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Scientific Russian vocabulary, as represented by substantives among the lead entries of a 1955 polytechnic Russian dictionary, is analyzed compositionally and by source language. (GK)

SOURCES OF SCIENTIFIC RUSSIAN

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The Moving Parts

I am sick of the gilded arts.
Sing me a song of the Moving Parts!
These have never embraced a sham:
Ratchet, poppet, tappet and cam.
Jack, rack, pinion, toggle and sear
Show no favor for love or fear.
Pin and piston, sprocket and spline
Answer only to their design.
Enough of feeble and fainting hearts!
Sing me a song of the Moving Parts!

—Robert Abernathy.

The present report is part of a synchronic analysis[1] of the language of Russian science as represented by Stepanov's Brief Polytechnic Dictionary.[2] The Stepanov text was chosen because it is a recent, encyclopedic dictionary compiled for Russian scientists and engineers and covers a broad area of the physical sciences, including, among others, mechanical engineering, metallurgy, chemistry, geophysics, electronics, navigation, architecture, and transportation. The social sciences are not represented, except for a few terms from economics. To keep the body of data to be analyzed within reasonable bounds, the study was limited to the lead entries. There are approximately 8800 lead entries in the Stepanov dictionary, of which about 55 percent are single words and 45 percent phrases. These entries contain approximately 5600 different nouns and 1900 different adjectives, with a sprinkling of adverbs and prepositions. There are no verbs, except by inference from the deverbatives. The repetition of words in phrases brings the total number of words treated to about 13,000.

One of the objects of this study has been to determine which sources of scientific Russian vocabulary are productive, and this point will be stressed in the present article.

However, before presenting a summary of the Stepanov material, I would like to comment briefly on the Russian reference sources available in this country. There are several hundred Russian-English and English-Russian general and specialized dictionaries readily available in the United States,[3] about 30 of which apply directly to the Stepanov material, yet no one of them listed more than 60 percent of the terms in Stepanov, and all of them combined listed only a bit more than 70 percent of the terms. The rest had to be found through "educated guessing" and subsequent verification in English reference material, through laborious searching of secondary sources and by direct questioning of scientists. There is no Russian-Russian or Russian-English dictionary that even approaches the coverage of the unabridged Webster dictionary of English.[4] I found the best source of information on scientific Russian vocabulary to be the Large Soviet Encyclopedia,[5] especially now that the index volumes have appeared. Other prime sources of information are the Ušakov[6] and Smirnickij[7] dictionaries published in the Soviet Union and the Callaham[8] and Bray[9] dictionaries published in the United States. A few scientific terms appear in Vasmer's etymological dictionary,[10] but most of them are old borrowings, prior to 1850. English, French, and German reference works usually lag 5-15 years or more behind developments, so it is difficult to trace the origin or even verify the existence of the names of new commercial products and trade names. The best reference to such material is Thomas' Register of American Manufacturers.[11]

Analysis

In this report I shall treat only the substantives. The statistics which follow pertain to the 5600 different nouns in the Stepanov lead entries; repetitions will not be considered. I have divided the substantives into two major groups, viz., words drawn from the native Russian vocabulary (including some Church Slavonic borrowings) and words borrowed or constructed from foreign languages.

Approximately 32 percent of the substantives in Stepanov are drawn from the native vocabulary fund. If the mixed Russian-foreign compounds are considered Russian words,

e.g., radioúzel (a radio broadcasting system), the native element amounts to nearly 40 percent. Any inclusion of foreign words assimilated into Russian would involve a subjective choice, so I have regarded words such as bašmák, bálka, betón and benzín as foreign, although there is a good case for considering them to be Russian words.

The deverbatives form the largest group of native substantives (63 percent). They are formed chiefly with the suffixes zero, -nie and -ka. Deadjectivals comprise another 10 percent and the remainder consists of words with diminutive or augmentative suffixes (9 percent) and simple words. The three most productive suffixes, -nie (450 words), zero (340) and -ka (314), all express the same general concepts, i.e., a process, an action or the product, result, or location of such a process or action. Other productive suffixes are -ost', -nost' (148 words), -tel' (121) and the diminutives -ka (103 words) and -ok (65).

