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General Remarks on Machine Translation

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Back in 1998, I was interviewed by Andrew Joscelyne for the *Language International* magazine. The present paper is an extended version of my answers to Mr. Joscelyne's questions.

Machine translation dates back to the 1950s in the ex-Union. You can read about the first steps of MT in the Soviet Union in the papers by Boris Pevzner and Xenia Piotrowska et al. in this issue. Here, I will discuss the 70s and 80s simply because I graduated from the Kharkov State University in 1974, so I was a witness of and then a participant in the development.

The first person to mention is, by no means, professor Rajmund Piotrowski, a man whose role in Soviet language engineering has been really great. He is both a brilliant linguist and a very energetic organizer. In the early 1970s, he founded the All-Union linguistic group that he called “Statistica Rechi” (Speech Statistics). It united language engineers from all over the USSR: Leningrad, Moscow, Ukraine, Kazakhstan, Moldavia, Uzbekistan, Azerbaijan, etc.

The first operational Soviet MT system was developed in 1976 at the Chimkent Teachers Training College, by the Kazakhstan subgroup headed by Piotrowski's pupils K.Bektayev and P.Sadchikova. The system ran on IBM-compatible mainframes and performed word-for-word and phrase-for-phrase English-Russian translation of patent chemical texts. The system was used at the Institute of Chemistry, Kazakhstan Academy of Sciences.

Piotrowski's Moscow colleague, Yuri Marchuk, Director of the All-Union Center for Translations, headed a project covering 3 MT systems: English-Russian (AMPAR), German-Russian (NERPA), and French-Russian (FRAP). The AMPAR system was launched in 1977. It was used for generating raw translations of technical texts both at the Center and at some departmental research institutes.

Marchuk published a 2-volume English-Russian contextual dictionary that can be used (and I plan to use it!) for disambiguation purposes. Yevgeni Lovtski developed a special language for representing linguistic rules in AMPAR.

Boris Tikhomirov, Zoya Shaliapina, and Nina Leontieva investigated into various aspects of semantic-based and transfer-based MT. I believe that Zoya was the best expert in Japanese-based MT in the USSR.

Boris Pevzner, my older friend and one of my teachers, published in the early 70s a series of papers on example-based text processing, which I consider revolutionary. The PARS "distant phrases" have very much to do with Pevzner's ideas!

In the 80s, the Leningrad subgroup of Speech Statistics headed by Rajmund Piotrowski himself and his best pupil, Larisa Beliayeva, the most charming of all linguists I have ever seen, launched an integrated language engineering project which included:

- MULTIS, a multilingual MT system based on what Larisa called MARS - a multi-aspect Russian automatic dictionary (my PARS systems include a grammatical Russian dictionary which resembles MARS to some extent!); the main language pairs were English-Russian and French-Russian; the latter direction was headed by Dr. Tatiana Apollonskaya;
- a system for automatic topic recognition preceding machine translation of information messages; the system was designed by Dr. Yelena Shingareva;
- automatic abstracting of information messages, the project headed by one of my teachers, Prof. Victor Berzon, and myself.

The user of the system was a large governmental analytical bureau that processed hundreds of such messages every day.

MULTIS was the first Soviet PC-MT system. It was made operational in 1988-1989 by Larisa Beliayeva as the ideologist, and Svetlana Sokolova and Alexander Serebriakov, the programmers. MULTIS was an implementation of several basic ideas put forward by Rajmund Piotrowski back in 1971 in his epoch-making paper in

"Problemy Strukturnoi Lingvistiki" (Problems of Structural Linguistics). One of them consisted in assigning a single generalizing translation to each polysemantic word instead of several translations (as it is made in PARS). Some time later, the Stylus system was developed by Sokolova and Serebriakov, based on the MULTIS linguistic principles, though much more efficient from the technological point of view.

Piotrowski's main idea was what he called the engineering approach to language modeling. My teacher argued that developing an MT system is a complicated process consisting of numerous stages. The linguist models the text, implements it in an operational (not hypothetical!) program, analyzes the results, modifies the model, and so on, thus "growing" the system up from the «napkin» state. That's exactly what we have been doing to the PARS systems for almost 10 years now!

