**AGILE**

*Automatic Generation of Instructions in Languages of Eastern Europe*

<table>
<thead>
<tr>
<th>Title</th>
<th>Implementation of grammatical resources for the intermediate demonstrator</th>
</tr>
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Abstract:

This document comprises the deliverables IMPL2-BAS, IMPL2-CU and IMPL2-RU of work package 7, task 7.2 of the AGILE project. We present the implementation of the grammatical resources for Bulgarian, Czech and Russian that are necessary to generate texts with stylistic variation. The resource implementation has followed the linguistic specification of a broader range of phenomena as described in deliverables SPEC2-BAS, SPEC2-CU and SPEC2-RU, so that a more general coverage has been achieved.
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1. Introduction

This document comprises the deliverables IMPL2-BAS, IMPL2-CU and IMPL2-RU of work package 7, task 7.2 of the AGILE project. We present the implementation of the grammatical resources for Bulgarian, Czech and Russian necessary to generate texts with stylistic variation in the CAD/CAM domain. The variation covered mainly concerns the parameters of explicitness and personal/impersonal (cf. deliverable TXSM; Kruijff-Korbayova et al., 1999). The target text we agreed upon for the intermediate demonstrator (henceforth: ImD) are given in the appendix.

To counteract a sublanguage-bias, the resource implementation has followed the linguistic specification of a broader range of phenomena as described in deliverables SPEC2-BAS, SPEC2-CU and SPEC2-RU (Andonova et al., 1999). Thus, a broader coverage of linguistic phenomena has been achieved. The phenomena in focus have been the following:

- clause complexity, transitivity, mood, voice, tense, aspect, theme (clause level)
- minor transitivity (prepositional phrase level)
- determination (nominal group and clause levels)

This has resulted in a coverage of regions of the grammars of Bulgarian, Czech and Russian that can be synoptically displayed by a table as follows.1

<table>
<thead>
<tr>
<th>Ideational</th>
<th>Interpersonal</th>
<th>Textual</th>
</tr>
</thead>
<tbody>
<tr>
<td>Logical</td>
<td>Experiential</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Clause</th>
<th>Transitivity, Circumstance, Voice, Tense, Aspect</th>
<th>Mood, Polarity, Attitude, Modality</th>
<th>Theme, Culmination, Conjunction, Determination</th>
</tr>
</thead>
<tbody>
<tr>
<td>prep nom</td>
<td>Minor transitivity</td>
<td></td>
<td>Determination</td>
</tr>
<tr>
<td>Complex</td>
<td>Classification Noun-type, Epithet, Qualification</td>
<td>Person, Attitude</td>
<td></td>
</tr>
<tr>
<td>Adj</td>
<td>Modification Quality-type</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quant</td>
<td>Modification Quantity-type</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adv</td>
<td>Modification Circumstantial-type</td>
<td>Comment</td>
<td>Conjunctive</td>
</tr>
</tbody>
</table>

Each of these areas is described in a separate section (see Section 2 below).

---

1 The regions in focus are given in bold face; other regions that have been treated as well, however not systematically, in order to be able to generate the target texts, are given in grey shade. Note that determination is located in the nominal group as well as the clause because in Slavic languages determination is predominantly, but not solely, reflected by word order in the clause.
In contrast to the first deliverable in this work package (IMPL1-BAS, IMPL1-CU, IMPL1-Ru; Bateman et al., 1998), in the present document we explicitly adopt an organization that is not language-specific. Each section is dedicated to the description of one particular phenomenon rather than to one particular language (Section 2.1: Transitivity, Section 2.2: Diathesis, Section 2.3: Minor Transitivity, Section 2.4: Mood, Section 2.5: Tense, Section 2.6: Aspect, Section 2.7: Clause-Complexity, Section 2.8: Determination, Section 2.9: Word Order). Each phenomenon is dealt with for all three languages. This reflects the implementation strategy we adopted for task 7.2: responsibilities were distributed across sites according to phenomena rather than languages so as to support a truly contrastive-linguistic method of work. The grammatical resources implemented have thus not only been built up by transfer comparison with the English grammar Nigel (cf. Bateman et al., 1998, Section 3.1) that is part of the KPML implementation platform, but crucially by continuous contrastive-linguistic comparison across Bulgarian, Czech and Russian. Only with this strategy has it been possible to implement rather general accounts of the grammars of Bulgarian, Czech and Russian in a year’s time. It is thus demonstrated once again that the methodology of resource sharing we have argued for in (Bateman et al., 1998) leads to fast, but nevertheless principled results.

Before we start the presentation of the system network implementations, let us give an overview of the main notational conventions used in this document.

### 1.1 Notational conventions

Below we give the notational conventions necessary to follow the description of the grammar implementation. Figure 1 presents the general notational conventions used in Systemic Functional Grammar, Figure 2 shows the notation we adopt for system networks, Figure 3 provides the syntax of computational system network specifications, and Figure 4 shows the syntax of multilingual system network specifications. In the text, feature names are given in bold face, system names are given in capitals, and also the names of regions are given in capitals.

<table>
<thead>
<tr>
<th>functional elements</th>
<th>Actor, Subject, etc</th>
</tr>
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<tbody>
<tr>
<td>system names</td>
<td>MOOD</td>
</tr>
<tr>
<td>grammatical features</td>
<td>feature</td>
</tr>
<tr>
<td>selection expressions:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>[feature-x : feature-y,...]</td>
</tr>
<tr>
<td></td>
<td>[feature-x &amp; feature-y,...]</td>
</tr>
<tr>
<td>realization statements:</td>
<td></td>
</tr>
</tbody>
</table>

---

2 Each section describing the phenomena in focus presents the system implementation and the corresponding chooser. Inquiries and inquiry implementations are not given because they are usually taken over from the NIGEL grammar (cf. IMPL1 (Bateman et al., 1998) for the concepts of choosers and inquiries). SPL specifications, i.e., input specifications for tactical generation, are given as examples only. For the full sets of SPLs for each language for the ImD texts please visit the individual sites’ webpages:

http://fairway.ms.mff.cuni.cz/~agile/
http://www.iinf.acad.bg/agile
http://www.aha.ru/~sharoff//Agile
insert        +Subject
conflate      Subject/Actor
expand        Mood(Finite)
order         Subject ^ Finite
preselect     Subject:nominal-group

lexical constraints:
classify      Process::doing-verb
inflectify    Noun:::singular
lexify        Noun ! LEXEME

syntactic structures
trees (presented as screen dumps of
generated structures)

Figure 1: Notational conventions in Systemic Functional Grammar

\[
\text{System-name} \rightarrow 
\begin{align*}
&[\text{feature-a}] \ (\text{Function1} : \text{feature-x}) \\
&[\text{feature-b}] \ (\text{Function2} : \text{feature-y}, \text{Function3} ! \text{feature-z}) \\
&[\text{feature-c}] \ (\text{Function4} : \text{feature-f,feature-g})
\end{align*}
\]

Figure 2: Notation for system networks

\[
\text{(system} \\
\begin{align*}
&:\text{name SYSTEM-NAME} \\
&:\text{inputs} \ (\text{OR feature-x} \\
&\quad \ (\text{AND feature-y feature-z})) \\
&:\text{outputs} \ ((0.5 \ \text{feature-a} \\
&\quad \ (\text{insert Function-1}) \\
&\quad \ (0.5 \ \text{feature-b} \\
&\quad \ (\text{conflate Function-2 Function-3} \\
&\quad \ (\text{preselect Function-2 feature-c}))) \\
&:\text{chooser} \ \text{SYSTEM-NAME-CHOOSER} \\
&:\text{region} \ \text{REGION-NAME} \\
&:\text{metafunction} \ \text{METAFUNCTION}
\end{align*}
\]

: name gives the name of the system; :inputs specifies the features that act as entry conditions to the system;
:outputs specifies the features of the system, where features may have realization statements attached (insert, conflate, preselect etc); :region specifies the functional region the system belongs to—this can be thought of as finer grained subclassification of metafunction given in the :metafunction slot and is used for the organization of resources.

Figure 3: Syntax for computational system network specifications

\[
\text{(system} \\
\begin{align*}
&:\text{name SYSTEM-NAME} \\
&:\text{inputs} \ (\text{:Language-1 :Language-2 OR feature-x} \\
&\quad \ (\text{AND feature-y feature-z})) \\
&:\text{outputs} \ ((\text{:language-1 language-2 0.5 feature-a} \\
&\quad \ (\text{:language-1 insert Function-1}) \\
&\quad \ (\text{:language-2 insert Function-4}) \\
&\quad \ (\text{:language-1 language-2 0.5 feature-b} \\
&\quad \ (\text{:language-2} \\
&\quad \ \text{conflate Function-2 Function-3}) \\
&\quad \ (\text{:language-1 :language-2})
\end{align*}
\]
2. Implementation of grammatical resources

2.1 Transitivity (nuclear and circumstantial)

In this chapter we describe the implementation of the transitivity resources for Russian, Czech and Bulgarian. The implementation is based upon the English Nigel grammar. Transitivity manifests itself structurally as a configuration of a process, the participants involved in the process (nuclear transitivity) and the attendant circumstances (circumstantial transitivity). This configuration forms the basis for the interpretation of the transitivity structure of the clause as a constituent structure, such as e.g., Actor + Process + Locative. In Nigel, nuclear transitivity is divided into relational and nonrelational transitivity. Here, nonrelational transitivity is described in Section 2.1.1, relational transitivity is described in Section 2.1.2. Included in Section 2.1.1 is a solution to the problem of agency (ergativity vs. transitivity), which has been discussed in the SPEC2 deliverable (Andonova et al., 1999). Circumstantial transitivity is described in Section 2.1.3.

2.1.1 Nonrelational transitivity

The most general transitivity systems are part of the region NONRELATIONAL-TRANSITIVITY. The system PROCESS-TYPE (see below) distinguishes between material, mental, verbal and relational processes. This system is common to the three Slavic languages. In the ImD we focus on two types of processes - material and relational. Verbal and mental are hardly used in this register, according to our corpus analyses. The PROCESS-TYPE system is shown in Figure 1.

PROCESS-TYPE:

\[
(\text{transitivity-unit}) \rightarrow \\
[\text{material}] \quad (\text{Process::do-verb}), \\
[\text{mental}] \quad (\text{Process::experience-verb}), \\
[\text{verbal}] \quad (\text{Process::symbolic-verb}), \\
[\text{relational}] \quad (\text{Process::relational-verb}).
\]
Another very general system in the NONRELATIONALTRANSITIVITY region is the AGENCY system. For English, this system reflects the ergative pattern of English, in which an Agent + Medium configuration (transitive construction) has a Medium-only variant (middle or ergative construction). While the grammars of Slavic languages have the middle variant as well, its construction needs more complex morpho-syntactic means. Example (1a) illustrates this pattern for English, and examples (1b) – (1d) illustrate which additional means are needed in Bulgarian, Czech and Russian, i.e., reflexivization of the Process.