There are two subgroups of native substantives which are quite interesting, although not numerous: 1) common words used in a technical sense, e.g., bašmák in the meanings of "brake shoe" and "bearing plate" and bába in the meaning "drop hammer," and 2) the diminutive names of animals in the meaning of machines or implements, e.g., lebëdka means a windlass and medvédka a punching machine. Many of these words have counterparts in other European languages, but proper investigation of the origin of the Russian words of this type would require study of the history of each craft and trade represented and the jargon of the Russian and foreign craftsmen who founded and developed the trade in Russia.

The compounds, more than any other type of word, show the dynamic nature of the scientific Russian language and the stages of assimilation of foreign elements. Compounds comprise 25 percent of the native words in Stepanov (if the mixed Russian-foreign compounds are included) and 35 percent of the foreign. Compounding is a highly productive medium of word formation, and Russian scientists borrow and create compounds from foreign elements much faster than the dictionary compilers can record them.

Many of the compounds borrowed intact from foreign languages should be regarded as simple words, since they were borrowed as a unit and the separate components are not evident to the Russian reader, e.g., bajpás (a by-pass valve). Other compounds borrowed intact are transitional

cases, e.g., the international metílsul'fát (methyl sulfate), since both components appear in other compounds borrowed into Russian and are potentially productive, but thus far no compounds created by Russians have been formed with these elements. In the Stepanov material there are some 300 Russian and 600 different foreign combining elements. Of course, many of them appear in only one compound, but some appear so frequently they might even be regarded as prefixes or suffixes. Some examples are Russian vodo-, which appears in 31 compounds, samo- in 16, -mer in 29 and -voz and -xod in 10 words each, and foreign avto-, which appears in 44 words, -metr in 109 and gidro- in 46 words. None of the above compounding elements exists as an independent word in the meaning of the combining component, which adds to the impression of prefix or suffix. The cases of -voz and -xod are quite interesting; in most examples it seems clear that -voz stands for parovóz or is modeled after parovóz and -xod stands for paroxód, but the paro- is dropped because the driving force of the locomotive or ship is no longer steam, e.g., gazovóz, gazoxód, èlektrovóz, èlektroxód.

There are several general categories of compounds, all productive: 1) compounds formed of two independent words joined by a linking vowel, brevnospúsk (a log chute) or joined directly, polukolónna (a half column), 2) those in which one of the components does not exist as an independent word, e.g., dernoréz (a sod cutter), and 3) those formed by the direct addition of three or more components, e.g., dimetílbutadién (dimethyl butadiene). Judging by the meaning of the compound, the form of the components or corresponding longer forms, the first component of a compound can be a noun in the accusative, dative, or instrumental case, e.g., dymosós (exhaust fan, acc.), ognezaščíta (fire prevention, dat.) and benzoréz (gasoline cutting torch, instr.), an adjective, e.g., boepripásy (ammunition), a numeral, mnogočlén (polynomial), or a preposition, nutromér (inside caliper, [v]nutri). However, as Šerech[11] points out, there is no grammatical indication of the relationship between the parts in the word itself and one must know the application of the word to know its meaning, so these are not significant differences but interesting variants of a single type of compound.

The extent to which some international components have been assimilated into Russian can be implied from the large number of mixed Russian-foreign compounds (244 in Stepanov),

e.g., anemorazvédka (a wind survey, fr. Greek ánemos 'wind' and Russian razvedka) and mjasokombinát (a meat-packing plant). Further, there is quite a number of all-foreign compounds which exist in Russian but not in German, English, or French. In those languages the concept exists, of course, but is expressed by a phrase or a longer compound, e.g., àvtobáza (an automobile and truck repair and storage yard), gidrolíft (a hydraulic hoist) and asbošífer (asbestos slate roofing, German Asbestschiefer). These words form a bridge between the native and the foreign vocabulary.

I have divided the foreign borrowings in Russian into several major categories:

1) International words, i.e., words which have the same form and, predominantly, the same stress in several modern languages, all possible sources of borrowing. In turn, these international words can be divided into two large groups: a) "Natural" words, i.e., those borrowed from the active vocabulary of modern languages, e.g., petít (a type size) and akkórd (chord, pitch); b) "Artificial" words, i.e., words created by science from Latin or Greek components, for example, for example, avtokláv (autoclave). The international words constitute 45 percent of the foreign substantives.