The 70s-80s were a period of scientific confrontation of two conceptions: the practical ("engineering") approach to machine translation, most vividly expressed by Rajmund Piotrowski, and the theoretical approach, backed by such outstanding linguists as Igor Melchuk and Yuri Apresian. They opposed the idea of automatic translation to Piotrowski's machine translation, and argued that the linguist's task is to offer an in-depth description of the language as the foundation of an AT algorithm instead of gradual improving an imperfect MT system. Apresian's group developed the ETAP family of pilot MT systems translating from French and English into Russian. It's interesting that the word-for-word English-Russian translation module was used for translating patent titles in the INPADOC information retrieval system.

A Kiev group headed by Oleg Galchenko developed a more efficient system for translating English patent titles into Russian based on a dictionary of 100,000 technical terms!

As to PARS, its 1st version was launched in 1989 and implemented at the Georgian Medical Information Center for generating raw translations of the MEDLINE database abstracts. However, it was in the 1990s, with the advent of personal computers, that machine translation was made accessible to hundreds of thousands of end

users. Would it be possible without the first steps made by our teachers?

So, in which ways has a translator's experience and knowledge influences the design of MT systems? How important is the role of the translator?

My first impulse would be to say that being a translator is by no means an advantage in developing an MT system because translating is art, and you can't **make** anyone, including a computer, an artist. In other words, **MT is not translation.** I remember very well translating *Alice's Adventures.* Trying to make the story, funny and amusing, I had, more often than not, to **invent,** not even translate!

Of course, one may say that a technical text is by no means so hard to translate as *Alice.* Yes, but there are some problems, too. When I worked as technical translator at the VNIITelektromash research institute, another my teacher, Vladimir Terletsky, a brilliant chemist and metallurgist, showed me the translation of an English paper on powder metallurgy, one of the paragraphs in which sounded absolutely senseless, though it was quite smooth syntactically. The translation had been made by a professional translator at the Chamber of Commerce. Terletsky asked me to translate the same paragraph word-for-word, as close to the context as possible, without trying to **understand** it. “It's up to me to make head or tail of it”, he said. After I did, he said, “Thanks God! Everything is clear now!” It was clear to him, not to me. So, my translation was a success because I acted **like a computer program:** I simply substituted Russian words for the English ones and put them in the proper morphological forms.

At the same time, being a translator is a great thing for a machine translator. I always understood very well that my colleagues might be disappointed with the numerous childish mistakes PARS would be making. I even thought that all of them would prefer extensive electronic dictionaries instead of an MT program. That's why I am always pleased and surprised when praised by a translator. And the paradox lies in the fact that it's the most skilled and experienced translators, such as my late friend Vladimir Kolykhmatov who worked for the Dupont company, who find PARS useful in their everyday work.

One of the brightest examples of a translator's attitude I have ever experienced was PARS presentation at the Antonov Aviation Plant in Kiev. I was surrounded by a group of brilliant professionals who were watching somewhat skeptically the computer screen while PARS was busy translating a technical text from Russian into English. They analyzed the result attentively, and then I asked one of them: "What do you think about it?" What he said amazed me: "Well, it translates like a student". "A fresher or a senior?" I asked him. He thought a little and said, smiling: "Like a sophomore". What he meant was that the translation was quite understandable but rather primitive. "You flatter me!" I replied. "The student is human, while the computer is not!"

I did use my translator's experience when I designed PARS. The peculiarities of our systems consist in the service options rather than in the translation algorithms, and the former were introduced because I am a translator.

Our systems feature specific target text post-editing facilities. The unique pen editor being developed by a team headed by my friend, Alexander Kazakov, will provide hot keys for the most typical editing operations performed by professional translators.

Another specific feature is the dictionary updating subsystem. I am really happy to hear translators saying that PARS is user friendly from this point of view, and that they create dictionaries of their own reflecting their professional experience. I think, however, that the program can and should be further improved!

Me and my elder daughter, Olga Bezhanova, use our MT systems together with the Polyglossum scientific and technical dictionaries, developed by ETS Publishers, for making professional translations. I always ask Olga to keep records of her work when using these systems. You may read her detailed accounts elsewhere, for example in *MT News International* and *Proceedings of MT Summit VI* as well as in my book on MT. The main conclusion she came to is this: a professional can't do without MT and MAT if he/she wants to be competitive! Olga edits 30 pages of technical texts a day after Russian to English MT, while her colleagues not equipped with computer programs do much worse, first of all because they

lack serious on-line professional dictionaries. If the subject area is covered by PARS specialist dictionaries, editing the raw translation is several times easier than translating the same text manually.