(1)

(a) En: The lion woke the tourist – The tourist woke.
(b) Cz: Lev probudil turistu - Turista se probudil.
   Lion-nom woke tourist-acc – Tourist-nom woke-refl
(c) Bg: Лъвът събули туриста. - Туристът се събули.
   Lion woke tourist – Tourist woke-refl
(d) Ru: Лев разбудил туриста – Турист проснулся.
   Lion-nom woke tourist-acc – Tourist-nom woke-refl

The English system of AGENCY accounts for this kind of alternation as follows:
AGENCY:

(transitivity-unit) →

[middle] (Process::middle-verb),

[effective] (Process::effective-verb).

This is hard to apply for Slavic languages because they are transitively rather than ergatively organized, i.e., we find the productive alternation of transitive vs. intransitive. Since both patterns exits, we decided to change the AGENCY system to a system that distinguishes between the number of participant roles, on the one hand, and proper agency, on the other hand. The system then looks as follows, where middle now stands for process types with one participant only, middle-transitive corresponds to the English middle, and effective stays the same.

AGENCY:

(transitivity-unit) →

[middle] (Process::intransitive-verb),

[middle-transitive] (Process::middle-verb),

[effective] (Process::transitive-verb).

Middle processes in the Slavic languages do not have Agents – they are inherently Agent-less (see examples (2a-d)); middle-transitive processes involve a Medium, but may have an Agent. An example from Russian would be "okno otkroetsja" (The window will open). There are no occurrences of this type in the ImD texts. What we have instead is - "okno pojavitsja" (The window will appear) – which is a middle configuration. Finally the effective option accounts for the transitive variant, and thus has the normal voice potential (active – passive), which the other two have not.

(2) Slavic intransitive verbs in middle configuration

(a) En: Switch to Arc mode.

(b) Bg: Превключите в режим Arc.

Switch to mode Arc

(c) Cz: Přepněte do režimu Kreslení obloku.

Switch to the mode of the arc drawing

(d) Ru: Переейдите в режим Arc

Switch to mode Arc

Middle processes can be realized by intransitive verbs (as in 2b-d) or by reflexive verbs. See examples (3b-d).
(3) \textit{Slavic reflexive verbs in middle configuration}

(a) En: The dialog box appears.
(b) Bg: ДIALOGOVYAT PROZOREC SE POJAVJA.
The dialog box appears.
(c) Cz: Objeví se dialogové okno
Appear-refl dialog box-nom.
(d) Ru: НА ЭКРАНЕ ПОЯВИТСЯ ДИАЛОГОВОЕ ОКНО
On the screen appear-refl dialog box-nom.

Effective processes are realized by lexical verbs that are transitive, i.e., that have a Direct Complement realized in accusative case. Effective processes are the most frequent kind of process in the ImD texts. See example (4).

(4) \textit{Effective = Slavic transitive}

(a) En: The user starts the command. (to specify the point), to enter (the symbol), etc.)
(b) Bg: ПОТРЕБИТЕЛЬ СТАРТИРА КОМАНДАТА. (ЗАДАВАМ (ТОЧКА), ВВЕЖДАМ (СИМВОЛ), etc.)
The user starts the command
(c) Cz: UŽIVATEL SPUSTÍ PŘÍKAZ. (uřítil (bod), zadat (symbol), etc.)
User-nom starts the command-acc
(d) Ru: ПОЛЬЗОВАТЕЛЬ ЗАПУСКАЕТ КОМАНДУ. (ЗАДАТЬ (ТОЧКУ), ВВЕСТИ (СИМВОЛ), etc.)
User-nom starts the command-acc

Finally, what we called middle-transitive processes are realized by reflexive forms of transitive verbs. See example (5).

(5) \textit{Middle-transitive}

(a) En: The command starts.
(b) Bg: Командата се стартира
The command starts-refl
(c) Cz: PŘÍKAZ SE SPUSTÍ
The command-nom starts-refl
(d) Ru: КОМАНДА ЗАПУСКАЕТСЯ
The command-nom starts-refl

The implementations of the AGENCY system and its chooser are shown in Figure 6.
The most frequent process type in the ImD texts is effective-material. Choice of this type is wired in the gate EFFECTIVE-MATERIAL. For middle-transitive agency we also need this gate (see Figure 7).

An example of an SPL input expression generating a middle-transitive clause with a reflexivized verb is shown in Figure 8.
Material processes may also include a Beneficiary as participant in the configuration. In relation to this participant in the English model the processes are divided into dispositive and creative by the system DOING-TYPE. In the ImD texts we have both, but there is no difference in their use concerning the Beneficiary. We nevertheless conserve the distinction of RECIPIENCY (for dispositive processes) and CLIENCY (for creative processes). Recipient and Client are subtypes of Beneficiary. In English they differ formally by the preposition (to for Recipient and for for Client). In Russian and Czech the Beneficiary is marked by dative case with both dispositive and creative processes. Creative processes have a variant with a preposition: (Ru) дару, (Cz) pro, (En) for. Bulgarian shows the same distinctions as English: (Bu) na - (En) to, (Bu) за - (En) for. For example:

(6) **Realizing Beneficiary**

(a) En: She sent her best wishes to John - She sent John her best wishes.

(b) Cz: Poslala pozdrav (Acc) Johnovi

(She) sent best wishes-acc John-dat

Poslala Johnovi (dat) pozdrav

(She) sent John-dat best wishes-acc.

(c) Bg: Тя изпрати поздрави на Джон

She sent best wishes to John

Тя изпрати на Джон поздрави

She sent to John best wishes

(d) Ru: Она передала привет Джону

She sent best wishes-acc John-dat

Она передала Джону привет

She sent John-dat best wishes-acc

The examples show that for dispositive processes the Slavic languages have only one way of expressing the Beneficiary – dative case for Russian and Czech and one preposition for Bulgarian. English has two different prepositions and different participant roles. But in all the cases we have two variants of word order (reflecting differences in communicative structure).
For creative processes the situation is the same as for dispositive for Bulgarian and English. For Russian and Czech there are two variants – realization by a nominal group in dative case or by a prepositional phrase with the prepositions *dlja* and *pro*, respectively. In the two variants, two variants of word order are possible as shown in examples (7):

(7) *Realizing Cliency*

(a) En: Fred bought a present for his wife - Fred bought his wife a present.

(b) Cz: Fred koupil dárek pro svou ženu - Fred koupil pro svou ženu dárek
Fred bought a present-acc for his wife-gen (different in communicative structure)
Fred koupil dárek (acc) své ženě (dat) - Fred koupil své ženě dárek
Fred bought a present-acc for his wife-dat (different in communicative structure)

(c) Bg: Фред купи подарък за жена си - Фред купи за жена си подарък
Fred bought a present for his wife

(d) Ru: Фред купил подарок для своей жены - Фред купил для своей жены подарок
Fred bought a present-acc for his wife-gen (different in communicative structure)
Фред купил подарок своей жене - Фред купил своей жене подарок
Fred bought a present-acc for his wife-dat (different in communicative structure)

We do not look at the problems any further, since the output features will be negative because there are no Beneficiary roles in the ImD texts. In Figure 9 we show the systems relating to the choice of Beneficiary.

```plaintext
(SYSTEM
 :NAME DOING-TYPE
 :INPUTS EFFECTIVE-MATERIAL
 :OUTPUTS ((0.5 CREATIVE
 (CLASSIFY PROCESS CREATION-VERB))
 (0.5 DISPOSITIVE
 (CLASSIFY PROCESS DISPOSAL-VERB)))
 :CHOOSER DOING-CHOOSER
 :REGION NONRELATIONALTRANSITIVITY
 :METAFUNCTION EXPERIENTIAL)

(CHOOSER
 :NAME DOING-CHOOSER
 :DEFINITION ((ASK (PREEXIST-Q GOAL PROCESS)
 (NONEXISTENT (CHOOSE CREATIVE))
 (EXISTED (CHOOSE DISPOSITIVE))))
)```
(SYSTEM
  :NAME CLIENCY
  :INPUTS CREATIVE
  :OUTPUTS ((0.5 CLIENCY
               (INSERT BENEFICIARY)
               (PRESELECT BENEFICIARY NOMINAL-GROUP))
             (0.5 NONCLIENCY))
  :CHOOSER CLIENCY-CHOOSER
  :REGION NONRELATIONALTRANSITIVITY
  :METAFUNCTION EXPERIENTIAL
)

(CHOOSER
  :NAME CLIENCY-CHOOSER
  :DEFINITION (((ASK (CLIENCY-Q PROCESS)
                   (CLIENCY (IDENTIFY BENEFICIARY
                              (CLIENT-ID PROCESS)))
                   (IDENTIFY BENEFICIARY
                    (CONCEPTUAL-CORRELATE-ID BENEFICIARY)))
                  (CHOOSE CLIENCY))
             (NONCLIENCY (CHOOSE NONCLIENCY)))
)

(SYSTEM
  :NAME RECIPIENCY
  :INPUTS DISPOSITIVE
  :OUTPUTS ((0.9 NONRECIPIENCY)
            (0.1 RECIPIENCY
             (INSERT BENEFICIARY)
             (PRESELECT BENEFICIARY NOMINAL-GROUP)))
  :CHOOSER RECIPIENCY-CHOOSER
  :REGION NONRELATIONALTRANSITIVITY
  :METAFUNCTION EXPERIENTIAL
)

(CHOOSER
  :NAME RECIPIENCY-CHOOSER
  :DEFINITION (((ASK (RECIPIENCY-Q PROCESS)
                   (NOPOSSESSIONCREATED (CHOOSE NONRECIPIENCY))
                   (POSSESSIONCREATED
                    (ASK (POSSESSION-ONSET-SPECIFICATION-Q PROCESS)
                    (SPECIFIED (CHOOSE RECIPIENCY)
                    (IDENTIFY BENEFICIARY
                     (BENEFICIARY-ID PROCESS)))
                    (IDENTIFY BENEFICIARY
                     (CONCEPTUAL-CORRELATE-ID BENEFICIARY)))
                   (NOTSPECIFIED (CHOOSE NONRECIPIENCY)))
                 ))
)

(GATE
  :NAME NONBENEFACTION
  :INPUTS (OR NONRECIPIENCY NONCLIENCY
            (AND EFFECTIVE-VERBAL NONADDRESS))
  :OUTPUTS ((1.0 NONBENEFACTIVE))
  :REGION NONRELATIONALTRANSITIVITY
  :METAFUNCTION EXPERIENTIAL
)
As it is shown in the Figure 9 both nonrecipiency and nonclienacy lead to the feature nonbeneactive and then to the feature nonblique-complemented defined by the gates shown in Figure 9. With these systems, the selection of participants is complete. Their realization by syntactic functions (Subject, Directcomplement etc.) is described in Section 2.2 on diathesis.

2.1.2 Relational transitivity

Relational processes are processes of being. In the intermediate demonstrator texts we have only one type of relational processes - the existential process, semantically a one-place relation. In English, existential constructions have the following constituents:

There (Subject) + are (Process of being) + Existent.

The Theme position is filled by the formal Subject in English (there). Slavic languages do not need to insert a formal Subject, the Subject position can stay empty or be occupied by a Circumstance (temporal or spatial). This gives rise to the following kinds of structure:

На экране (Locative) + появиться (Process of being) + окно (Existent/Subject) (Nom)

On the screen will appear a window

The topmost system of the RELATIONALTRANSITIVITY region which accounts for the general types of relational process is the system TYPE-OF-BEING (see Figure 10).
An SPL input expression for generating existential clauses is given in Figure 11.

For Bulgarian the process to appear is described as motion process, so is is not covered here.

2.1.3 Circumstantial transitivity

Circumstantial transitivity is the resource for representation of phenomena attendant on (rather than involved in) the process (Adjuncts).

The types of Circumstances are described in the CIRCUMSTANCE region. The region covers a number of simultaneous systems each describing one type of Circumstance. Circumstances can be realized as prepositional phrases or adverbial groups. Realization by prepositional phrases is described in Section 2.3 (Minor Transitivity). The types of Circumstances are described by the system TYPE-OF-CIRCUMSTANCE as follows:

(TYPE-OF-CIRCUMSTANCE):
   (transitivity-unit) →
      [nonaccompaniment]
      [accompaniment] (+Accompaniment
         Accompaniment:prepositional-phrase
         Accompaniment:accompaniment-process)
      [noncause]
      [cause] (+Cause)
      [nonmanner]
      [manner] (+Manner)
      [nonmatter]
      [matter] (+Matter
         Matter:matter-process)
Matter, Role and Timeextent do not occur in the ImD texts. We therefore focus on the other types in the remainder of this section.

In Figure 12 we display the system’s implementation for the types of Circumstances that are present in our corpus: Accompaniment, Cause, Manner, Spaceextent, Spacialocative and Timelocative.

