artificial systems of signs and concrete data, such as formulas, marks or symbols with the greatest incidence in technical fields and mathematics. These “linguistic devices of science” (Čechová, 2003, 188) constitute the basic textual line implicitly considered comprehensible to the recipient.

A comparison between the lengths of simple sentences and compound sentences reveals that the simple sentence length makes up almost  $2/3$  of the compound sentence length. Within this parameter, the groups of fields show only minimal differences – in technical fields with mathematics, the simple sentence length corresponds to 72.55 % of the compound sentence length; in social sciences and humanities, the ratio is 64.53 %; in the sciences of inanimate nature, it is 61.8 %; in agricultural and biological-environmental fields it is 61.72 %; in medical and biological fields it is 58.92 %. The ratio between the simple sentence length and the compound sentence length was the highest of all groups of fields in technical fields with mathematics, that is, the fields featuring both the shortest simple sentence excerpts and the shortest compound sentence excerpts. In technical fields with mathematics, compound sentences are the least elaborate, yet efficient

and noticeably the shortest, in the whole corpus. The opposite of them, in this respect, are social sciences and humanities, as well as agricultural and biological-environmental fields containing both the longest simple and compound sentences. Though, the differences are small. Simple compound structures consisting of short units concurrent with parcelling information into longer simple sentences are typical of all groups of fields and are not related to the textual content orientation.

In all groups of fields, compound sentences slightly prevail over single sentences. The highest ratio between simple and compound sentences is found in technical fields with mathematics, its lowest incidence is in agricultural and biological-environmental fields. The greatest incidence of simple sentences is in technical sciences with mathematics (25.3), whereas their lowest incidence is evidenced in medical and biological fields (8). The absolutely highest occurrence of compound sentences in the corpus of scientific texts is found in the monograph produced in mathematical fields (35.4), the absolutely lowest frequency is in the monograph from biological fields (7). Different from the other fields in the corpus are monographs written in physical sciences from the group of sciences of inanimate nature and a monograph produced in forestry science, where the ratio is reversed (26 SS – 23.5 CS and 29 SS – 25.5 CS).

Although both monographs are distinguished by the final averages with small prevalence of simple sentences over compound sentences, the calculated values for both team monographs always exceed only in one of the examined samples. In the first case, it is the second sample, namely chapter twelve (*Kvantitativní odhad srážek z distančních měření*) against chapter one (*Meteorologické procesy a jevy*). The second monograph shows a distinct prevalence of simple sentences in the first chapter (*Přírodní rezervace Polom*), while the fifth excerpted chapter features the reverse (*Zobecnění poznatků*). In both cases, the inquiry reveals a regular recurrence of a higher proportion of simple sentences to compound sentences in more practically oriented chapters of the monograph. This is corroborated by examples of partial dominance of the simple sentence over the compound sentence even in other monographs, written namely in physical sciences from the scrutinised technical fields with mathematics, and in meteorological sciences, i.e. agricultural and biological-environmental sciences, where the simple sentence slightly prevails in the second sample, i.e. in the first case, in chapters seven (*Křemíková nanofotonika*), in contrast to the first chapter (*Luminiscence neuspořádaných polovodičů*), and in the second case, in chapter six (*Zásoby uhlíku ve vegetaci České republiky a modelová uhlíková bilance krajiny*), as compared to the first chapter (*Globální změna uhlíku a klimatu*).

The quantitative characteristics of Czech as used in the latter half of the twentieth century (Těšitelová 1980, 1985) showed that various texts written in one functional style have “different values” (Těšitelová 1985, 172) of this parameter and that the ratio of simple and compound sentences “does not belong in Czech to the marks of functional style”, rather being the manifestation of “individual authorial style” (ibidem 127). Our excerpts of the corpus of present-day scientific texts lead to the conclusion that within theoretically scientific style, the author is a minimally functioning stylistic factor. A more structured utterance and the need to express the context through mutual relations is accompanied by a generally conceived

theme and a higher degree of abstraction, whereas a more specified theme, tending to divide the text into simple sentences and to more independent communication, increases the simple sentence proportion in the text. However, the relation between the generalness or concreteness of the theme and the proportion of the simple and compound sentences do not concern the length of a single sentence in the compound sentence and the compound sentence as a whole, which in no way deviate from average values.