2) Russified foreign borrowings, i.e., foreign words which have become Russified through suffixation. The native suffixes most used in this type of construction are -ka, -nie and -(n)ost', e.g., kolónka (a gasoline pump), normirovánie (standardization), and radioaktívnost' (radioactivity). The suffixes -ij and -ija are included here as marginal cases. This group comprises 20 percent of the foreign substantives.

3) Russian words formed from foreign components on the pattern of international words, but not used as such in German, French, or English. This is a small group, about 2 percent of the foreign substantives.

4) Words borrowed directly from a single foreign language. These comprise about 24 percent of the foreign substantives.

5) Others, including abbreviations, e.g., GÈC (Gidroèlektorcentral'), units of measure, om (ohm), place names, e.g., bógxed (the type of coal mined in Boghead, Scotland), and family names, e.g., Abel' (Abel).

The trade names, a rather numerous group, are included among the artificial words. There are a few Russian trade

names, such as graleks (a kind of rubberized cloth) named for the inventors Grafov and Alekseenko.

The question of the source of borrowing of a scientific word is often quite perplexing. Clear cases of borrowing are comparatively rare. More often, a word has the same form in several languages, each a possible source of borrowing. The task can be simplified somewhat by dividing the borrowings into two general classes: 1) those borrowed before the middle of the nineteenth century, and 2) recent borrowings. Thus, the first group includes old borrowings from Russia's Asiatic, Scandinavian, Baltic, and Greek neighbors, words borrowed from western languages around the time of Peter the Great and words borrowed during the early stages of development of the physical sciences. The second group includes the international borrowings made during the rapid expansion of scientific vocabulary in the past century and generally limits the sources of borrowings to German and French, the chief media of scientific information during this period. Recently, English has begun to exert an influence on Russian scientific vocabulary. It seems unlikely that Russian created many of its own international words in the nineteenth and early twentieth centuries or that it borrowed directly from such secondary languages of science as Portugese, Chinese, or Swedish; and thus words such as jakaránda (Portugese), tung (Chinese), and skarn (Swedish) were probably borrowed through German or French.

In a few cases, the borrowing of an international word can be attributed to German, French, or English on the basis of stress, form, or spelling, but in a great number of cases even the stress is identical in these languages and in Russian. Undoubtedly, the source of borrowing of many scores of these international words could be identified through investigation of the history of each word individually and by study of the history of each science in the West and in Russia, but this would be a significant study in itself. To point up the inherent complexities of such a study, let us take the case of chemistry. Russian chemical vocabulary, like that of the other sciences and of other European scientific languages, is stratified. Side by side one finds old Slavic words such as želézo and rtut', terms from alchemy, e.g., satúrn (lead), from old chemistry, ftor (fluorine, formerly phthore), elements named before the Mendeleev system was adopted (before approximately 1870) such as azót (nitrogen, from French)

and selén (selenium, from German), and elements named after the adoption of the Mendeleev system, e.g., barij (barium), compounds named before the standardizing Congress of Geneva (1892) and after the Congress, and trade names which abandon the Geneva system for the sake of brevity, e.g., búna (artificial rubber), which is an abridgment of butadiene and natrium.

The form and stress of the international suffixes: -án, -át, -íd, -ít, -ón is the same in German, French, Russian, and often English. One of these is productive in contemporary Russian, i.e., the suffix is added to native words to indicate minerals and manufactured products such as solomít (straw insulation), glinít (baked clay) and stalinít (an alloy and a glass).

Russian has two suffixes of its own which are used almost exclusively with scientific vocabulary; both are productive. The suffix -ij (65 cases in Stepanov) is used to name new chemical elements. Previously it was used in place of the Greek suffix -on (akroterij for akroterion) or Latin -um (opij for opium), but at present foreign words ending in -um are borrowed intact, e.g., óleum and petrolátum. The -ija suffix, with its variants -ácija and -izácija, correspond to the German and French -ie and English -y and -ation, -ization, respectively, e.g., meteorológija, aprobácija, mexanizácija. There are 370 words with the -ija suffix in Stepanov. Occasionally, this suffix is used with a Russian stem, e.g., jarovizácija (vernalization, a seed-treating process).

Of the remaining foreign suffixes, the two most productive are -or (-átor, -izátor) and -er (-ër). The -or group retains the form and stress of the Latin from which it is derived. This is also the form and stress of German and English, but not of French. There are 164 words with the -or suffix in Stepanov. Russian words with the suffix -er are taken from modern languages, Dutch, English, French, and German; in most cases the language of origin is quite evident: Du. bűer (an ice boat), French glissër (a glider, hydroplane), English stóker, and German rějter (a rider, machinery).