```
(SYSTEM
 :NAME ACCOMPANIMENT-ADJUNCT
 :INPUTS TRANSITIVITY-UNIT
 :OUTPUTS ((0.9 NONACCOMPANIMENT)
 (0.1 ACCOMPANIMENT
 (INSERT ACCOMPANIMENT)
 (PRESELECT ACCOMPANIMENT PREPOSITIONAL-PHRASE)
 (PRESELECT ACCOMPANIMENT ACCOMPANIMENT-PROCESS)))
 :CHOOSER ACCOMPANIMENT-CHOOSER
 :REGION CIRCUMSTANTIAL
 :METAFUNCTION EXPERIENTIAL)

(SYSTEM
 :NAME CAUSE-ADJUNCT
 :INPUTS TRANSITIVITY-UNIT
 :OUTPUTS ((0.9 NONCAUSE)
 (0.1 CAUSE
 (INSERT CAUSE)))
 :CHOOSER CAUSE-CHOOSER
 :REGION CIRCUMSTANTIAL
 :METAFUNCTION EXPERIENTIAL)
```
We comment on these systems in the order they appear in Figure 12.

In the system ACCOMPANIMENT the Circumstance Accompaniment is inserted and preselected for prepositional-phrase and accompaniment-process. The preposition realizing this type of Circumstance is „in relation to“ (see Section 2.3).

For the selection of Cause, the system of CAUSE-PHORICITY offers the choice of realizing the Cause phorically (as an adverbial group) or nonphorically (as a prepositional phrase). In the ImD texts, we only have nonphoric Causes. Also, Cause has to be subclassified further (see the system CAUSE-TYPE presented in Figure 13).
In the ImD, we only have Purpose Circumstances. See example (8).

(8) **Purpose circumstance** *(TEXT4) (simplified)*

(a) En: Select an arc for the startpoint of the multiline.

(b) Cz: Zvolte oblouk pro počáteční bod multičáry.

    Select an arc-acc for startpoint-gen multiline-gen

(c) Bg: Изберете дъга за началната точка на мултилинията.

    Select an arc for the startpoint of the multiline

(d) Ru: Выберите дугу для начальной точки мультилинии.

    Select an arc-acc for startpoint-gen multiline-gen

An example of a semantic input representation (SPL) with information on purpose is shown in Figure 14.

```plaintext
(EXAMPLE
 :NAME D1-TEXT4-5-1-RU
 :TARGETFORM "Sadajte dugu dlja nachalnoj tochki muljtilinii."
 :LOGICALFORM
 (P / DIRECTED-ACTION :LEX ZADATJ :SPEECHACT IMPERATIVE
 :ACTEE (A2 / OBJECT :NAME duga)
 :purpose (t / OBJECT :LEX tochka :PROPERTY-ASCRITION
 (t1 / QUALITY :LEX nachaljnyj)
 :meta-actant
 (t2 / OBJECT :NAME MULJTLINIIJA))
 :SET-NAME D1-TEXT4
)
```

**Figure 14: Semantic representation with purpose function (Ru)**

In terms of MANNER-TYPE, the only Circumstance that occurs in the ImD texts is Means. Russian and Czech realize the Means Circumstance by a nominal group in Instrumental case (see example (9)). Russian has the additional option of realization with a
prepositional phrase. This depends on whether the Means is interpreted as some sort of an agentic instrument or as a manipulating instrument (see example (10)).

(9) **Means circumstance**

(a) Cz: Spusťte příkaz KŘIVKA jedním z následujících způsobů

   Start the PLINE command one-instr of following-gen methods-gen

(b) Ru: Запустите команду PLINE одним из следующих способов

   Start the PLINE command by one-instr of following-gen methods-gen

This kind of realization is not possible for Bulgarian. In Bulgarian it can be only expressed by a clause complex.

