INTRODUCTION

In the preliminary analysis presented in this paper, referent grammatical rules of the type developed in Sigurd 1987 will be applied to some examples of Russian and Polish yes/no questions and wh-questions. Our aim is to investigate the possibility of computer translation between English and Swedish and the Slavic languages by means of RG — a theory that the computer parser used by SWETRA (Swedish Computer Translation Group, Lund) is based on.

As RG is a phrase structure grammar, inspired by GPSG (Gazdar, Klein, Pullum and Sag 1985), such constructions as interrogative sentences and relative clauses are not analyzed as results of transformations, but as structures containing a topicalized constituent and a defective sentence. This means that a question like who hit him is analyzed as:

\[
\text{esent}(q,T,P,F) \rightarrow \text{enpqs}(P), \text{esdsent}(_,_,P,s(subj(P),pred(B),obj(X))).
\]

who who who hit him

q = question
T = tense
P = the focused constituent
F = functional representation
esdsent = English subject defective sentence
enpqs = interrogative noun phrase (subjective form)

The questions introduced by a finite verb are analyzed as verb defective (or aux-defective); if the objective wh-word is fronted (whom did he hit), the sentence following the interrogative pronoun is classified as object defective, and so on. The computer translation is based on the functional representation of a sentence,
i.e. on the terms ‘subject’, ‘predicate’, ‘object’, ‘adverbial’ and ‘sentence adverbial’.

The other kind of sentence representation, the so-called categorial representation, based on such terms as subjective or objective noun phrase, finite verb, infinitive etc., allows one to denote the constituents in the same order in which they occur in a particular language; as the function of each variable used in the categorial representation is marked in the functional representation \( F \), a quite adequate translation is possible in spite of language-specific word order rules.

**RUSSIAN AND POLISH YES/NO QUESTIONS WITHOUT INTERROGATIVE PARTICLES**

The main difference between the English and Swedish yes/no questions on the one hand, and the Russian and Polish on the other hand depends on the fact that the Slavic languages concerned here do not use word order as a primary marker of the interrogative mode. The syntactic order in a Russian or Polish question is relatively free (different constituents may be fronted) and the interrogative function is often marked by the sentence intonation only. This kind of interrogative constructions can be illustrated by the following examples:

1. \( \text{rsent: } \text{ty pročital } \text{ětu knigu?} \)
2. \( \text{rsent: } \text{čtu knigu ty pročital?} \)
3. \( \text{psent: } (\text{ty}) \text{ przeczytałeś } \text{tę ksiązkę?} \)

\( r = \text{Russian} \)
\( p = \text{Polish} \)

The English equivalent of the sentences (1), (2) and (3) is (simplified) represented as:

\[
\text{esent}(q,_,\text{ty},s(\text{subj}(\text{ty}),\text{pred}(\text{pročital}),\text{obj}(\text{np}(\text{dem}(\text{ětu}),\text{n}(\text{knigu})))))) \rightarrow
\text{rpros(\text{ty}),rsdsent(\_,\_,\text{ty},F)}.
\]

\[
\text{rsdsent(\_,\_,\text{ty},s(\text{subj}(\text{ty}),\text{pred}(\text{pročital}),\text{obj}(\text{np}(\text{dem}(\text{ětu}),\text{n}(\text{knigu})))))) \rightarrow
\text{rnpa(\text{np}(\text{dem}(\text{ětu}),\text{n}(\text{knigu}))),radsent(\_,\_,\text{np}(\text{dem}(\text{ětu}),\text{n}(\text{knigu})),F)}.
\]

The perfective aspect of the sentence may be expressed by inserting an appropriate value in the tense-slot (after ‘\( q \)’), but the quite complicated problems of tense and aspect relations will not be discussed in this paper.