The prevailing occurrence in the corpus of scientific texts means compound sentences consisting of two clauses. In all groups of fields, the proportion of two-clause compound sentences is almost seventy percent of all compound sentences. With the increasing sentence length, their representation in the text decreases. The prevalence of two-clause compound sentences reinforces the tendency of professional discourse towards economy of expression, to succinct and concise style and it is symptomatic of all groups of fields. Two-clause compound sentences are the highest occurrence in monographs written in technical fields and, within this group of fields, in mathematical sciences. The proportion of compound sentences formed by three or more clauses is similar in all groups, around twenty percent. Most three-clause compound sentences are found in medical and biological fields and in sciences of inanimate nature, their highest incidence at all is in the monograph produced in medical sciences. The proportion of four-clauses compound sentences is roughly four 4 – 8%, their highest incidence is in the sciences of inanimate nature. The incidence of compound sentences comprising five or more clauses is insignificant; they are not found in monographs written in physical sciences; geological sciences; medical and forestry sciences. The only exception is social sciences and humanities where the occurrence of five-clause compound sentences is almost 8%.

In all groups of fields, hypotactic compound sentences prevail over paratactic compound sentences. The greatest differences in their frequency are in technical fields with mathematics (H 78.72%; P 21.28 %); followed by sciences of inanimate nature (H 66%; P 34 %); agricultural and biological-environmental sciences (H 63.2 %; P 36.8 %); social sciences and humanities (H 56.3 %; P 42.7 %); and medical and biological fields (H 53.7 %; P 46.3 %). The absolutely highest incidence of hypotactic compound sentences is in monographs written in information sciences and technical fields (91 %); in geological sciences (78.2 %) and mathematical sciences. By contrast, texts with the lowest share of hypotaxis, where the proportion of hypotactic and paratactic relations is balanced, are found in monographs produced in art history (56.4 %); further in medical fields (50 %); and in forestry (47 %). The prevalence of hypotaxis is most noticeable in technical fields with mathematics. Though, a higher incidence of hypotactic compound sentences does not burden the text with formal intricacy. Prevailing in monographs are compound sentences with one, maximally two, hypotactic clauses. The relationship between presented facts is not described in a complicated way; symptomatic is the intent to convey logical, mostly causal relations, accurately, clearly and unambiguously. Paratactic compound sentences show the highest frequency in social sciences and humanities as well as in medical and biological fields. A higher occurrence of parataxis reveals the authorial endeavour to enhance stylisation and to present

more facts through adding paratactic information. The proportion of hypotaxis and parataxis most prominently reflects the antinomy of “humanities” and “sciences”.

In hypotactic compound sentences, the highest incidence is recorded for attributive clauses, mostly in sciences of inanimate nature, and in social sciences and humanities. The absolutely highest frequency of attributive clauses is found in the monograph written in art history from the field of social sciences and humanities. In the whole corpus, it is only the monograph produced in mathematical sciences, where attributive clauses do not prevail, but the most frequent incidence registered by adverbial clauses, followed by object clauses. They are succeeded by adverbial clauses and object clauses; in technical fields, they appear in the reverse order, which means, object clauses and adverbial clauses in succession. Surprising as the incidence of adverbial clauses may be, their lower occurrence can be explained by using lexical means instead.

The greater proportion of simple sentences and the prevalence of shorter, mostly two-clause, compound sentences symptomatically distinguish the sentence structure of the scientific text, yet its prevaillingly notional character impairs its connectivity. The textual coherence of professional discourse is chiefly generated by the unifying theme and the lexical stereotype of connectors. Typical of the contemporary scientific text is limited variability in the choice of connectors and minimal differences between the explored groups of fields. While the frequency and concrete representation of relative pronouns and adverbs were almost identical, there can be some differences in the use of conjunctions. Specifically, the incidence of relative pronouns in technical fields with mathematics was 26.7; in sciences of inanimate nature, it was 27; in medical and biological fields 30; in social sciences and humanities, 26.5; and in agricultural and environmental fields, 22.3. Relative adverbs, which are less frequent, feature more noticeable differences, although there are less distinct dissimilarities between individual groups of fields: in technical fields with mathematics, the incidence is 8.6; in sciences of inanimate nature, it is 14.5; in medical and biological fields, 2.5; in social sciences and humanities, 6; and in agricultural and environmental fields, 5.3.