```
(SYSTEM
 :NAME MANNER-TYPE
 :INPUTS MANNER
 :OUTPUTS ((0.33333334 MEANS
   (INSERT MEANS)
   (:CZECH (PRESELECT MEANS INSTRUMENTAL-CASE)
     (PRESELECT MEANS NOMINAL-GROUP))
   (CONFLATE MANNER MEANS))
  (0.33333334 QUALITY
   (INSERT QUALITY)
   (PRESELECT MANNER ADVERBIAL-GROUP MANNER-ADVERBIAL)
   (CONFLATE MANNER QUALITY))
  (0.33333334 COMPARISON
   (INSERT COMPARISON)
   (CONFLATE MANNER COMPARISON)
   (PRESELECT COMPARISON PREPOSITIONAL-PHRASE)
   (PRESELECT COMPARISON COMPARATIVE-PROCESS))))
 :CHOOSER MANNER-TYPE-CHOOSER
 :REGION CIRCUMSTANTIAL
 :METAFUNCTION EXPERIENTIAL)
```

Figure 15: Manner type system (Cz, Ru)

(10) **Means circumstance realized as preposition phrase and as nominal group**

(a) Ru: следующим методом

   (by the) following method-instr (agentive-instrument)

(b) Ru: с помощью молотка

   (by means of a hammer-gen (manipulating-instrument)

For Russian, we therefore have to introduce a more fine-grained subsystem for means, which distinguishes between the agentic and the manipulating function of a Means circumstance.

Spatial-location Circumstances are differentiated according to whether they express a rest process or a motion process, and if they are motion processes whether the motion is towards an object or way from it. The system implementations of these choices are shown in Figure 16. Examples and realizations of these alternatives are described in Section 2.3.
(SYSTEM
:NAME SPATIAL-LOCATION-PHORICITY
:INPUTS SPATIAL-LOCATION
:OUTPUTS ((0.5 PHORIC-PLACE
(PRESELECT SPACELOCATIVE SPATIAL-ADVERBIAL))
(0.5 NONPHORIC-PLACE
(PRESELECT SPACELOCATIVE SPATIAL-PROCESS)))
:CHOOSER SPATIAL-LOCATION-PHORICITY-CHOOSER
:REGION CIRCUMSTANTIAL
:METAFUNCTION EXPERIENTIAL)

(CHOOSER
:NAME SPATIAL-LOCATION-PHORICITY-CHOOSER
:DEFINITION ((ASK (QUESTION-VARIABLE-Q SPACELOCATIVE)
(VARIABLE
(ASK (LOCATION-RELATION-SPECIFICITY-Q SPACELOCATIVE)
(UNSPECIFIED (CHOOSE PHORIC-PLACE))
(SPECIFIED (CHOOSE NONPHORIC-PLACE))))
(NONVARIABLE
(ASK (IDENTIFIABILITY-Q SPACELOCATIVE)
(IDENTIFIABLE
(ASK (LOCATION-RELATION-SPECIFICITY-Q SPACELOCATIVE)
(UNSPECIFIED (CHOOSE PHORIC-PLACE))
(SPECIFIED (CHOOSE NONPHORIC-PLACE))))
(NOTIDENTIFIABLE (CHOOSE NONPHORIC-PLACE))))))

(SEMANTIC
:NAME LOCATION-STATE
:INPUTS NONPHORIC-PLACE
:OUTPUTS ((0.5 REST
(PRESELECT SPACELOCATIVE REST-PROCESS))
(0.5 MOTION
(PRESELECT SPACELOCATIVE MOTION-PROCESS)))
:CHOOSER LOCATION-STATE-CHOOSER
:REGION CIRCUMSTANTIAL
:METAFUNCTION EXPERIENTIAL)

(CHOOSER
:NAME LOCATION-STATE-CHOOSER
:DEFINITION ((ASK (SOURCE-DESTINATION-Q SPACELOCATIVE PROCESS)
(NONSOURCEDESTINATION (CHOOSE REST))
(SOURCEDESTINATION (CHOOSE MOTION))))

(SEMANTIC
:NAME MOTION-DIRECTION
:INPUTS MOTION
:OUTPUTS ((0.5 TOWARDS-MOTION
(PRESELECT SPACELOCATIVE TOWARDS))
(0.5 AWAY-FROM-MOTION
(PRESELECT SPACELOCATIVE AWAY-FROM)))
:CHOOSER MOTION-DIRECTION-CHOOSER
:REGION CIRCUMSTANTIAL
:METAFUNCTION EXPERIENTIAL)

(CHOOSER
:NAME MOTION-DIRECTION-CHOOSER
:DEFINITION ((ASK (SOURCE-Q SPACELOCATIVE PROCESS)
(SOURCE (CHOOSE AWAY-FROM-MOTION))
(NOTSOURCE (CHOOSE TOWARDS-MOTION))))
2.2 Diathesis

This section documents the diathesis systems for the three Slavic languages. We provide a systemic functional account of the diathesis phenomena that occur in the present domain. The described networks draw upon the English Nigel grammar regions NONRELATIONALTRANSITIVITY and VOICE, exploiting cross-linguistic similarities as much as possible. Section 2.2.1 recapitulates the notions involved in diathesis. Section 2.2.2 sketches the types of diathesis needed for the intermediate demonstrator and Section 2.2.3 presents the actual implementation.

2.2.1 Notions involved in modeling Diathesis

There are various methods of modeling diathesis. For instance, in (Meljchuk, Kholodovich 1970) the notion of diathesis is defined as the accordance of deep cases to surface cases. Other models speak of relation changes. Following the SFG perspective, diathesis can be described as the relation between transitivity functions (participant roles), agency functions (Agent, Medium) and syntactic relations.

One kind of diathesis change that affects the mapping of transitivity, agency and syntactic functions is voice. For example, in an English material process that is in active voice, the Agent is conflated with the Actor and the Subject, the Goal is conflated with the Medium and the Direct Complement, and the verbal group is in the active voice from. In passive voice, the Medium is mapped onto the Subject and the Agent is realized with a prepositional phrase with by. The situation is similar in Slavic languages. The only difference is in the Agent realization in passive voice. In Russian and in Czech it is expressed by Instrumental case, in Bulgarian it is realized as in English by a prepositional phrase with the preposition от. The active – passive voice pairs for English and Slavic languages are illustrated in the examples below:
Active and passive voice pairs

(a) En: The user opens the window - The window is opened by the user

(b) Bg: Potrebiteiat otvarya prozoreca.

The user opens the window
Prozorecat e otvoren (ot potrebiteia)
The window is opened (by the user)

(c) Cz: Uživatel otevře okno

The use-nom opens the window-acc
Okno-nom je otevřeno (uživatelem)
The window is opened (by the user)

(d) Ru: Пользователь открывает окно

The user-nom opens the window-acc
Окно открыто пользователем
The window-nom opened (by) the user-instr

In Czech and Bulgarian, the passive form with Agent is grammatically possible, but it is not used frequently. So, one kind of diathesis alternations is the active – passive alternation. Another kind of diathesis alternation for English is the active versus middle construction:

(12) En: The user opens the window – The window opens.

Because the transitivity organization of Slavic languages is different (cf. Section 2.1), voice alternations are affected. A voice alternation always also affects the verbal group. See examples (13a-c):

(13)

(a) Bg: Прозорецът се открива

The window opens-refl

(b) Cz: Okno se otevře

The window opens-refl

(c) Ru: Окно открывается

The window opens-refl

The choice of voice therefore goes together tightly with that of agency. Voice type affects the mapping of syntactic functions, agency and transitivity roles, and the realization of the Process constituent.

2.2.2 Types of diathesis in the intermediate demonstrator

Recall that the transitivity system of Slavic languages is organized transitively rather than ergatively. While both patterns exists, the more productive and morpho-syntactically less complex alternation follows the transitive pattern. See example (14).
Traditionally, verbs in the Slavic languages are classified into transitive and nontransitive. In example (14) above the first sentence of each pair has active voice, which is realized by a transitive construction with the verb being in active form. This is the same for all four languages. In English, the middle alternation is simply created by putting the second argument of the transitive variant into the Subject position in the middle variant, whereas in the three Slavic languages the change is also reflected on the verb, which takes on the “medio-passive” voice. This is formally realized in Russian morphologically by means of a reflexive verb, and in Czech and Bulgarian by insertion of a reflexive particle (a clitic).³

Another difference to English in voice formation is that in our three Slavic languages only the syntactic function of Directcomplement is involved in voice transformations: in English also Oblique Complements can become Subjects in passive voice (e.g., I gave a book to Mary – Mary was given a book), which is not possible in Bulgarian, Czech or Russian.

We can observe three voice meanings and voice forms (active-process, passive-process and medio-passive-process) for Czech, Bulgarian and Russian which interact with four transitivity features:

- **Middle (one participant) -> operative voice, active-process** (Agent = Subject)
  One-role, middle processes are always in active voice. ⁴

- **Effective (two participants) -> operative-voice, active-process** (Agent = Subject + Medium = Directcomplement)
  See example (15).

---

³ To represent “reflexive” participants, Slavic languages use reflexive pronouns – Bg: „себе си”, Cz: “sebe” and Ru: „себя”.

⁴ We do not discuss here the specifically Slavic forms as “Я гуляю – Мне (хорошо) гуляется” (I walk – It is walking (well) for me) – they are not relevant to our register.
(15)
(a) En: Specify the endpoint.
(b) Bg: Prozorecat e otvoren (ot potrebitelia)
   The window is opened (by the user).
(c) Cz: Určete koncový bod
   Specify-active the end point-acc
(d) Ru: Укажите конечную точку
   Specify-active the end point-acc

- Effective (two participants) -> **receptive-voice, passive-process**, (Medium = Subject + Agent in Instrumental Case or with Agentmarker „от“ for Bulgarian)
  See example (16).

(16)
(a) En: The window is opened by the user.
(b) Bg: Прозорецът се отваря от потребителя.
   The window is opened by the user
(c) Cz: Okno je otevřeno (uživatelem)
   The window-nom is opened the user-instr
(d) Ru: Окно открыто пользователем
   The window-nom is opened the user-instr

- Middle-transitive (one participant) -> **medio-passive-voice, reflexive-process** (Medium = Subject; no Agent possible)
  See example (17).

(17)
(a) En: The window opens.
(b) Bg: Прозорецът се отваря.
   The window opens-refl
(c) Cz: Okno se otevře.
   The window opens-refl
(d) Ru: Окно откроется
   The window will open-refl

Since the transitivity and voice organization of Bulgarian, Czech and Russian is rather different from that of English, the Nigel modeling can only be re-used to a restricted degree. The implementation is described in the next section.
2.2.3 Modeling diathesis for Bulgarian, Czech and Russian

As stated above, in modeling diathesis, two grammar regions interact – NONRELATIONALTRANSITIVITY and VOICE. We take as point of departure for choices in voice (diathesis) the AGENCY system, which classifies processes into three types: middle, middle-transitive, effective (cf. Section 2.1).

For intransitive processes (middle, in the present terminology), voice can be defaulted to operative (i.e., active). Intransitive processes have the feature noncomplemented which leads to the gates ACTIVE-PROCESS and VOICE-LEXVERB, which are shown in Figure 17. These gates are identical to the English ones.

```
(GATE
  :NAME ACTIVE-PROCESS
  :INPUTS (OR (AND RELATIONAL
               (OR EXISTENTIAL ASCRIPTIVE))
            NONRANGED RANGE-OPERATIVE METEREORLOGICAL OPERATIVE IDENTIFYING
            BENEFACTIVEOPERATIVE BENEFACTIVE-NONMEDIATED-OPERATIVE
            (AND NONADDRESS REPORT))
  :OUTPUTS ((1.0 ACTIVE-PROCESS))
  :CHOOSER ACTIVE-PROCESS-CHOOSER
  :REGION VOICE
  :METAFUNCTION EXPERIENTIAL
)

(GATE
  :NAME VOICE-LEXVERB
  :INPUTS (OR (AND ACTIVE-PROCESS NOT-PHASE))
  :OUTPUTS ((1.0 VOICE-LEXVERB
            (CONFLATE VOICE LEXVERB)))
  :CHOOSER VOICE-LEXVERB-CHOOSER
  :REGION VOICE
  :METAFUNCTION EXPERIENTIAL
)
```

Figure 17: Selecting Slavic intransitive (En, Cz, Ru, Bg)

In Figure 18 we show a sample SPL for generating middle clauses (Ru: Okno ischeznet s ekrana – En: The window disappears from the screen).

```
(EXAMPLE
  :NAME VOICE-2-4-8A-RU
  :GENERATEDFORM "Okno ischeznet s ekrana."
  :TARGETFORM "Okno ischeznet s ekrana."
  :LOGICALFORM
    (P / NONDIRECTED-ACTION :LEX ISCHEZNUJ :TENSE PRESENT :ACTOR
     D / OBJECT :LEX OKNO )
  :SOURCE
    (C1 / ONE-OR-TWO-D-LOCATION :LEX EKRAN))
  :SET-NAME VOICE
)
```

Figure 18: Semantic form for the intransitive sentence (En, Cz, Ru, Bg)

Effective processes can occur in three types of diathesis: operative (active), receptive (passive) and medio-passive. The point of departure for them is the system AGENTIVITY, shown in Figure 19. It is identical for the Slavic languages and English.