The Polish interrogative sentence (example(3)) can be described by formulas analogous to those used in (1), if the personal pronoun \( \text{ty} \) is lexically realized. The use of personal pronouns in their subjective forms is optional in Polish, as the information about the grammatical person is carried by the inflected form of the verb. In general, the subjective personal pronouns are realized only in the cases of emphasis; the constructions where the pronoun is deleted are more common.
In the analysis of Polish 'subjectless' sentences one has to take into consideration the fact that they are functionally equivalent to those containing an appropriate personal pronoun. It would be inadequate to describe the 'subjectless' constructions as consisting of a verb and a verb defective sentence, although the finite verb is the first lexical item occurring in the sentence. The functional representation of sentences lacking lexically expressed personal pronouns must contain this grammatical information about the subject that is necessary for establishing translation; without inserting certain grammatical properties in the subject-slot we would not be able to translate such well-formed Polish questions, as e.g. czytasz? 'are you reading?'.

In the example (3), the verbal form is carrying information not only about the grammatical person, but also about the subject’s number and gender (here: singular, male). In the plural, there are different verb forms used for subjects with the properties +male and -f-human, and for those that do not have this combination of properties, e.g.:

spiewaliście?
you(plural,male,human),sing
spiewałyście?
you(plural,non-male,human),sing
or:
you(plural,male,non-human),sing.

As we can see, the referent of the subject can be described with several properties — even in these cases where the subject is not realized as a separate lexical item. Therefore, we suggest that both variants of the sentence (3) can be treated as comprising subject defective sentences. In the case where the pronoun is deleted, the subject-slot will contain the description of the referent, but the lexical entity corresponding to the referent’s properties will be marked as an empty set: [ ]. The rule for ‘psdsent’ (Polish subject defective sentence) will also be provided with an agreement condition saying that the verbal form must have the same number and gender values as the referent of the subject (variables N and G2 represent, respectively, the categories 'number' and 'grammatical gender'; S is used for marking the property 'human' or 'non-human').

The interrogative sentence (3) can be described as:

\[
\text{psent}(q,\_\text{R},F) \rightarrow \text{pnps}(\_\text{R}),\text{psdsent}(\_\text{R},\text{subj}(\_\text{R}),\text{pred}(\_\text{B}),\text{obj}(\_\text{X})).
\]

\[
\text{psdsent}(\_\text{R},\text{subj}(\_\text{R}),\text{pred}(\_\text{B}),\text{obj}(\_\text{X}))) \rightarrow \text{pvt}(\_\text{Y}),\text{pnpa}(\_\text{X}),\{\text{R=}\text{np}(\_\text{R},1,\text{N},\text{S},\_\text{G2}),\_\text{J}\}
\]

\[
\text{plex}(\_\text{A},\text{pros},\_\text{N},\_\text{S},\_\text{G2},\_\text{P})).
\]

Rule I is the most general one: it says that a single Polish question may contain a subjective noun phrase and a subject defective sentence; the functional subject of the defective sentence refers to an entity marked R. The second rule (II) is to be read as: a Polish subject defective sentence, where the subject refers to the entity R and the predicate has the meaning B, can be realized as a finite transitive verb Y, with the meaning B, and an accusative noun phrase X; the referent of the subject (R) and the verb must have the same N, S and G2 values; furthermore, the value P (grammatical person) of the verb must be identical with the corresponding value of the lexical item (the pronoun) which has the same meaning as the referent R. In our example (3), the referent of the subject can be characterized as:

\[
\text{R=}\text{np}(\_\text{R},1,\text{you},\_\text{N},\_\text{S},\_\text{G2},\_\text{ma}),\_).
\]

because the verb przeczytałeś has the following properties:

\[
\text{plex}(\_\text{przeczytałeś},\text{m(read,prf)},\text{v},\text{vt},\_\text{fin},\_\text{N},\_\text{S},\_\text{G2},\_\text{ma},\_\text{p2}).
\]

The value p2 is common for the verb and the lexical item (plex) representing the pronoun ty:

\[
\text{plex}(\_\text{ty},\_\text{you},\_\text{pros},\_\text{N},\_\text{S},\_\text{G2},\_\text{p2}).
\]