Our excerpts corroborated a limited range of conjunctions used in contemporary scientific discourse. The greatest occurrence of various conjunctions was found in medical and biological fields (6.75); followed by technical fields with mathematics (5.6); agricultural and biological-environmental fields (5.3); social sciences and humanities (5). And sciences of inanimate nature (5). Represented in all groups of fields is the pronounced dominance of coordinating conjunctions over subordinating conjunctions, which is not surprising, because the former, unlike the latter, coordinate not only sentences but also sentence members, for example in itemisation. As a means of explicitly factual expression, homogeneous sentence members are used to present details or to variate information conveyed earlier. Their larger occurrence can be regarded as a persuasive device, for it decreases the information satiety and factuality of the text and reduces the exigence of the recipient's perceptive abilities. The highest representation of coordinating conjunctions was recorded in social sciences and humanities (102); in agricultural and environmental fields (95.7); further, in sciences of inanimate nature (91.5); in medical and biological sciences (85); and in technical fields with

mathematics (59.3). The only exception is technical sciences with mathematics with the prevalence of subordinating conjunctions (44). Subordinating conjunctions show the following order of representation: medical and biological fields (21.5); agricultural and biological-environmental fields (14.3); social sciences and humanities (13); and sciences of inanimate nature (10). The highest representation of subordinating conjunctions is recorded in technical fields with mathematics (8); followed by medical and biological fields (4.5); sciences of inanimate nature (3.5); agricultural and biological-environmental fields (3.3); and social sciences and humanities (2). The range of coordinating conjunctions is comparable in all groups of fields – medical and biological fields (6.75); technical fields with mathematics (5.6); agricultural and biological-environmental fields (5.3); social sciences and humanities (5); sciences of inanimate nature (4.5). Only technical fields with mathematics reveal different values in the frequency of conjunctions, the other fields show comparable data.

The completed frequential analyses support our claim that contemporary Czech theoretical scientific discourse avoids complicated sentence structures or complicated compound sentences, employing lucid and clearly organised syntax instead. The scientific information is condensed into longer simple sentences and shorter compound sentences, showing preference of not very complex, concise, often formalised expression. The contention that, in scientific texts, “we can find relatively greatest incidence of compound sentences consisting of four or more sentences” (Těšitelová 1985, 130) and that, in the syntactic construction of theoretically scientific texts reflecting the complexity of “the hierarchizing of ideas and relations”, we can expect texts featuring the most intricate sentence and compound sentence structure, i.e. a higher incidence of longer sentences and elaborate compound sentences, was not corroborated by the selected samples of contemporary scientific texts. The quantitative characteristics confirmed the universal inclination of the syntactic structure of professional discourse towards the economy of expression. The styling of scientific texts into longer simple sentences and shorter compound sentences is typical of all researched groups of fields and is reflected in succinctness, coherence and general tendency to economy of expression resulting from the natural ambition to communicate the content in the most comprehensible way. The emphasis on conceptuality weakens the inter-sentence relationship as individual abstractions become independent. Contemporary Czech theoretically scientific discourse conveys the specific content in a succinct, coherent, formalised and isolated manner.

The analyses of selected quantitative characteristics of syntactic structure did not evidence in the corpus of professional communication written in contemporary Czech prominent processes of linguistic differentiation between individual groups of fields. Monographs representing particular fields revealed differences among the examined aspects, though no substantial discord. Traditional conceptions of the syntactic complexity of scientific discourse featuring long sentences and compound sentences impacted by complicated textual content were not corroborated by the analyses in present-day theoretically scientific communication. More distinctive disproportions were documented in the group of technical fields with mathematics in contrast with other fields. The text written in mathematical sciences

shows the strongest propensity to produce independent statements and to isolate individual facts. It is a strictly formalist structure, with the highest proportion of simple and compound sentences, where simple sentences approach compound sentences in length, with the prevalence of hypotaxis. Mathematical discourse is typified, most distinctly in the whole corpus of differentiated texts, by concise and coherent expression. The opposition of “sciences” and “humanities” showed to be less prominent; it was more obvious in the different ratio of simple and compound sentence incidence and in a higher representation of paratactic compound sentences, with a greater proportion coordinating conjunctions. Social sciences and humanities may differ from the other groups of fields in a selection of quantitative characteristics of sentence structure, but not so significantly as in lexis or phraseology (Schacherl 2016, 2017). The professional discourse there is more tolerant of longer sentences, or potentially of more intricate sentence structure. From the other groups of fields they differ in a stronger inclination to stylise the expression of scientific content. The primary cognitive function of scientific discourse enabling better understanding of the communicated subject is in social sciences and humanities supplemented by greater, and mainly more original stylistic ambition of the author.

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