Deep in my heart I suspect that machine translation as a scientific task is a mathematical problem. But my practical experience tells me that an operational MT system can only be designed by a linguist. Life is really full of paradoxes! I don't know how I would be able to head an MT team if I were a mathematician rather than a linguist and translator.

What are the most important aspects in MT?

I think that the dictionary updating and compiling tool is one of the most important characteristics of an operational MT system. Boris Pevzner taught me that I should only develop **technologically efficient** systems, that is such systems that could be easily used by as many people as possible. This condition presupposes **tuning** the system to the user's requirements. A flexible dictionary updating program is sometimes even a more important condition put forward by a professional translator than the translation quality itself! An MT system is a product made by linguists and programmers for people who have nothing to do with linguistics and programming (translation and linguistics are two different things!), and we have to ask ourselves, “Look, how would I feel if I were the user who wants to enter new words into the dictionary”? The procedure suggested by the program is to be **natural and understandable.**

Let me compare this with translating *Alice's Adventures:* when I came across a pun or some specific English expression, I did my best to find a translation, but I never included it in the final variant until I offered it to Olga, who was 7 then - Alice's age! I never told her I was translating something - she didn't have to know about my technical problems, I simply offered her the Russian joke invented by me, and the only criterion was whether she smiled or not. If the user smiles when entering new words into the dictionary, you did well. If he or she looks serious, maybe your solution was not the best one. 10 points.

As to an industrial process of compiling dictionaries for MT, it's one of my company's "visiting cards". Together with ETS Publishers, we made a "conveyer" technology for inputting new and new dictionaries. A colleague of mine, Igor Fagradiants, attracted Russian most eminent lexicographers to developing world's largest specialist English-Russian and German-Russian bi-directional dictionaries, which are then converted into the PARS format. Later this year, I am planning to implement a breakthrough technology of interactive example-based converting dictionary text files into PARS. This will make dictionary compilation an industrial process backed up by first-class lexicographers! 10 points.

Having a single client is another *conditio sine qua non.* One of my principles is to have a definite user in mind when developing an MT system. This principle dates back to 1980, when I began developing a retrieval system at VNIITelektromash. It was not easy to convince my bosses, very wise and experienced people, though somewhat conservative, as a real boss should be, to finance the work. I needed someone who would support me and use the system in his everyday professional work to provide feedback. Dr. Vladimir Terletsky, head of the powder metallurgy laboratory, was such a person. We discussed system structure and ways of practical usage so scrupulously and carefully that I saw the light clearly, and, due to this collaboration, the system was really made technologically efficient.

Another such person was Valeri Yepifanov, whose assistance let me understand the necessity of the topic recognition engine, which made our system an absolutely unique tool for information retrieval. By the way, it was based on Pevzner's ideas of example-based text processing!

Developing an "organism" as complex as an MT system is hardly possible without communicating regularly with one or several users, preferably amiable, though reasonably critical. Of course, you should not take all their advices and demands for granted, but you must take them into account! More than that, an exceptionally important thing is that, in this case, you see that the system you are developing is needed, a feeling which can hardly be overestimated!

Thus my principle is: develop your system for someone you know very well, and then it'll be accepted by many others! 10 points for having a concrete end-client +7 more for the freedom of accessing as many “invisible” end-clients as possible.

What is MT design? Well, it's everything! An exercise in computer science? Yes. We can't design a competitive MT system if the most talented and progressive programmers are not engaged. The art of communication engineering? Of course, especially if we mean that the system is supposed to be part and parcel of a complex technological process, not just a stand-alone program: we have to suggest **a technology of using** the MT system, which is more than “simply” write a translation program.

And it also means quite a lot of other things, first of all a challenge for a linguist because teaching a computer is much harder than teaching a child: the child masters the basics very soon and keeps studying on his/her own, sometimes asking you for assistance, but the computer program always remains dependent on you, so “a perfect MT system” is something I can hardly imagine. Thus in total:

- MT as a computer science task - 9 points;
- MT as a communication engineering task - 6 points;
- MT as a linguistic task - 10 points.

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Is MT setting quality targets or quantity targets? Both, I believe. These two criteria should not be separated from each other. Some of my colleagues say that a very large dictionary is practically everything needed for producing good quality machine translations since the lion's share of the information is in the words, not in the syntactic relations. This may result in a try-anything **industrial-scale** system for making average quality, raw translations. In this case quality is sacrificed for quantity. Others argue that quality is more important and overburden the system with semantic data making it hard for the end user, being no linguist, to extend the dictionary. This results in an almost perfect **pilot** but not industrial-scale system. In this case quantity is sacrificed for quality.