```
(SYSTEM
  :NAME AGENTIVITY
  :INPUTS (OR EFFECTIVE-MATERIAL EFFECTIVE-MENTAL EFFECTIVE-VERBAL)
  :OUTPUTS ((0.9 NONAGENTIVE)
```
The feature \textit{agentive} leads to the choice between \textit{operative} (active) and \textit{receptive} (passive) with Agent, the choice of \textit{nonagentive} leads to passive without Agent or to \textit{medio-passive}. The system \textit{EFFECTIVE VOICE} is shown in Figure 20.

\begin{verbatim}
(SYSTEM
 :NAME   EFFECTIVE-VOICE
 :INPUTS   (OR (AND AGENTIVE
 (OR NONRECIPIENCY NONCLIENCY MENTAL
 (AND NONADDRESS REPORT-NAME)))
 EQUATIVE)
 :OUTPUTS  ((0.9 OPERATIVE
 (CONFLATE MEDIUM DIRECTCOMPLEMENT))
 (0.1 RECEPTIVE))
 :CHOOSER   EFFECTIVE-VOICE-CHOOSER
 :REGION   VOICE
 :METAFUNCTION   EXPERIENTIAL
)
\end{verbatim}

Figure 20: System for active and passive voice (En, Cz, Ru, Bg)

The \textit{operative} feature then leads to the realization of the Directcomplement and to the \textit{ACTIVE-PROCESS} system shown in Figure 21. \textit{Effective} and \textit{active-process} features launch the gate \textit{MEDIUM-INSERT} and then the gate \textit{GOAL-INSERT-CONFLATE} (presented in Figure 22).

\begin{verbatim}
(GATE
 :NAME   ACTIVE-PROCESS
 :INPUTS   (OR (AND RELATIONAL
 (OR EXISTENTIAL ASCRIPTIVE))
 NONRANGED RANGE-OPERATIVE METEOROLOGICAL OPERATIVE IDENTIFYING
 BENFACTORIOPERATIVE BENFACTORI-NONMEDIATED-OPERATIVE
 (AND NONADDRESS REPORT))
 :OUTPUTS  ((1.0 ACTIVE-PROCESS))
 :CHOOSER   ACTIVE-PROCESS-CHOOSER
 :REGION   VOICE
 :METAFUNCTION   EXPERIENTIAL
)
\end{verbatim}

Figure 21: System ACTIVE-PROCESS (En, Cz, Ru, Bg)
The inserted transitivity functions are conflated with Directcomplement in the EFFECTIVE-VOICE system for the active construction (operative) and with the Subject function for the passive construction (receptive) in the gate MEDIUM-SUBJECT-CONFLATE, shown on the Figure 23.

Transitive active voice and passive voice constructions with Agent have similar SPL representations, the latter including answers to the effective-voice-chooser inquiries, differentiating these two constructions. Examples of SPLs for active transitive and passive with Agent are shown in Figure 24.
For the passive construction, the form of the verb is described in the gate PASSIVE-VOICE, and the realization of the Agent is described in the gate ADJUNCT-AGENT. Both are shown in Figure 25.

The medio-passive is accounted for by the gate MEDIO-PASSIVE-PROCESS, presented in Figure 26. This gate is relevant only for the three Slavic languages and not for English.
(GATE
  :NAME MEDIO-PASSIVE-VOICE
  :INPUTS (AND MIDDLE-TRANSITIVE NONAGENTIVE)
  :OUTPUTS ((1.0 MEDIO-PASSIVE-PROCESS
    (CONFLATE VOICE LEXVERB)
    (CONFLATE FINITE VOICE)
    (INFLECTIFY LEXVERB REFLEXIVE-FORM)))
  :REGION VOICE
  :METAFUNCTION EXPERIENTIAL
)

Figure 26: The gate MEDIO-PASSIVE-PROCESS (Cz, Ru, Bg)

Figure 27 gives an example SPL for generating medio-passive.

(EXAMPLE
  :NAME VOICE-4-RU
  :TARGETFORM "Okno otkroetsja" – "The window opens"
  :LOGICALFORM
    (P / DIRECTED-ACTION :LEX OTKRYTJ
     :CAUSATIVE-MENTION-Q WITHHOLD
     :PREFER-MENTION-AGENT-Q WITHHOLD
     :ACTOR
       (P1 / PERSON :LEX POLJZOVATELJ)
     :ACTEE
       (D1 / OBJECT :LEX OKNO))
  :SET-NAME VOICE
)

Figure 27: The semantic representation for medio-passive (Ru)

For the Bulgarian and Czech grammars, the medio-passive is implemented as a subtype of passive-process. The gate PASSIVE-PROCESS and the new system PASSIVE-PROCESS-TYPE are shown in Figure 28.

(GATE
  :NAME PASSIVE-PROCESS
  :INPUTS (OR RANGE-RECEPTIVE RECEPTIVE BENEFACTIVE-NONMEDIATED-
    RECEPTIVE
    MEDIORECEPTIVE BENERECEPTIVE NONAGENTIVE NONMEDIATED)
  :OUTPUTS ((1.0 PASSIVE-PROCESS))
  :REGION VOICE
)

(SYSTEM
  :NAME PASSIVE-PROCESS-TYPE
  :INPUTS PASSIVE-PROCESS
  :OUTPUTS ((0.5 PARTICIPLE-PASSIVE
    (CLASSIFY VOICE SAM-AUX)
    (INSERT VOICEDEPENDENT)
    (INFLECTIFY VOICEDEPENDENT PASTPARTICIPLE))
  (0.5 MEDIO-PASSIVE
    (CONFLATE FINITE PROCESS)
    (INSERT REFLEXIVEPARTICLE)
    (LEXIFY REFLEXIVEPARTICLE SE))
  :CHOOSER PASSIVE-PROCESS-TYPE-CHOOSER
  :REGION VOICE
)

Figure 28: The types of passive-processes in Czech and Bulgarian
In Czech and Bulgarian, the medio-passive is realized by insertion of a reflexive particle (a clitic). This clitic can be ordered in different places and there are different possible orderings for Czech and Bulgarian. Bulgarian orders the reflexive particle after the Finite as default, and Czech orders the reflexive particle after the first constituent in a clause. Two systems account for this (see Figure 29).

```
(SYSTEM
  :NAME    MEDIO-PASSIVE-ORDER (:CZECH)
  :INPUTS  (AND MEDIO-PASSIVE THEME-ORDER)
  :OUTPUTS ((0.5 THEME-REFLEXIVEPARTICLE
              (ORDER THEME REFLEXIVEPARTICLE))
            (0.5 REFLEXIVEPARTICLE-THEME
              (ORDER REFLEXIVEPARTICLE THEME)))
  :CHOOSER MEDIO-PASSIVE-ORDER-CHOOSER
  :REGION  voice)

(SYSTEM
  :NAME    MEDIO-PASSIVE-ORDER (:BULGARIAN)
  :INPUTS  (MEDIO-PASSIVE)
  :OUTPUTS ((0.5 finite-REFLEXIVEPARTICLE
              (ORDER finite REFLEXIVEPARTICLE))
            (0.5 REFLEXIVEPARTICLE-finite
              (ORDER REFLEXIVEPARTICLE finite)))
  :CHOOSER MEDIO-PASSIVE-ORDER-CHOOSER
  :REGION  voice)
```

Figure 29: Ordering of the reflexive clitic in Czech and Bulgarian

2.3 Minor transitivity

This section documents the system network for the prepositional phrase (PP). An analysis of the current domain (SPEC2; Andonova et al., 1999) has revealed that only a certain subset of prepositional phrases are used in the intermediate demonstrator texts and in the register of instructional texts more generally. The described network draws upon the English Nigel grammar’s prepositional phrase rank, exploiting cross-linguistic similarities as much as possible. In this chapter we first present a short summary of the differences between the Slavic languages under investigation in this region of grammar (Section 2.3.1). Then we present the implementation of the PP network focusing on realizational details (Section 2.3.2).

2.3.1 The prepositional phrase in Bulgarian, Czech and Russian

Prepositional phrases are treated as grammatical realizations of the Upper Model semantic relation of circumstantial. They are semantically represented as two place relations between a domain (a process or an object) and a range (an object). Following SFG terminology, in the grammar they are presented as the functional elements of Minorprocess (realized by a preposition) and Minirange (typically realized as a nominal group).

A general discussion of prepositional phrases in Slavic languages has been presented in the SPEC2 deliverable (Andonova et al. 1999). In Czech and Russian, prepositions are a case-governing word class - so the selection of a preposition for realizing the Minorprocess structural element is directly followed by a case inflection constraint on the Minirange of the PP. Also, for Russian and Czech the same preposition can select different cases. For example, the Russain preposition v may select locative or accusative case, depending on
whether the process denotes location (locative case) or destination (accusative case). See example (18a) which illustrates the destination reading and (18b) illustrating the location reading. Examples (18c) and (18d) illustrate the location reading (with two prepositions: v and na) in Czech, and (18e) illustrates the Czech destination reading

(18) Spatial-locating vs. Destination (Russian, Czech)

(a) Ru: Добавьте элементы в стиль S1
   Add elements-acc into the style-acc S1.1.
(b) Ru: В стиль S1 добавьте элементы в подтип S1.1.
   In the style-loc S1 add elements-acc into the subtype-acc S1.1.
(c) Cz: V dialígovém okně Style zadejte s.
   In dialogue-adj-box-loc Style enter s
(d) Cz: Na příkazovém řádku zadejte s
   At command-adj-box-loc line-loc enter s
(e) Cz: Přeměňte čtyři úsekky vlna obdélník
   Change four lines into rectangle-acc

Bulgarian resembles English: Since it does not have case, prepositions can be ambiguous as to whether they denote location or destination. In (19a) в стила S is interpreted as destination because the verb implies directionality, and в стила S in (19b) is interpreted as location, since a destination is already expressed by към.

(19) Spatial-locating vs. Destination

(a) Bg: Добавете елементи в стила S
   Add elements to the style S1
(b) Bg: В стила S добавете елементи към стила S1
   In the style S add elements to the subtype S1

Since the differences between Russian, Bulgarian and Czech only lie in realization, we can use the same functional classification, i.e., the same system network.

Problems arise when the same meaning is expressed at different ranks in different languages. A case in point is Czech and Russian using a genitive construction for expressing the meaning of ‘part-of’ and Bulgarian using a prepositional phrase (again like English):

(20) PP vs. NG (genitive)

(a) Cz: Zadá se koncový bod oblouku.
   Specify the endpoint-nom arc–gen
(b) Ru: Задается конечная точка дуги
   Specify the endpoint-nom arc–gen
(c) Bg: Задава се крайната точка на дъгата
   Specify the endpoint of the arc

Since we only deal with the structural unit of the prepositional phrase here, we have to ignore this issue for the time being.
In the following sections we present the implementation of the prepositional phrase by first giving the most general types (Section 2.3.2), and then moving to the two regions the prepositional phrase network is composed of: PPSPATIOTEMPORAL (Section 2.3.2.1) and PPOTHER (Section 2.3.2.2).

2.3.2 Types of prepositional phrases

The most general system at prepositional phrase rank is the system MINOR-PROCESS-TYPE (see Figure 30).

```
(SYSTEM :NAME MINOR-PROCESS-TYPE
 :INPUTS PREPOSITIONAL-PHRASE
 :OUTPUTS ((0.125 SPATIO-TEMPORAL-PROCESS)
 (0.125 INSTRUMENTAL-PROCESS)
 (0.125 COMPARATIVE-PROCESS)
 (0.125 CAUSAL-PROCESS)
 (0.125 ACCOMPANIMENT-PROCESS)
 (0.125 MATTER-PROCESS)
 (0.125 ROLE-PROCESS
 (CLASSIFY MINORPROCESS PREPOSITION)
 (CLASSIFY MINORPROCESS ROLE-VERB))
 (0.125 PORTION-PROCESS
 (:BULGARIAN (LEXIFY MINORPROCESS))
 )
 :CHOOSER MINOR-PROCESS-TYPE-CHOOSER
 :REGION PPOTHER
 :METAFUNCTION IDEATIONAL )
```

Figure 30: Minor process type system for (En, Bg, Cz and Ru)

The feature spatio-temporal-process is the entry condition of the systems of the PPSPATIOTEMPORAL region. The other features are entry conditions to PPOTHER systems.

2.3.2.1 The PPSPATIOTEMPORAL region

The top level distinction in the system network of spatiotemporal PPs is spatial-process and temporal process. In this section we only consider spatial processes (the most frequently occurring type of prepositional phrase in the ImD texts is spatial-process, temporal processes do not occur).

The other major distinction made in the PPSPATIOTEMPORAL region are extent/location and spatial/temporal. This cross-classification is reflected by the systems SPATIO-TEMPORAL, EXTENT-PROCESS-TYPE and SPATIO-TEMPORAL-TYPE. They are presented in Figure 31.