Rules III and IV express the fact that the subjective noun phrase having a certain referent R can be realized either as a subjective pronoun or as the empty set [ ]. For the purpose of translation, the lexicon must contain such items as this
described in rule IV, i.e. items which are not realized lexically, but which have a meaning and certain grammatical properties. The need for such 'plex's' can be explained by means of the examples given below:

(4a) śpiewałeś?
(4b) śpiewałaś?
(4c) śpiewaliście?
(4d) śpiewałyście?

The four Polish sentences in (4) have to be translated as ‘were you singing?’ (or ‘did you sing?’; the tense and aspect relations will not be discussed, as mentioned). None of the sentences contains a lexically realized pronoun, but the different inflected forms allow us to identify the N,S and G2 values of the referent of the subject. The verbal items are characterized as, respectively:

(4a) plex(spiewales,m(sing,past),v,vi,fin,_,sg,_,ma,p2).
(4b) plex(spiewalaś,m(sing,past),v,vi,fin,_,sg,_,fe,p2).
(4c) plex(spiewaliście,m(sing,past),v,vi,fin,_,pl,hum,ma,p2).
(4d) plex(spiewałyście,m(sing,past),v,vi,fin,_,pl,inh,_,p2)

or:
plex(spiewałyście,m(sing,past),v,vi,fin,_,pl,hum,nc,p2)

or:
plex(spiewałyście,m(sing,past),v,vi,fin,_,pl,inh,_,p2).

The common property of the verbal forms – the value p2 (2nd grammatical person) indicates that – according to the agreement condition in II – only the lexical items with the values ‘pros’ and ‘p2’ can form correct interrogative sentences in connection with the verbs concerned above. The lexicon contains three such items:

plex(ty,you,pros,_,sg,_,_,ma,p2),
plex(wy,you,pros,_,pl,_,_,p2),
plex(,you,pros,_,_,p2).

As the subjects of the sentences (4a)-(4d) are realized as [], the
plex([],you,pros,_,_,p2) will be identified as referring to the subject. The agreement condition says that the meaning of the ‘plex’ representing the subject and the meaning of the referent (variable A in the referent description) have to be identical. Hence, the referent of the subject will be correctly identified as having the meaning ‘you’ and the sentence (4a) will be represented as:

psent(q,_,np(r(R1,you,_,sg,_,ma),_),F) → pdsent(_,_,np(r(R1,you,_,sg,_,ma),_),
  s(subj(np(r(R1,you,_,sg,_,ma),_),pred(sing,past))).

In sentences (4b)-(4d) the referents of the subject will have different N, S and G2 values (according to the description of the verbal items presented above), but the meaning of the referent will still be identified as ‘you’, and, subsequently, sentences (4a)-(4d) will be translated as ‘were you singing’.

In the Russian subject defective sentence (example (1)), the agreement between the subject and the predicate may be handled by a rule analogous to II, i.e. for sentences with transitive verbs, without adverbials – like (1):

rsdsent(_,R,s(subj(R),pred(B),obj(X))) rvt(Y),rnpa(X),
(R=np(r(R1,A,_,N,_,_,G2),_),rlex(Y,B,v,vt,fin,_,N,_,G2,P),
 rlex(_,A,pros,_,N,_,G2,_,p2)).

The agreement condition in the rule for object defective sentences (example (2)) has the following shape:

radsent(_,_,R,s(subj(A),pred(B),obj(R))) → rpros(X),rvt(Y),
{rlex(X,A,pros,_,N,_,G2,_,p2),
 rlex(_,A,pros,_,G2,_,P,_)}.

The referent of the lacking constituent is not involved in the agreement rule above, as there is no agreement between the object and the predicate.