In Stepanov, the borrowings which can definitely be attributed to a single language follow the familiar patterns of the history of the Russian language.

From Dutch: Chiefly late seventeenth and early eighteenth century borrowings of shipping and navigation[12] terms and the names of some mechanical devices.

From English: Early borrowings of shipping terms[13] and the names of manufactured products. Recent borrowings of the names of machines and machine parts and a few terms from physics and electronics.

From French: Chiefly nineteenth and twentieth century borrowings in many fields, including architecture, chemistry, mineralogy, mechanics, shipping, warfare, and mathematics.

From German: Borrowings from the time of Peter the Great to the present, representing all fields of science and industry, e.g., physics, electronics, architecture, commerce, mathematics, warfare, mining, and engineering.

From Polish: A few terms borrowed through Polish from Latin and German in many fields, including machinery, metals, implements, and manufactured products.

Others: Old borrowings from Russia's neighbors, words long assimilated into Russian, and a few architectural terms from Italian.

To summarize, the substantives which appear in the lead entries of the Stepanov dictionary are classified as follows.

Total number of substantives		5557
Type of Substantive	Number	Percent of total
Words taken from the native vocabulary	1807	32.5
Mixed Russian - foreign compounds	244	4.4
Words taken from foreign languages[14]	3506	63.1
Russified foreign words	693	12.5
International vocabulary	1572	28.3
From German	283	5.1
From French	226	4.1
From English	114	2.0
From Dutch	99	1.8
From Polish	47	0.8
Others	78	1.4
Russian words created from components of the international vocabulary	78	1.4
Abbreviations, proper names and units of measure not classified above	316	5.7

Notes

1. Doctoral dissertation in progress at Harvard University, under the direction of Professor Roman Jakobson, entitled "The Language of Scientific Russian." The present paper was read at the annual meeting of the AATSEEL, in Philadelphia, on December 28, 1960.

2. Ju. A. Stepanov, ed., Kratkij politexničeskij slovar' (Moskva: Gostexizdat, 1955). (1136 pp.)

3. Stephen Juhasz, Draft List of Russian-English & English-Russian Dictionaries for EJC-NSF Survey of Engineering Dictionaries (Stephen Juhasz, 8500 Culebra Road, San Antonio, Texas, July 1959). (33 pp.)

4. W. A. Neilson, ed., Webster's New International Dictionary of the English Language (2nd ed., unabridged, Springfield, Mass.: G. & C. Merriam Co., 1960 printing).

5. Bol'šaja sovetskaja ènciklopedija (2nd. ed., Moskva: Gosnaučizdat "Bol'šaja sovetskaja ènciklopedija," 1948-1957), plus supplements and 2 index volumes (1958-1960).

6. D. N. Ušakov, ed., Tolkovyj slovar' russkogo jazyka (4 vols., Moskva: Gosinstitut "Sovetskaja Enciklopedija," 1935-1940).

7. A. I. Smirnickij, ed., Russko-anglijskij slovar' (3rd ed., Moskva: Gosizdat Inostrannyx i Nacional'nyx Slovarej, 1958). (951 pp.)

8. L. I. Callaham, Russian-English Technical and Chemical Dictionary, (New York: John Wiley & Sons, 1947). (794 pp.)

9. A. Bray, Russian-English Scientific-Technical Dictionary, (New York: International Universities Press, 1945). (551 pp.)

10. Max Vasmer, Russisches etymologisches Wörterbuch (3 vols., Heidelberg: Carl Winter Universitätsverlag, 1953-1958).

11. Thomas' Register of American Manufacturers, Vol. IV. Alphabetical (A. Z.) List of Manufacturers–Trade Names–Commercial Organizations (New York: Thomas Publishing Company, 1959).

11. J. Šerech (Shevelov), "Word Composition in Contemporary Standard Russian" (unpublished manuscript, Cambridge, Mass., 1953).

12. Naval terms borrowed from Dutch pertain primarily to rigging and ship's parts.

13. Naval terms borrowed from English refer primarily to ship building.

14. The statistics of the subgroups of foreign borrowings may differ slightly in the final version of the analysis.