THE THEORETICAL BASIS OF THE UNI-DIRECTIONAL MATCHING (LUKJANOW) METHOD

by

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Those who deal with computers, even indirectly, speak of them as "logical machines". This is true, with a caveat: the logic involved is not the ordinary human logic of inductive and deductive reasoning, but a logic based on a particular mathematic, Boolean algebra, or some similar system. Everything in this system is based on two "concepts", if one wants to call them that, of "yes" and "no", plus and minus, one and zero. The machine has often been called "stupid" by computer men themselves, but when it comes to matching, that is, saying "yes" or "no", the machine is a phenomenal genius. We all probably remember Mr. Bellmore's account of how the machine arrives at the square root of 25. It goes through a laborious, redundant series of matching: Is it I? (I x I = I). No. Is it 2? (2 x 2=4) No. Is it 3? (3 x 3 = 9) No. Is it 4? (4 x 4 = 16). No. Is it 5? (5 x 5 = 25) Yes. This redundancy would be a hopeless obstacle were it not for the fantastic speed of electrons. To operate most effectively on this plus-or-minus circuit the machine must be fed the maximum of data. Only then can it perform its binary operations successfully. Anything resembling "logical human reasoning" that may come out of a machine depends entirely on what the programmer has fed into it. The "logical machine" is, above all, a machine of redundance.

We now come to what I have called the "uni-directional matching method" of Miss Lukjanow. Miss Lukjanow has said that her system is based on "traditional grammar". This has frightened some. But it must be remembered that Russian is an arachaizing Indo-European language, and the "traditional grammar" of Greek and Latin fits Russian, if not English, rather well. The reasons given may be the
wrong ones (e.g., "adjectives modify nouns", when a more descriptively correct statement might be that forms that take only one set of inflectional morphemes are "nouns", while forms that take two or more are "adjectives"), but the results are very nearly right. Miss Lukjanow applies this grammatical apparatus not only to Russian, but to English as well, and to Russian what distinctions English has that are missing there, e.g. "(there) is, are". Thus, we arrive at the essence of the oft-repeated phrase, "bi-lingual grammar." This, in a sense is the intermediate language, the language, in the black box that represents the combined grammar of both source and target languages. Throw everything in so the machine can most efficiently perform its binary operations. The excess can be easily removed later. On the chart you will note that all operations from the beginning of the coded Russian glossary box to the end of the coded English glossary box are in the domain of this bi-lingual grammar. This is the most important point, the principle of redundancy which the machine requires.

The method is spoken of as being "uni-dimensional". That is, the search is always from left to right except in such a sequence as N A N where N = noun A = adjective) where the search goes one step to the left only (and this is rare).

КНИГА     ИНОСТРАННОГО     АВТОРА
Book       of foreign      of author
Nmsg       Amsga           Nmsga

The second attribute of the method is "matching". Miss Lukjanow
has compared this to a dial telephone or the links in a chain. Such a link or sequence could, for the purposes of MT, be called a construct. A construct might consist of adjective (or adjectival participle) plus noun, or preposition requiring only one case plus noun, or verb requiring one case (acc. or gen.) plus (adjective) noun. Anything else means a break in the sequence, the start of a new construct. The chain of constructs consists of series of simple matching operations somewhat as follows:

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a a a  l l l  x x x
b b b  m m m  y y y
c c c  n n n  z z z
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This can be illustrated by such a Russian phrase as:

<table>
<thead>
<tr>
<th>КОВЕР</th>
<th>ИНТЕРЕСНОЙ</th>
<th>ОКРАСКИ</th>
</tr>
</thead>
<tbody>
<tr>
<td>Msn</td>
<td>Afsgdie</td>
<td>Nfsg</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Nplna</td>
</tr>
</tbody>
</table>

Constructs:  
a  (Nmsn)  1   (Afsg)  1   (Nfsg)  x
m  (Afsd)  m  (Ngpln)  y
n  (Afsl)  n  (Nfpla)  z
rug of interesting of color

English syntax pattern: N pr. A N
(a, the) rug of interesting color

In providing the maximum possibilities of matching this method entails the minimum of searching. This certainly makes the task easier for the linguist and programmer and should shorten the time required by the machine (this latter will have to be checked by a computer expert, of course).
The simplicity of operations of the (predominantly) matching method versus the (predominantly) searching method "Experimental Group") can readily be seen from a comparison of the two methods dealing with the noun morph — a (except F).

<table>
<thead>
<tr>
<th>Searching method</th>
<th>Matching method</th>
</tr>
</thead>
<tbody>
<tr>
<td>I.a. Is subdivided item preceded or followed by НЕТ or РАДИ? if yes, suffix is</td>
<td>НЕТ Нsg</td>
</tr>
<tr>
<td>translated as Ø stem is singular.</td>
<td>HE Nsg</td>
</tr>
<tr>
<td>I.b. Is subdivided item preceded by -certain prepositions governing the genitive</td>
<td>Вg Nsg</td>
</tr>
<tr>
<td>only, or -indefinite numerals (i.e. СКОЛЬКО 'howmuch),</td>
<td>Ag Nsg</td>
</tr>
<tr>
<td>Or -certain verbs governing the genitive only,</td>
<td>Prg Nsg</td>
</tr>
<tr>
<td>or -adjectival case morphs: ( -ЕГО, -ОГО, -БЕГО /). If yes, suffix is</td>
<td>(genetiv's &quot;of&quot;, in noun ignored</td>
</tr>
<tr>
<td>translated as Ø stem is singular.</td>
<td>&quot;of&quot; is kept)</td>
</tr>
<tr>
<td>I.e. Is subdivided item immediately or next to immediately preceded by НЕ?</td>
<td>А Nsg</td>
</tr>
<tr>
<td>If yes, suffix is translated as Ø, stem is singular.</td>
<td>&quot;of&quot; = &quot;-s&quot;)</td>
</tr>
<tr>
<td>2. Is subdivided item preceded by</td>
<td></td>
</tr>
</tbody>
</table>
Is subdivided item preceded by a noun?
If yes, suffix is translated as "of",
stem is singular, reverse order of translation of stem and suffix.
3. Is subdivided item preceded by a comparative adjectival form?
If yes, suffix is translated as 'than', stem is singular, reverse order of left and right partials.
4. Is subdivided item preceded by certain numerals (ОБА, ДВА, ТРИ, четыре / -'both, two, three.
four)? If yes, suffix is translated as Ø, stem is plural.
5. Otherwise, translate suffix as Ø, stem as singular.

Finally, let it be stated that this method is by no means complete or perfected. It is the outline of a method that needs the implementation of much hard spade work. But, as an outline of a method, it seems, to this writer at least, to indicate a path to the goal of MT, a path less steep and tortuous than some others that have been taken.
FLOW CHART

Bilingual grammar

RUSSIAN TEXT → CODED RUSSIAN GLOSSARY → CODED ENGLISH GLOSSARY → ENGLISH TEXT

TEMPORARY MEMORY
STORAGE, MATCHING, SELECTION, ARRANGEMENT