Furthermore, the variable S is not used in the agreement conditions for ‘rsdsent’ and ‘radsent’, because the Russian finite verbs do not express the difference between ‘personal gender’ and ‘non-personal’ gender in the plural (the Polish inflection forms przeczytałeście – personal gender and przeczytałyście – non-personal gender – are both translated as pročitali – a form common to all grammatical genders in Russian).

Yes/no questions with predicative constructions
The analysis here will be limited to this type of Polish and Russian predicative constructions, which contain a finite form of the copula verb być (Polish) or byť (Russian) and an adjective; as the copula być is not lexically realized in most sentences in the present tense, we will also deal with Russian copulaless sentences.
The syntactic and inflectional differences between an English question with a predicative construction and its equivalents in Russian and Polish can be considered by analysing the following examples:

**English:** are you ill?

**Russian:**

5a) ty bolen?

you ill,ma

5b) ty bol'na?

you ill,fe

5c) vy bol'ny?

you ill,pl

**Polish:**

6a) (ty) jesteś chory?

(you) are ill,ma

6b) (ty) jesteś chora?

(you) are ill,fe

6c) (wy) jesteś chory?

(you) are ill,pl,

personal gender

6d) (wy) jesteś chora?

(you) are ill,pl,

non-personal gender

The sentence (5c) can also be used for addressing a single person (the pronoun vy may function either as the plural form of the 2nd grammatical person, or as a polite term of address, comparable with the German Sie); however, as vy is as a rule combined with predicates in plural forms, in the following analysis it will be treated as a plural pronoun, although the logical referent may be singular. The translation of terms of address requires a more detailed analysis, which cannot be presented in this paper.

In the sentences (5a)-(5c) the function of the predicate is accomplished by the adjective in predicative form (Russian adjectives have two kinds of inflection: predicative and attributive). The adjective agrees with the referent of the subject in number and gender (despite the above mentioned use of vy as a term of address). The copula verb is not used, as the tense value of all sentences is T= present.

In all sentences, the subject noun phrase (the pronoun) is fronted, so they can be analyzed as containing subject defective sentences. An 'rsdsent' with a predicative construction, as in (5a)-(5d), may be described by the following rule:

rsdsent(q,pres,R,s(subj(R),pred(B))) \rightarrow ra(X),(R=np(r(R1,A,_,N,_,G2,_,_)), rlex(X,B,a,pred,N,G2,_,_))

A REFERENT GRAMMATICAL ANALYSIS OF INTERROGATIVE SENTENCES

In the cases where the copula verb is present (past and future tense in Russian), the agreement condition must also provide the correct choice of the verbal form. The rules used for Russian sentences with copula verb will therefore be similar to the formula describing the Polish sentences (6a)-(6d):

psdsent(q,T,R,s(subj(R),pred(cop(B,T),copo(C)))) \rightarrow pcop(X),pa(Y),

(R=np(r(R1,A,_,N,S,_,G2,_,_),plex(Y,C,a,_,N,S,G2,_,_),plex(X,m(B,T),v, cop,fin,_,N,S,G2,P),plex(_,A,_,pros,_,N,S,G2,_,P,_,_)).

If we consider e.g. the example (6a), we can see that the lexical items fulfil the agreement condition formulated above:

plex(ty,you,pros,_,sg,_,_,_,p2,_.).

or – in the pronounless variant:

plex([],you,pros,_,sg,_,_,_,p2,_.).

plex(jestes,m(be,pres),v,cop,fin,_,sg,_,_,p2).

plex(chory,ill,a,_,sg,_,ma,_,_).

The referent of the lacking constituent will be identified as:

r(R1,you,_,sg,ma).

The variable S is not used in this case, but it is of importance for examples (6c) and (6d).

**YES/NO QUESTIONS WITH INTERROGATIVE PARTICLES**

The interrogative mode of Russian and Polish sentences may be marked by question particles: czy in Polish, razve, neuzeli or li in Russian. In transformational analysis, interrogative particles are treated as complementizers, generated directly under S-bar (Radford 1981:173); in English, the complementizer nodes are assumed to be empty in main clauses.