```
(SYSTEM :NAME SPATIO-TEMPORAL :INPUTS SPATIO-TEMPORAL-PROCESS
 :OUTPUTS ((0.5 EXTENT-PROCESS)
 (0.5 LOCATION-PROCESS))
 :CHOOSER SPATIO-TEMPORAL-CHOOSER
 :REGION PPSPATIOTEMPORAL
 :METAFUNCTION IDEATIONAL )
```

```
(CHOOSER
 :NAME SPATIO-TEMPORAL-CHOOSER
 :DEFINITION {{ASK (EXTENT-Q MINORPROCESS)}}
```
Relations expressing spatial locations are further classified with respect to two pairs of features: On the one hand they are subdivided into relations that indicate an object’s position with respect to an axis (grammatical feature orientation-axis). This choice is covered by the system ORIENTATION-AXIS-TYPE presented in Figure 32. On the other hand, spatial locating relations are split into relations that encode the idea of a movement and those that imply the idea of rest (features motion-process and rest-process). The relevant systems are shown in Figure 33. They provide the features which form the entry conditions to three other areas of the PPSPATIOTEMPORAL network – orientation rest processes, nonorientation rest processes and motion processes. In this Section we consider only the latter two, since they are the only ones occurring in the ImD texts.
In the area of nonorientation rest processes, the choice of a preposition interacts with the dimensional properties of the object that realizes the Minirange. In the English model three types are distinguished: \textit{(at)} zero-dimension, \textit{(on)} one-two-dimensions, \textit{(in)} three-dimensions. In principle, the three Slavic languages only show a distinction between three-dimensions and one-two-dimensions. There is a preposition that is used with zero-dimension objects, but its use is more restricted than the English \textit{at}. It is important that accordingly in terms of the frequency of object types in Russian, the more frequent type in Russian is \textit{three-dimensions}. A sample semantic input representation is shown in Figure 34.

A number of gates then serve the realization of the Minorprocess by particular lexical items (prepositions). See, for example, the gates AT, IN and ON presented in Figure 35.
Motion processes are further classified according to the opposition source vs. destination. The relevant prepositions describe a dynamic meaning, one reflecting movement. This classification is triggered by the feature motion-process. The two major subtypes are relations denoting a movement towards a place/object and those indicating a movement away-from it. The system is shown in Figure 36.
The pairs of gates, realizing the dynamic prepositions for the one-two-dimensions objects and three-dimensions objects are shown in Figures 37 and 38. Instances of dynamic meanings with zero-dimension source objects are not present in the ImD texts. The gate realizing zero-dimension destination is shown in Figure 39.

Figure 36: Motion-process-type system and chooser (Bg, Cz, Ru)

Figure 37: One-two-dimensional dynamic prepositions (Bg, Cz, Ru)

Figure 38: Three-dimensional dynamic prepositions (Bg, Cz, Ru)
Figure 38: Three-dimensional dynamic prepositions (Bg, Cz, Ru)

Figure 39: Zero-dimensional dynamic destination preposition (Bg, Cz, Ru)

Extent processes form the third subregion of the PPSPATIOTEMPORAL region we deal with in the ImD. Extent process is triggered in the system SPATIO-TEMPORAL shown earlier and then elaborated in two systems shown in Figure 40.
2.3.2.2 The PPOTHER region

In the PPOTHER grammar region we have four types of processes relevant for the ImD. They are accompaniment, causal (purpose), instrumental and portion processes. Accompaniment and portion processes require some language-specific changes.

In the ImD text, there is a minor process type that is realized in English with the preposition in relation to. The type coming closest to this is accompaniment-process. We therefore add a new subtype to accompaniment-process called relative-additive. This modification is shown in Figure 41.

For Russian, the type cumulative-additive is not needed, however. The meaning reflected here is realized by coordination (see example (21)).

(21) The meaning of cumulative-additive expressed as coordination

(a) Ru: Он любит меня также как и тебя
He loves me-acc as well as you-acc

(b) Ru: Он взял сына вместо дочери
He took the son-acc instead of the daughter-gen

The examples show that the relation of cumulative-additive, realized in Nigel by a prepositional phrase with the preposition as well as is presented in Russian as syntactic coordination, reflected by the case marking: in (21a), меня and тебя have the same case (governed by the verb), which indicates coordination of the two in one complex nominal group, whereas in (21b) the preposition вместо governs its own case. Thus, for Russian we
omit the cumulative-additive feature from the ACCOMPANIMENT-PROCESS-TYPE system. The system and chooser for Russian is shown in Figure 42.
In Figure 43 we show an SPL input expression generating an additive relation with the preposition ‘in relation to’ (Ru: po otnosheniju k).

\begin{verbatim}
EXAMPLE
"Ukazhite ugol linii po otnosheniju k konechnoj tochke dugi."
\end{verbatim}
Causal processes are selected identically for the three Slavic languages and English. The system CAUSAL-PROCESS-TYPE is presented in Figure 44.

```agi
(SYSTEM
  :NAME CAUSAL-PROCESS-TYPE
  :INPUTS CAUSAL-PROCESS
  :OUTPUTS ((0.25 REASON-PROCESS
              (CLASSIFY MINORPROCESS PREPOSITION)
              (CLASSIFY MINORPROCESS REASON-PREP))
             (0.25 PURPOSIVE-PROCESS)
             (0.25 CLIENT)
             (0.25 CONCESSIVE-PROCESS
              (LEXIFY MINORPROCESS DESPITE)))
  :CHOOSER CAUSAL-PROCESS-TYPE-CHOOSER
  :REGION PPOTHER
  :METAFUNCTION IDEATIONAL)

(CHOOSER
  :NAME CAUSAL-PROCESS-TYPE-CHOOSER
  :DEFINITION ((ASK (PURPOSE-Q MINORPROCESS)
                 (NONPURPOSE
                  (ASK (REASON-Q MINORPROCESS)
                    (NONREASON
                     (ASK (BEHALF-Q MINORPROCESS)
                       (NONBEHALF (CHOOSE CONCESSIVE-PROCESS))
                       (BEHALF (CHOOSE CLIENT)))))
                    (REASON (CHOOSE REASON-PROCESS)))))
             (PURPOSE (CHOOSE PURPOSIVE-PROCESS))))))
```

Figure 44: The causal-process-type system and chooser for (Cz, Ru, Bg)

The realization of purposive-process is accounted for in the FOR gate (Figure 45). For Slavic languages it differs from English in the input conditions and in lexicalization statements. In the input slot, the conditional feature extent-process has been omitted, because the prepositions corresponding to English for in Czech, Bulgarian and Russian do not denote the meaning of extent:

(Ru) для меня – (En) for me (client)

(Ru) для начальной точки – (En) for the startpoint (purposive-process)

(Ru) *для три дня – (En) for three days (temporal-extent)

The gate FOR is presented in Figure 45.

```agi
(GATE
  :NAME FOR
  :INPUTS ((:ENGLISH (OR CLIENT ABSOLUTE-EXTENT-PROCESS PURPOSIVE-PROCESS))
           (:BULGARIAN (OR CLIENT PURPOSIVE-PROCESS))
           (:CZECH (OR CLIENT PURPOSIVE-PROCESS))
           (:RUSSIAN (OR CLIENT PURPOSIVE-PROCESS)))
  :OUTPUTS ((1.0 FOR
              (:BULGARIAN (LEXIFY MINORPROCESS ЗА))
              (:CZECH (LEXIFY MINORPROCESS PRO)
              (PRESELECT MINIRANGE ACCUSATIVE-CASE))
              (:RUSSIAN (LEXIFY MINORPROCESS ДЛЯ)
              (PRESELECT MINIRANGE RGENITIVE)))
  :REGION PPOTHER
  :METAFUNCTION IDEATIONAL)
```

Figure 45: The gate FOR realizing purpose process (Cz, Ru, Bg)
Instrumental processes are further subclassified in the system INSTRUMENTAL-PROCESS-TYPE. In the intermediate demonstrator texts, the only type of instrumental process that occurs is **agentive-instrument**. The system is presented in Figure 46.

```lisp
(SYSTEM
  :NAME INSTRUMENTAL-PROCESS-TYPE
  :INPUTS INSTRUMENTAL-PROCESS
  :OUTPUTS ((0.33333334 MANIPULATING-INSTRUMENT)
             (0.33333334 ENABLING-INSTRUMENT)
             (0.33333334 AGENTIVE-INSTRUMENT))
  :CHOOSER INSTRUMENTAL-PROCESS-TYPE-CHOOSER
  :REGION PPOTHER
  :METAFUNCTION IDEATIONAL
)

(CHOOSER
  :NAME INSTRUMENTAL-PROCESS-TYPE-CHOOSER
  :DEFINITION ((ASK (MANIPULATION-Q MINORPROCESS MINIRANGE)
                   (MANIPULATION (CHOOSE MANIPULATING-INSTRUMENT))
                   (NONMANIPULATION (ASK (ENABLED-Q MINORPROCESS MINIRANGE))
                   (ENABLED (CHOOSE ENABLING-INSTRUMENT))
                   (NONENABLED (ASK (AGENTIVE-Q MINORPROCESS MINIRANGE))
                   (AGENTIVE (CHOOSE AGENTIVE-INSTRUMENT)))))
)
```

Figure 46: System and chooser for instrumental-process-type (Cz, Ru, Bg)

The realization of the agentive-instrument process for Russian and for English are shown in Figure 47. A sample SPL for generating an instrumental Circumstance is shown in Figure 48.

```lisp
(GATE
  :NAME BY
  :INPUTS (OR NONEXPLICIT-ENABLING AGENTIVE-INSTRUMENT)
  :OUTPUTS (1.0 BY
             (:ENGLISH (LEXIFY MINORPROCESS BY))
             (:BULGARIAN (LEXIFY MINORPROCESS ELLIPSISITIVE)
             (:RUSSIAN (LEXIFY MINORPROCESS ELLIPSISZERO)
             (PRESELECT MINIRANGE INSTRUMENTAL))
)
  :REGION PPOTHER
  :METAFUNCTION IDEATIONAL
}
```

Figure 47: Gate for agentive-instrument realization (Bg, En and Ru)