As to me, I prefer compromises. This is my *profession de foi.* An MT system should be a good combination of quantitative and qualitative factors. However, if one asks me which do I prefer: to make a system simpler for the end user, i.e. **potentially larger,** or more complicated (again, from the user's point of view) and **smaller,** I will choose the former. A simple system will be **used** and extended, that is, to some extent, **improved.** A complicated system will hardly be used, that is why it hardly has any future.

- Quantitative characteristics: 10 points.

- Qualitative characteristics: 8 points.

And, the last but not the least: the computer platforms. This affects our solutions greatly! Sometimes this almost drives me crazy. As soon as we come up with a new version of a translation system, "those Americans" invent something else, so we have to update our products. Since 1994, we have passed a long way from DOS systems to Windows 95 and Windows NT. All PARSes are linked to MS Word 6.0, MS Word 7.0, and MS Office 97, Word 2000. And people from all over the world ask me: "Look, can you make your systems compatible with Unix? Macintosh? Sun?" But I only choose those platforms that can attract **many** customers instead of making PARS universal. Maybe sometime, when I get rich, PARS will run on all kinds of machines in all surroundings, but not now, unfortunately, although **it's no problem from the technical pint of view.**

At present, we prefer the most popular platforms to meet the major market requirements. Windows 95, 98, 2000 as well as Windows NT, with WinWord 7.0, MS Office 97 and Word 2000 are very broadly used all over the world, including Ukraine and Russia, which makes our life easier. There are no problems with fonts there, while Microsoft Tool Kits simplify compatibility! Number of platforms: 6 points.

My first PARS project was launched in 1985 and covered English to Russian, which was only natural for the Soviet Union in those years. It would have been strange to begin one's MT career with something else than an English-Russian system!

In 1989-1990, we were financed by Marchuk's Translation Center to develop a Russian-English system, and we did it, being the first in Ukraine. PARS/English-Russian is distributed all over the world.

Developing a Russian-Ukrainian bi-directional product was a strategic decision, and again we were the first. We came up with PARS/RU in 1990, and it is **very** popular in Ukraine. More than that: it's our main commercial product here because the importance of Ukrainian is growing every day. Unfortunately, computer pirates make thousands of copies on CD-ROM, which makes our life very difficult.

PARS/Ukrainian was to some extent the result of my reading the paper by Boyan Onyshkevich in a book on machine translation edited by Sergei Nirenburg (my University friend, by the way). That paper described an English-Ukrainian prototype MT system, and I decided to make a system to translate between Ukrainian and English. In 1992, we were financed by the computer department of the Ukrainian Supreme Rada, and came up with the world's first Ukrainian-English-Ukrainian operational MT system. Now its newest version is marketed both in Ukraine and in North America, by the California-based IBT company. It was presented at the AMTA conference held in Montreal in 1996, and then at MT Summit VI, in San Diego. Some of PARS/U dictionaries are quite unique, such as those on computers and telecommunications developed by Dr. Orest Kossak and Dr. Roman Kravets.

The DOS version of PARS/D, the German-Russian system, was made on the order of the Izvestia Concern, Moscow, to translate VWD information messages. Unfortunately, we failed to complete the project for a number of reasons. Last year, however, we resumed the work due to financing from the Hamburg-based *Jourist Verlags,* It's a commercial product translating between Russian and German now, but it needs intensive improvement since we can't develop a commercial MT system overnight. We work very hard to improve and extend it (qualitative and quantitative factors!). By the way, PARS/D is the Ukrainian first MT system for this language pair.

The PARS/DU Ukrainian-German-Ukrainian system was developed in the framework of the COPERNIC project launched

by Ukrainian Ministry of Education. The project includes all our 5 PARSes on CD-ROM, in a nice package, with the user's guide in 4 languages. The number of dictionaries is very limited, which makes it possible for us to sell the disk at a very low price for university, college, and high school students and have something in store for professionals. One will be surprised to know that a student who produces his/her student's card will buy a COPERNIC for $13.

I think that the role of the Russian language will be at least as high as it is now, and that of Ukrainian will be growing rapidly. The need for MT systems translating between Russian and Ukrainian is tremendous now in Ukraine, and it will be increasing (see item 7).