It would be quite difficult to apply this analysis to the Russian sentences with the particle li, as li can be placed either after the predicate or after another
The particle *li* will be marked by a symbol different from ‘rq’ (as we have to avoid generating such ungrammatical constructions as e.g. *davno razve ty videl Ivana?*). Here, we use the symbol ‘rq’. The sentences (7a)-(7c) are analyzed as (simplified – we ignore agreement conditions and the condition excluding possibility of using both ‘rq’ and ‘rql’ in the same single sentence):

(7a) rSENT(q,_,R,F) → rv(R),rq(L),rvdSENT(,s(subj(X),pred(B),obj(Z))).
qvSENT=Russian verb lacking sentence

(7b) rSENT(q,_,R,F) → radv(R),rq(L),radvSENT(,s(subj(X),pred(B),obj(Z),advl(R))).
radvSENT=Russian adverb lacking sentence

(7c) rSENT(q,pres,_,R,F) → ra(R),rq(L),radjSENT(,s(subj(X),pred(R))).
radjSENT=Russian adjective lacking sentence

The optional use of *li* is expressed by the rules:

rq([ ]) → [].

**WH-QUESTIONS WITH THE RUSSIAN AND POLISH EQUIVALENTS OF ‘WHO’/’WHOM’ AND ‘WHAT’**

The Russian interrogative pronouns *kto* ‘who’, *čto* ‘what’ and their Polish equivalents *kto* ‘who’ and *co* ‘what’ are case-inflected. Their declination forms are shown below:

<table>
<thead>
<tr>
<th>Case</th>
<th>Russian</th>
<th>Polish</th>
</tr>
</thead>
<tbody>
<tr>
<td>nominative</td>
<td>kto</td>
<td>kto</td>
</tr>
<tr>
<td>genitive</td>
<td>kogo</td>
<td>kogo</td>
</tr>
<tr>
<td>dative</td>
<td>komu</td>
<td>kemu</td>
</tr>
<tr>
<td>accusative</td>
<td>kogo</td>
<td>kogo</td>
</tr>
<tr>
<td>instrumentalis</td>
<td>kem</td>
<td>kem</td>
</tr>
<tr>
<td>locative</td>
<td>kom</td>
<td>kim</td>
</tr>
</tbody>
</table>

The use of *li* can be illustrated by the examples (7a)-(7c):

(7a) videl li ty Ivana?

‘did you see Ivan?’

(7b) davno li ty videl Ivana!

‘did you see Ivan a long time ago?’

(7c) zdorov li on?

‘is he well?’

The fact that a Polish or Russian interrogative sentence may optionally be preceded by the particle *czy* (Polish) or *razvé/neuželi* (Russian) can be expressed by the following simple rule:

\[
\begin{align*}
\text{r/psent}(q,_,P,F) & \rightarrow r/pq(X), r/psent(q,_,P,F). \\
\text{pq}(X) & \rightarrow [czy]. \\
\text{rq}(X) & \rightarrow [razvé]. \\
\text{rq}(X) & \rightarrow [neuželi]. \\
\text{r/pq}([ ]) & \rightarrow [].
\end{align*}
\]

In these formulas, we ignore the slight semantic difference between *razvé* and *neuželi* (using *neuželi*, the sender is marking a high grade of doubt; a sentence like *neuželi on pročital etu knigu?* could be translated as ‘has he really read this book?’; here, we will simplify the analysis and assume, that both *razvé on pročital etu knigu?* and *neuželi on pročital etu knigu?* can be translated as ‘has he read this book?’; there is of course a possibility of expanding the formulas, so that appropriate sentence adverbials would be inserted in the functional representation and, consequently, in the translation into English or Swedish).

constituent focused in the question (the use of *li* after a fronted adverbial is very common); contrary to the particles *czy, razvé* and *neuželi, li* cannot precede a question. Hence, it seems impossible to place this particle under 