```lisp
(EXAMPLE
  :NAME D1-TEXT2-2-RU
  :TARGETFORM "ZAPUSTITE KOMANDU PLINE SLEDUJUSCHIM SPOSOBOM"
  :LOGICALFORM (P / DIRECTED-ACTION :LEX ZAPUSTITJ :SPEECHACT Imperative :ACTEE
                 (D / OBJECT :LEX KOMANDA :LABEL-ASRIPTION
                 (L1 / OBJECT :NAME PLINE))
  :GENERALIZED-MEANS (M / ABSTRACTION :LEX SPOSOB :PROPERTY-ASRIPTION
                       (F / QUALITY :LEX SLEDUJUSCHI))
  :SET-NAME D1-TEXT2
)
```

Figure 48: Semantic representation for agentive-instrument function.
Finally, we have to account for the portion-process type for Bulgarian. Recall that for Czech and Russian, the meaning of ‘part-of’ is realized by a nominal group in genitive case. The realization of the feature *portion-process* for Bulgarian is described in the system MINOR-PROCESS-TYPE shown in Figure 30.

2.4 Mood

The present chapter describes the implementation of the MOOD region for Bulgarian, Czech and Russian. The linguistic properties of mood in Czech, Bulgarian and Russian have been presented in the SPEC2 deliverable (Andonova et al., 1999). On the basis of the Nigel grammar a number of modifications have been introduced in order to generate imperative and indicative clauses in Bulgarian, Czech and Russian for the purposes of the intermediate demonstrator. We describe the process of generation in the MOOD region and present the systems and choosers which have been changed or added.

The region’s topmost system is MOOD-TYPE which divides clauses into indicative and imperative. One main difference emerges in the comparison of the English with the Bulgarian/ Russian/ Czech imperative clause. In English imperative sentences, a nonfinite form of the verb (infinitive) is used, whereas in Slavic languages imperatives are expressed by a finite verb form (2nd person). In order to account for this, we insert Finite in the imperative output of the MOOD-TYPE system as follows:

MOOD-TYPE:

\[(\text{independent-clause-simplex}) \rightarrow \]

\[\text{[indicative]}, \]

\[\text{[imperative]} (+\text{Finite}). \]

The corresponding system and chooser implementations are shown in Figure 49.

| SYSTEM |
| :NAME MOOD-TYPE |
| :INPUTS INDEPENDENT-CLAUSE-SIPLEX |
| :OUTPUTS ((0.5 IMPERATIVE (INSERT FINITE)) (0.5 INDICATIVE)) |
| :CHOOSER MOOD-TYPE-CHOOSER |
| :REGION MOOD |
| :METAFUNCTION INTERPERSONAL |

| (CHOOSER |
| :NAME MOOD-TYPE |
| :DEFINITION ((ASK (COMMAND-Q SPEECHACT) (COMMAND (CHOOSE IMPERATIVE) (IDENTIFY SUBJECT (COMMAND-RESPONSIBLE-ID SPEECHACT)))) (NOCOMMAND (CHOOSE INDICATIVE)))) |

Figure 49: Mood type: system and chooser (Cz, Ru, Bg)

In the following sections, we shall discuss the details of indicative clause processing (Section 2.4.1) and then we present the implementations in the grammar which serve to realized imperative clauses in the three languages (Section 2.4.2).
2.4.1 Indicative Clauses

The three Slavic languages use the same system of differentiating indicative clauses into **interrogative** and **declarative** as presented in English:

INDICATIVE-TYPE:

(indicative) → [declarative], [interrogative]

In the genre of written software instructions, there are typically no **interrogative** clauses and there are no such occurrences in the AGILE corpus. Therefore, we do not consider the interrogative branch of the network any further here.

**Declarative** clauses occur most frequently in the texts when the text is in the so-called nonpersonal style (cf. TExS2 deliverable; Kruijff-Korbayova et al., 1999). In this style, all clauses are declarative and use the medio-passive construction, which is specific to Slavic languages (cf. Section 2.3). Example (22) below shows the correspondences to English imperative clauses.

(22) *Declarative clause in medio/reflexive passive (text 4)*

(a) En: Under Name, enter the name of the style.

(b) Cz: Pod Jméno se zadá název stylu.

   Under Name, enter-refl-passive3sg the name of the style.

(c) Bg: В полето Name се въвежда името на стила.

   Under Name, enter-refl-passive3sg the name of the style.

(d) Ru: В пункте Name задается имя стиля.

   Under Name, enter-refl-passive3sg the name of the style.

Clauses expressing side effect are also in declarative. See for example (23):

(23) *Declarative clause Side Effect (text 1)*

(a) En: The Select Color dialog box appears.

(b) Cz: Objeví se dialogové okénko Select Color.

   Appear-refl3sg dialog box Select Color.

(c) Bg: Диалоговият прозорец Select Color се появява на екрана.

   The dialog box Select Color appear-refl3sg on the screen.

(d) Ru: На экране появится диалоговое окно Select Color.

   on the screen appear-refl3sg the dialog box Select Color

A major system of the grammar network for indicative clauses is the **FINITE-CLAUSE SYSTEM** which introduces the Mood element. By means of the Expand realization statement Mood (Finite) in this system, the clause structure of indicative clauses is built up with a constituent labeled Mood which has a sub-constituent labeled Finite. The system is shown below. Its implementation is given in Figure 50:
FINITE-CLAUSE:

(indirect-indicative; finite-enhancing; finite-elaborating;
finite-extending; finite-rankshift; indicative) →

[Finite-clause]

(+Mood, Mood(Finite))

(GATE
  :NAME    FINITE-CLAUSE
  :INPUTS  (OR INDIRECT-INDICATIVE FINITE-ENHANCING FINITE-ELABORATING
            FINITE-EXTENDING INDICATIVE FINITE-RANKSHIFT)
  :OUTPUTS ((1.0 FINITE-CLAUSE
             (INSERT MOOD)
             (EXPAND MOOD FINITE)))
  :REGION  DEPENDENCY
  :METAFUNCTION LOGICAL
)

Figure 50: Finite clause: system (Cz, Ru, Bg)

Further elaboration of the Mood element requires the insertion of the Subject and the Finite.

FINITE-INSERT:

(finite-clause; finite-in-imperative) →

[Finite-inserted]

(+Finite)

(GATE
  :NAME    FINITE-INSERT
  :INPUTS  (OR FINITE-CLAUSE FINITE-IN-IMPERATIVE)
  :OUTPUTS ((1.0 FINITE-INSERTED
             (INSERT FINITE)))
  :CHOOSER  FINITE-INSERT-CHOOSER
  :REGION   MOOD
  :METAFUNCTION INTERPERSONAL
)

(CHOOSER
  :NAME    FINITE-INSERT-CHOOSER
  :DEFINITION  ((CHOOSE FINITE-INSERTED))
)

Figure 51: Finite insert: system and chooser (Cz, Ru, Bg)

By passing through the INDICATIVE-MOOD-PERSON system the person of the Finite is chosen. Figure 52 below presents the system and its chooser.
INDICATIVE-MOOD-PERSON:

(finite-clause,
 [mental, verbal, creative, dispositive, identifying, relational-other,
 (material, nonmeteorological)]) →
 [indicative-interactant]
 [indicative-noninteractant]
 (Finite:::Thirdperson-form)

(SYSTEM
 :NAME INDICATIVE-MOOD-PERSON
 :INPUTS (AND (OR MENTAL VERBAL CREATIVE DISPOSITIVE
 (AND MATERIAL NONMETEOROLOGICAL)
 IDENTIFYING RELATIONAL-OTHER)
 FINITE-CLAUSE)
 :OUTPUTS ((0.5 INDICATIVE-INTERACTANT)
 (0.5 INDICATIVE-NONINTERACTANT
 (INFLECTIFY FINITE THIRDPERSON-FORM)))
 :CHOOSER INDICATIVE-MOOD-PERSON-CHOOSER
 :REGION MOOD
 :METAFUNCTION INTERPERSONAL
)

(CHOOSER
 :NAME INDICATIVE-MOOD-PERSON-CHOOSER
 :DEFINITION ((ASK (MEMBER-SET-Q SPEAKER SUBJECT)
 (NIL)
 (INCLUDED (CHOOSE INDICATIVE-INTERACTANT))
 (NOTINCLUDED
 (ASK (MEMBER-SET-QQ HEARER SUBJECT)
 (INCLUDED (CHOOSE INDICATIVE-INTERACTANT))
 (NOTINCLUDED (CHOOSE INDICATIVE-NONINTERACTANT))))))
)

Figure 52: Person in Indicative Mood: system and chooser (Cz, Ru, Bg)

The Finite’s further elaboration leads to other regions such as VOICE (cf. Section 2.2) and TENSE (cf. Section 2.5). The presence or absence of the Subject is accounted for by the systems INDICATIVE-SUBJECT-PRESUMPTION, EXPLICIT-DECLARATIVE-SUBJECT and SUBJECT-INSERT. They are identical with those in the Nigel grammar. We only present the definitions here:

INDICATIVE-SUBJECT-PRESUMPTION:

((declarative, speaker-subject)
 (interrogative, addressee-subject)) →
 [subject-explicit]
 [subject-implicit]

All declarative sentences of the target texts have the subject-explicit feature.

EXPLICIT-DECLARATIVE-SUBJECT:

( declarative,
SUBJECT-INSERT:
([wh-subject; meteorological; existential;
indicative-noninteractant; metathing-subject;
subject-specified; explicit-subject-elaborating;
indirect-indicative; finite-enhancing; finite-extending;
finite-rankshift; explicit-subject;
explicit-declarative-subject; explicit-interrogative-subject;
imperative-other; imperative-subject-explicit; subject-explicit;
(imperative [oblative; suggestive])) →
 [subject-inserted]
(+Subject)

In Bulgarian Russian and Czech Subject and Finite agree in number and person, and, depending on tense selection, they may also agree in gender. Since we do not have any tense variation in the ImD texts and tense is present, Subject-Finite agreement in gender is not our current issue, but we have to see to persona and number agreement. Figure 53 shows two new systems which account for Subject-Finite agreement in number. Figure 54 shows three systems which provide the Finite with the appropriate person.

```plaintext
(GATE
 :NAME    FINITE-SG
 :INPUTS  (OR SPEAKER-SUBJECT IT-SUBJECT
           NONPLURAL-SUBJECT)
 :OUTPUTS ((1.0 FINITE-SG
            (INFLECTIFY FINITE SINGULAR-FORM)))
 :REGION   MOOD
)