To my great disappointment, I can see no other language in ex-Union whose importance would become international in the nearest future. In 1990-1991, we discussed a Russian-Georgian system with Dr. Roman Serebriany, Director of the Georgian Medical Information Center, but we lost contacts after the war broke in Georgia. I have written several letters to Roman, but he didn't answer; I suspect he didn't even receive them...

Speaking of strategic development of MT, my opinion is that Russia and Ukraine will remain absolute leaders in this field in ex-Union. We have very serious linguistic and programming traditions that our colleagues in other post-Soviet republics can hardly do without in the nearest future. More than that, I don't think that someone will be willing to develop MT systems of their own there; they would rather prefer to use Stylus or PARS. However, I may be mistaken, of course.

The prospects in Ukraine and Russia depend, to a very large extent, upon the Governments: either they launch serious prosecution of computer pirates, or some or even most of the MT companies will simply disappear. Now, we may see all kinds of pirate CDs in almost any Ukrainian or Russian computer shop or at other places where CDs are sold, such as the numerous “electronic market places”. One of the freshest disks is named “Flint's Treasures”, and it has a picture of a hideous pirate taking his (his?) treasures out of a bag. Hundreds of thousands of Stylus'es and PARSes can be pulled out of those bags!

People call me on the phone asking to help them about the pirate versions of PARS/Russian-Ukrainian and PARS/Russian-English: sometimes they wouldn't work at all. Others tell me that pirate disks discredit our products, making people think that the original versions are as bad.

Another item of importance is training qualified language engineers. We may be astonished to hear that **such specialists are not trained at Ukrainian universities.** More than that, language engineering as a scientific discipline is not present in the list of specialties of the Ukrainian Highest Attestation Commission, so it's rather difficult to defend dissertations on language engineering in this country! I hope, however, that at least my initiative to organize a language engineering department at Kharkov Slavic University will be supported. I also have an idea of organizing an international student language engineering group (see item 8).

As to the objective requirements, they are as follows.

Individual users

A very numerous subgroup is made up by *students who need their diplomas and other kinds of papers to be translated from Russian into Ukrainian.* We hope to meet their requirements with the COPERNIC CD-ROM and convince at least some of them to abstain from using pirate disks.

Some people want to communicate with people living abroad. PARS/U, is bought, in particular, by Americans and Canadians wishing to communicate with their friends and relatives residing in Ukraine. One of them told me: “They speak Ukrainian, while I speak English. The only way to communicate is to use a computer program”. I wonder if one of the international pen pal organizations might be interested in using PARSes for communication purposes. It would certainly require serious modifications to the systems in order to take into account peculiarities of this style, but the idea itself seems rather promising to me.

Professional free-lance translators make up another subgroup, though less numerous. Their language pairs are mainly English,

German, French, Italian to and from Russian. Some of them like MT systems, some prefer MAT software (electronic dictionaries such as Polyglossum), while others buy both. My opinion is, however, that the majority of this group are still our **potential** clients. The fact is that the foreign languages departments of Ukrainian universities train people who are good at languages but have no idea of the computer as translator's everyday tool. Introducing elements of language engineering at such departments would contribute a lot to expanding the circle of our conscientious clients!

There is a group of *individual users who require Russian to English translation of scientific texts.* Here is an example. A scientist asked me to translate his medical paper for submitting to a serious British journal. When I looked through the text, there was only one thing that I understood - I could not do without PARS because the paper was abundant in “awful” medical terms. I faced a dilemma: either to translate the text manually looking every second or third word up in the Polyglossum Russian-English medical dictionary, or to let PARS make a draft translation and post-edit it. I chose the latter variant, and the paper was accepted.

Corporate users

MT and MAT systems seem to be very popular with corporate users. Generally speaking, all kinds of *organizations, both state-owned and private, use PARS/RU for translating official documentation, including that of financial, scientific, and technical nature, between Russian and Ukrainian.*

Many *Ukrainian banks use PARS/RU for translating financial documentation, such as official instructions, between Russian and Ukrainian.* Here is another example. In autumn, I installed PARS/RU in one of the banks in the town of Saki, the Crimea. They use it to translate megabytes of instructions they receive electronically from the Ukrainian National Bank, Those texts are written in Ukrainian, the country's state language, and the problem is that many people in the Southern and Eastern parts of Ukraine doesn't even **understand** Ukrainian, to say nothing of speaking it.