**COMP** in the structural tree proposed by transformational grammar. Since RG-rules allow a free constituent order in the categorial representation, the interrogative particles can simply be inserted in the positions where they really occur (*li* after the focused constituent, the others – before the sentence); there is no need of inserting the symbols representing the interrogative particles in the functional representation, as the question mode is marked by the mode value ‘q’.

\[
\begin{align*}
\text{The fact that a Polish or Russian interrogative sentence may optionally be preceded by the particle *czy* (Polish) or *razvé/neuželi* (Russian) can be expressed by the following simple rule:}
\end{align*}
\]

\[
\begin{align*}
\text{r/psent}(q,_,P,F) & \rightarrow r/pq(X), r/psent(q,_,P,F). \\
\text{pq}(X) & \rightarrow [czy]. \\
\text{rq}(X) & \rightarrow [razvé]. \\
\text{rq}(X) & \rightarrow [neuželi]. \\
\text{r/pq}([ ]) & \rightarrow [].
\end{align*}
\]

In these formulas, we ignore the slight semantic difference between *razvé* and *neuželi* (using *neuželi*, the sender is marking a high grade of doubt; a sentence like *neuželi on pročital etu knigu?* could be translated as ‘has he really read this book?’; here, we will simplify the analysis and assume, that both *razvé on pročital etu knigu?* and *neuželi on pročital etu knigu?* can be translated as ‘has he read this book?’; there is of course a possibility of expanding the formulas, so that appropriate sentence adverbials would be inserted in the functional representation and, consequently, in the translation into English or Swedish).
The genitive forms are not equivalent to ‘whose’ – they are combined with genitive lacking sentences, in which the genitive noun phrase functions as direct object.

According to the RG-rules, a $wh$-question is analyzed as containing a noun phrase marked ‘npq’, in a certain case form $x$, and a sentence lacking a constituent in the same case form, i.e.:

\[
\text{sent}(q,_,R,F) \rightarrow \text{npqx}(R), x\text{dsent}(_,_,R,F).
\]

We will illustrate the use of the rule by applying it on some Russian and Polish examples (without agreement conditions):

**Nominative:**

(8) r: kto pročital etu knigu?
   p: kto przeczytał tę książkę?

The rules for ‘$r/p\text{sent}$’ are common for (9) and (10):

\[
\text{r/p\text{sent}}(q,_,R,F) \rightarrow \text{r/pnpqg}(R), \text{r/pgdsent}(_,_,R,F).
\]

Genitive:

The genitive form of the object is used after certain verbs, classified as ‘vg’ – genitive demanding – here chotět (Russian) and chcicie (Polish), or when a transitive predicate is denied (sentence adverbial=nix). In both cases, we use the same rule for ‘sent’, but the rules describing ‘gdsent’ (genitive defective sentence) must be different for (9) and (10):

(9) r:čego ty chotel?
   p:czego (ty) chciałesz?

The genitive defective sentences in the examples (9) and (10) have different categorial representations:

(9) $r/pgd\text{sent}(_-,R,s(\text{subj}(X),\text{pred}(B),\text{obj}(R)))) \rightarrow r/ppros(X), r/pvg(B)$.

Functional representation (rgd\text{sent}):

\[
\text{s}(\text{subj}(ty),\text{pred}(chotel),\text{obj}(čego)).
\]

Genitive:

\[
\text{plex}(čego,\text{what},\text{wh},_,_,_,_,\text{g},_,_).
\]

Dative:

Examples:

(11) r: komu ty dal knigu?
   p: komu (ty) dales książkę?

The rules for ‘$r/p\text{sent}$’ are common for (9) and (10):

\[
\text{r/p\text{sent}}(q,_,R,F) \rightarrow r/pnpqg(R), r/pgd\text{sent}(_,_,R,F).
\]
Formulas:
r/psent(q,_,R,F) → r/pnqd(R), r/pddsent(_,_,s(subj(X),pred(B),obj(Z),

dobj(R))).

r/pnqd(r(R1,A,_____,_),_) → r/pwh(X), {r/plex(X,A,wh,_____,d,___)}.

r/plex(komu,m(to_whom),wh,_____,d,___).

Functional representation (rddsent): s(subj(ty),pred(dal),obj(knigu),dobj(komu)).

you give,past book to_whom

Accusative:
Examples:

(12)
r: kogo ty videl?
p:kogo (ty) widziales?

whom you see,past

Formulas:
r/psent(q,_,R,F) → r/pnqa(R), r/padsent(_,_,s(subj(X),pred(B),obj(R))).

r/pnqa(r(R1,A,_____,_),_) → r/pwh(X), {r/plex(X,A,wh,_____,acc,___)}.

r/plex(kogo,whom,wh,_____,acc,___).

 Functional representation (radsent): s(subj(ty),pred(videl),obj(kogo)).

you see,past whom

Instrumentalis:
The Russian and Polish instrumentalis noun phrases (r/pnpi) may function as objects or as adverbials; in Russian, the instrumentalis is also used for expressing the agent function.

Here, we will limit the analysis to the cases, where the instrumentalis noun phrase fulfills the function of direct object or adverbial (in RG, prepositional objects are also treated as adverbials). We will not deal with the agent function (passive constructions have a quite low frequency in the Slavic languages) or with other possibilities of using the instrumentalis case (e.g. in phrases denoting comparison, units of measure etc.). Although the examples below do not illustrate all functions of the ‘r/pnpi’, they show that a Russian/Polish instrumentalis np can be equivalent either to an English noun phrase or to a prepositional phrase; we will use Russian examples only, as their Polish equivalents can be described with analogous rules:

Examples:

(13) mpi as direct object:
on pol’zovalsja perom
he use,past pen,inst
‘he used a pen’

(14) mpi equivalent to an English pp, denoting an instrument:
on ubil ego toporom
he kill,past him axe,inst
‘he killed him with an axe’

(15) mpi equivalent to an English pp, not denoting an instrument:
on gorditsja svoimi uspechami
he be proud,pres his successes, instr
‘he is proud of his successes’

(16) mpi as time adverbial:
eto sluchilos’ letom
it happen,past summer, inst
‘it happened in the summer’

If we now consider the Russian _wh_-questions, which can be answered by the sentences (13)-(16), we will see that the pronouns _kem/cem_ can occur only in the interrogative sentences corresponding to (13)-(15); in the question corresponding to (16), the interrogative adverb _kogda_ ‘when’ must be used:

(13a) cem on pol’zovalsja?
what he use,past
‘what did he use?’

(14a) cem on ego ubil?
what he him kill,past
‘what did he kill him with?’
The computer program must provide the possibility of distinguishing constructions like (13a) (which have to be translated as an English wh-pronoun and an object defective sentence) from those like (14a)-(15a) (translated as a wh-pronoun and a sentence containing a defective prepositional phrase) and from sentences like (16a), where an appropriate interrogative adverb must be correctly inserted.

We suggest that the term ‘instrumentalis defective sentence’ (r/pidsent) should be used only for such constructions that can be preceded by an interrogative (or relative) pronoun in the instrumentalis form. As question (16a) cannot be formulated as *cem eto slučilos’, it must be analyzed in a different way than (13a)-(15a).

On the sent-level, sentences (13a)-(15a) can be described as:

\[
\text{rsent}(q,\text{R,F}) \rightarrow \text{npqi}(\text{R}),\text{ridsent}(\text{_,_,R,F}).
\]

The differences can be found in the categorial and functional representations of the defective sentences ‘ridsent’.