A tendency that gains popularity is making *MT systems part of integrated products*, such as PRAVO, a system very well-known in Ukraine. It is supplied on CD-ROM and comprises the full set of Ukrainian laws and decrees, with a retrieval system and our Ukrainian-Russian translation module. Later this year, Ukrainian to English and German modules will be added.

I am especially proud that PARS/ER is used for translating Russian medical abstracts into English for the *Medical Practice* journal published in Kharkov. I used to do it myself, first running the texts through PARS and then post-editing the raw translations. *Using MT systems for translating abstracts in scientific journals* may become a tendency.

Large plants and design bureaus that export their products are among the users of the PARS/ER system. The Antonov Aviation Design Bureau in Kiev as well as the Yangel Spacecraft Bureau in Dnepropetrovsk are among them. We supplied PARS/Avia to them, which includes the core Russian-English-Russian system and a number of terminological dictionaries on aviation, space, communications, etc. Their reaction is very important for me: they say that PARS is better for translating technical documentation, while Stylus is preferable for business correspondence. Well, we'll try to be up to the mark in all the aspects!

A new tendency is application of PARS *to translate Russian textbooks and courses of lectures into English for foreign students coming to study at our universities.* A vivid example is described by Olga Bezhanova: we translated Russian texts on aviation for Kharkov State Aviation University at which students from Iran were coming to study.

MT can and should also be used for purely academic purposes. An example is using PARSes at Kharkov State Polytechnical University in the course of machine translation at the Department of Intelligent Information Systems. Presently, we are going to set up a department of language engineering at Kharkov Slavonic University. I plan to implement all our systems there.

Access to Internet and E-mail will contribute to a higher role of MT. However, this will require not only technical (which is

comparatively simple) but also linguistic solutions because colloquial texts, which are very often to be found on web sites, to say nothing of E-mail messages, are very hard to translate automatically. I am sure that Internet and MT will stimulate each other greatly. And this application is very promising. The fact is that Internet resources are in fact inaccessible to Russian and Ukrainian speaking scientists because of the language barrier, and so are the Russian and Ukrainian publications for the English-speaking community. You should take into account that the state system of scientific information, which was the pride of the former Soviet Union, does not exist in Ukraine for a number of reasons, so Internet will be a very good, though not the only source of information if the decision will be taken to build up such a system in this country.

I might also suggest that you should read my pamphlet on machine translation to find more examples of using PARS, some of them being quite amusing and even instructive, as I hope.

We are also going to make our marketing policy more flexible and user-oriented. Among the measures, I can see developing and direct mailing numerous demo versions oriented at various groups of users.

Another idea I am cherishing consists in creating an international group of young language engineers (linguists and programmers), preferably university students, whose practical goal would be developing a new generation of PARSes, including new language pairs, to be used by governmental organizations in Europe and the Americas. I think that this group could be headed by me and some of my European colleagues, and financed (may I dream of this?), for example, by some of the European foundations.

As to the academic goal, this work will be extremely useful for the young people who join the group since they will learn and master much more than any University can offer! On the other hand, maybe the universities will somewhat amend their curricula according to the practical necessities.

I hope it would be a kind of honor to be enrolled in this group, and the students would be willing to qualify! I am absolutely sure this would be a very serious stimulus for developing language engineering in Ukraine. More than that, it would contribute to

eliminating skepticism in some of Ukrainian boys and girls who are greatly disappointed with the present moral and economic situation in this country and are of the opinion that science is no longer needed in our society and it's much more prestigious to be someone else rather than a scientist or engineer.

Linguistic aspect

I hope that the new algorithm of syntactic analysis of Russian texts being developed now will help us raise the quality of translations from Russian.

As to new language pairs, I mentioned some of them above, although everything will depend on financing.

One of the most important amendments will consist in transition from numerous specialist dictionaries to what I call «dictionary libraries». Such a «library» will comprise a collection of dictionaries and cover 8 broad subject areas:

- business, economics, law;
- mathematics, physics;
- electronics, computers, communications;
- chemistry, oil, gas, mining;
- automobile building, road design;
- aviation, space;
- medicine, biology, ecology;
- polytechnic.

The general dictionaries in each system will be extended greatly. There are two sources:

- real-life texts which we run through the corresponding system and update the dictionary respectively;
- large printed dictionaries, such as the English-Russian one by Yuri Apresian; this will let us compile an unique general English-Russian-English professional dictionary of not less than 300,000 translations in each part, English-Russian and Russian-English.