(13a):
The verb pol’zovat’sja is classified as ‘rvin’ – an instrumentalis-demanding verb, because a sentence without a direct object, like *on pol’zovalsja is unacceptable, and the only possible case form of the direct object after pol’zovat’sja is the instrumentalis. Thus, the defective sentence can be represented as:

\[
\text{ridsent}(\text{_,_,R},s(\text{subj(X)},\text{pred(B)},\text{obj(Z)})) \rightarrow \text{rpros}(\text{X}),\text{rproa}(\text{Z}),\text{rvin}(\text{B}).
\]

(14a):

\[
\text{on ubil ego cem }\text{ on ubil ego ubil he kill,past him what,A3 on ego ubil he kill,past him what,A3 he him kill,past}
\]

The sentence is analyzed analogously to (14a) (the only difference being the fact that the finite verb gorditsja belongs to the category ‘instrumentalis-demanding verbs’):

\[
\text{ridsent}(\text{_,_,R},s(\text{subj(X)},\text{pred(B)},\text{advl(R,A3)})) \rightarrow \text{rpros}(\text{X}),\text{rproa}(\text{Z}),\text{rvin}(\text{B}).
\]

(16a):
As we have to distinguish the sentence (16a) from those introduced by an 'mpi',
we will describe it by the following rule:

rsent(q,_,R,F) → readq(R),radvdsent(,_R,F).

The symbol 'radvdsent' will denote such sentences, which can be preceded by an
interrogative adverb, but not by a single 'npqx'. If an interrogative pronoun is
preceded by a preposition, the prepositional phrase is treated as an interrogative
adverb, too.

In the example (16a) the interrogative adverb is realized as a single wh-adverb kogda (when). The sentence is analyzed as:

rsent(q,_,R,F) → radvq(R),radvdsent(,_R,F).
radvdsent(,_R,s(subj(X),pred(B),advl(R,A1))) → rpros(X),rvi(B).

Èto slucilos' kogda,Al èto studios'

Locative:
The locative case does not always denote the function of place adverbial, but the
interrogative pronoun in the locative form is always preceded by a preposition;
therefore, all phrases containing an 'r/pnploc' are treated as interrogative
adverbs – as in the following example:

(17)
r: o čém on govori?  
p: o czym on mowi?
about what he talk,pres
'what is he talking about?'

r/present(q,_,R,F) → r/padvq(R,F),r/padvdsent(,_R,s(subjX),pred(B),advl(R,A3))).
r/padv(R,pp(prep(A),np(C)) → r/prep(Z),r/pnpqloc(W),(r/plex(Z,A,p,loc,_,_,_,_,_,_),
    r/plex(W,C,wh,_,_,_,_,loc,_,_).

The rule describing 'r/padvq' says that an interrogative adverbial may contain a
preposition and an interrogative pronoun in the locative form, if the preposition
is locative-demanding (i.e. if the lexical item representing the preposition has the
property 'loc' – locative-demanding).

SUMMARY
The overview of some types of Russian and Polish interrogative sentences
presented above shows that there is a possibility of computer translation between
sentences with different syntactic structures, containing different number of
constituents, if the sentences are functionally equivalent. The RG-rules, based on
the division between focused constituents and defective sentences, are very useful
for the analysis of Russian and Polish yes/no questions, where the constituent
order is quite free, and the focus stress is of great importance (particularly in the
Russian yes/no questions, where the interrogative particle li is placed after the
focused constituent). Furthermore, the referent description used in RG can be
effectively used for establishing agreement conditions, which are necessary for
adequate translation.

A part of translation difficulties depending on the case-inflection of the
Russian and Polish wh-pronouns can also be handled by the RG-rules, as the case
form and its function are denoted separately (in the categorial and in the
functional representation); thus, the different functions of the same grammatical
case can be identified.

Obviously, there are many problems that require expansion of the RG-rules;
it remains e.g. to formulate rules which would correctly choose the perfective
and imperfective forms of the Slavic verbs; the translation of prepositional
phrases, especially those containing Russian and Polish compound prepositions,
is another area for further study.

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