(GATE
 :NAME    FINITE-PL
 :INPUTS  (OR SPEAKER-PLUS-SUBJECT ADDRESSEE-SUBJECT PLURAL-SUBJECT)
 :OUTPUTS ((1.0 FINITE-PL
            (INFLECTIFY FINITE PLURAL-FORM)))
 :REGION   MOOD
)
```

Figure 53: Subject-Finite agreement in plurality/singularity: gates (Bg, Cz, Ru)
Employing these systems, we can generate sentences such as those in (22) and (23). For an example of an input SPL expression see below:

(EXAMPLE
 :NAME PERS-TEXT1-9-a1
 :TARGETFORM "Диалоговият прозорец Select Color се появява на екрана."
 :LOGICALFORM
 (C / NONDIRECTED-ACTION :LEX POIAVIAVAM-SE
 :ACTOR (C1 / OBJECT
 :PROPERTY-ASCRIPTION (Q1 / QUALITY :LEX DIALOGOV)
 :LEX PROZOREC
 :CLASS-ASCRIPTION (L2 / SOFTWARE-COMMAND
 :NAME SELCOL)
 :IDENTIFIABILITY-Q IDENTIFIABLE )
 :SPATIAL-LOCATING
 (P / ONE-OR-TWO-D-LOCATION :LEX EKRAN
 :IDENTIFIABILITY-Q IDENTIFIABLE))
 :SET-NAME PERS-TEXT1)

Choice of declarative is the default here, so this information is not included in the SPL. The grammatical structure of the generated sentence is shown in Figure 55. Note that Subject and Finite carry the same person features (singular-form).
2.4.2 Imperative Clauses

The following is an example of an imperative clause as it occurs in the ImD texts:

\[(24) \text{ Imperative clause (text 2)}\]

(a) En: Specify the start point of the line segment.
(b) Cz: Určete počáteční bod rovného segmentu.
   Specify-imp-2pl the start point-acc the line segment-gen
(c) Bg: Задайте начальна точка на отсечката.
   Specify-imp-2pl the start point of the line segment
(d) Ru: Укажите начальную точку сегмента линии.
   Specify-imp-2pl the start point-acc the line segment-gen

All occurrences of imperative clauses are jussive (rather than suggestive or oblative). Therefore we only consider the jussive branch. This choice is specified in the system IMPERATIVE-INTERACTANT-SUBJECT given below. Its chooser implementation is shown in Figure 56.

Common in the three languages (and different from English) for jussive imperative clauses is that the Finite is realized in the imperative-form which means that the verb is put in secondperson-form.

\[\text{IMPERATIVE-INTERACTANT-SUBJECT:} \]
\[(\text{imperative-interactant}) \rightarrow \]
[jussive]
(Finite:::secondperson-form,Finite:::imperative-form),
[suggestive]
:Bu (+Conjunct, Conjunct ! Haide,
    Finite:::plural-form, Finite:::firstperson-form,
    Finite:::indicative-form)
:Cz (Finite:::plural-form, Finite:::firstperson-form,
    Finite:::imperative-form)
:Ru (Finite:::plural-form, Finite:::firstperson-form,
    +AuxDavatj:::imperative-form)
[oblative]
:Bu (+Conjunct, Conjunct ! Neka, Finite:::indicative-form,
    Finite:::firstperson-form)
:Cz (+Conjunct, Conjunct ! At3, Finite:::indicative-form)
:Ru (+Conjunct, Conjunct ! Pust,
    Finite:::indicative-form)

{CHOOSER
  :NAME   IMPERATIVE-INTERACTANT-SUBJECT-CHOOSER
  :DEFINITION   ((ASK (MEMBER-SET-Q SPEAKER SUBJECT)
    (NOTINCLUDED (CHOOSE JUSSIVE))
    (INCLUDED
      (ASK (SAME-AS-Q SPEAKER SUBJECT)
        (SAME (CHOOSE OBLATIVE))
        (DIFFERENT (CHOOSE SUGGESTIVE))))))
}

Figure 56: Imperative Interactant Subject: chooser (Cz, Ru, Bg)

To generate the appropriate verb form in imperative clauses, we need an additional system: imperatives are further distinguished as to the relationship of speaker and addressee. There are different realizations depending on whether the imperative is expressed politely or nonpolitely. The system given below thus distinguishes between polite-imperative and personal-imperative. The realization statements specify the form of the Finite – plural-form for polite-imperative and singular-form for personal-imperative. The new system IMPERATIVE-POLITENESS-TYPE is shown in Figure 57.

IMPERATIVE-POLITENESS-TYPE

(jussive) →

[polite-imperative] (Finite:::plural-form)
[personal-imperative] (Finite:::singular-form)
Although the Subject (semantically the addressee) can potentially be expressed explicitly in imperatives in Slavic languages, the imperative clauses in the ImD texts have no explicit Subject. The optionality of the Subject is accounted for in the system of IMPERATIVE-SUBJECT-PRESUMPTION. The implementation of the system is given in Figure 58:

**IMPERATIVE-SUBJECT-PRESUMPTION**

\[
(\text{imperative}) \rightarrow \\
[\text{imperative-subject-implicit}] \\
[\text{imperative-subject-explicit}] \quad (\text{Subject : Addressee})
\]
Employing this implementation, we can generate imperative sentences such as those in (24). The polite imperative form is defaulted according to the style of texts generated and is not explicitly given in the SPL. For a sample SPL see below (generating the clause „Specify a point.”)

\[
\text{EXAMPLE}
\]

The grammatical structure of the generated sentence is shown in Figure 59.

Figure 58: Imperative Subject Presumption: system, chooser and inquiry Express-Hearer-Q (Cz, Ru, Bg)
2.5 Tense

In this chapter we describe the basic systems in the region of TENSE. The general discussion of tenses in Bulgarian, Czech and Russian languages has been presented in the SPEC2 deliverable (Andonova et al., 1999). Here, we present the implementations for our three languages, as relevant for the texts generated in the intermediate demonstrator.

The entry condition to the TENSE region is the feature finite-clause. The types of finite clauses we deal with are exemplified in (25)-(27):

(25) *Independent Clause Simplex- Side Effect (text 4)*

(a) En: The Multiline Style dialog box appears.

(b) Cz: Objeví se dialogové okénko Multiline Style.

    Appear-refl-3sg dialog box Multiline Style.

(c) Bg: Появява се диалоговиет прозорец Multiline Style.

    Appear-refl-3sg dialog box Multiline Style.

(d) Ru: (На экране) появится диалоговое окно Multiline Style.

    (On the screen) appear-refl-3sg dialog box Multiline Style.

In the Bulgarian version, side effects as illustrated above are expressed by means of the present-tense verb forms of *imperfective aspect* whereas in Russian and Czech they are realized by present-tense forms of *perfective verbs* with the meaning of futurity.
Unlike Czech and Russian, the Bulgarian texts for the ImD include examples of finite clauses which correspond to English imperatives in the nonpersonal style. An example is given below.

(26) Independent Clause Simplex in nonpersonal style (text 2)

(a) En: Specify the endpoint of the arc.
(b) Bg: Задава се крайната точка на дългата.

Specify-refl-passive3sg the endpoint of the arc.

Here, the Bulgarian version requires a finite verb form in the appropriate tense, in this case, present tense. The Russian and Czech versions do not contain stylistic variation which employ this type of finite clause for expressing a ‘command’.

Another type of finite clauses are dependent clauses in some clause complexes, as in the example given below.

(27) Finite Dependent Clause (text 3)

(a) En: Start the ARC command using one of these methods:
(b) Bg: Personal style

Стартирайте командата ARC,
като изпоказвате един от следните методи:
by use-2pl one of these methods:

Nonpersonal style

Стартира се командата ARC,
като се искат един от следните методи:
by use-refl.passive,3sg one of these methods:

In Bulgarian, the dependent clause is finite whereas the corresponding English dependent clause is nonfinite. In Czech and Russian, the corresponding texts do not use combinations of main and dependent clauses. Instead, they render the intended meaning by means of a single clause incorporating a nominal phrase, i.e., by means of nominalization. That is why specification of tense in dependent clauses needs to be applied for the realization of Bulgarian only. The tense in such clauses in Bulgarian is present.

Thus, in general, the only tense used in the texts chosen for the ImD is present tense. As noted above, the use of present tense perfective verb forms in the Russian and Czech texts carries the meaning of future. This does not require, however, a change in the specification of tense in the grammar. The use of present in the TENSE system is sufficient for the implementation in the ImD and does not require carrying out an exhaustive theoretical analysis and comparison of the tense systems of the three languages which exhibit considerable differences otherwise.

There are no occurrences of modal verbs, so we will not consider further the branch modal of the system DEICTICITY- the main system of the region of TENSE as presented in Figure 60 together with its chooser.
Following the temporal branch, we get to the system PRIMARY-TENSE with the features future, present and past. The logic of the choice is provided by the inquiries TIME-IN-RELATION-TO-SPEAKING-TIME-ID, COUNTERFACTUALITY-Q, EXTENSIONALITY-Q, LOGICO-TEMPORAL-CONDITION-Q and PRECEDE-Q. They are shown in Figure 61 together with the system and the chooser PRIMARY-TENSE.
(SYSTEM
  :NAME PRIMARY-TENSE
  :INPUTS TEMPORAL
  :OUTPUTS ((0.33333334 FUTURE
              (CLASSIFY FINITE FUTURE-AUX)
              (CONFLATE TEMPO0 FINITE))
             (0.33333334 PRESENT
              (CONFLATE FINITE TEMPO0)
              (INFLECTIFY FINITE PRESENT-FORM))
             (0.33333334 PAST
              (CONFLATE FINITE TEMPO0)
              (INFLECTIFY FINITE PAST-FORM)))
  :CHOOSER PRIMARY-TENSE-CHOOSER
  :REGION TENSE
  :METAFUNCTION LOGICAL
)

(CHOOSER
  :NAME PRIMARY-TENSE-CHOOSER
  :DEFINITION ((IDENTIFY TEMPO1
                  (TIME-IN-RELATION-TO-SPEAKING-TIME-ID TEMPO0 SPEECHACT))
                 (ASK (COUNTERFACTUALITY-Q ONUS TEMPO1)
                      (COUNTERFACTUAL (CHOOSE PAST))
                      (NONCOUNTERFACTUAL
                       (EXTENSIONAL (ASK (EXTENSIONALITY-Q PROCESS)
                                      (EXTENSIONAL (ASK (LOGICO-TEMPORAL-CONDITION-Q ONUS)
                                                      (LOGICTEMPORALCONDITION
                                                      (ASK (PRECEDE-Q TEMPO1 TEMPO0)
                                                          (PRECEDES (CHOOSE PAST))
                                                          (NOTPRECEDES (CHOOSE PRESENT))))
                                                      NOTLOGICTEMPORALCONDITION
                                                      (ASK (PRECEDE-Q TEMPO1 TEMPO0)
                                                          (NOTPRECEDE)
                                                          (PRECEDES (CHOOSE PAST))
                                                          (NOTPRECEDES
                                                          (ASK (PRECEDE-Q TEMPO0 TEMPO1)
                                                          (PRECEDES (CHOOSE FUTURE))
                                                          (NOTPRECEDES (CHOOSE
                                                          PRESENT))))))))
                        (INTENSIONAL (CHOOSE PRESENT))))
       ))

(ASKOPERATOR
  :NAME COUNTERFACTUALITY-Q
  :DOMAIN KB
  :PARAMETERS (POTENTIALITY ASSESSMENTTIME)
  :ENGLISH ("Is the occurrence, performance, or"
             "actualization of"
             POTENTIALITY
             "at the time specified by"
             ASSESSMENTTIME
             "a hypothesis inconsistent with the"
             "facts, i.e. counter to them,
             at that time or judged to"
             "be highly unlikely?"
             )
  :OPERATORCODE KPML::TRIVIALDEFAULTCODE
  :PARAMETERASSOCIATIONTYPES (CONCEPT CONCEPT)
  :ANSWERSET (COUNTERFACTUAL NONCOUNTERFACTUAL
               TRIVIALDEFAULT NONCOUNTERFACTUAL
               )
)

(ASKOPERATOR}
:NAME EXTENSIONALITY-Q
:DOMAIN KB
:PARAMETERS (CONCEPT)
:ENGLISH ("Is"
CONCEPT
"extensional i.e. concrete rather than"
"intensional i.e. generic?"
)
:OPERATORCODE KPML::TRIVIALDEFAULTCODE
:PARAMETERASSOCIATIONTYPES (CONCEPT)
:ANSWERSET (EXTENSIONAL INTENSIONAL)
:PRESELECTIONGUIDANCE (SINGULAR . EXTENSIONAL)
(NOUN . EXTENSIONAL)
:TRIVIALDEFAULT EXTENSIONAL
)

(ASKOPERATOR
:NAME LOGICO-TEMPORAL-CONDITION-Q
:DOMAIN KB
:PARAMETERS (ITEM)
:ENGLISH ("Does the state of affairs,
i.e. event or"
"situation, specified for expression by"
ITEM
"constitute a logical or temporal"
"condition, i.e. restriction,
on some process i.e. does"
"it set up, logically or temporally,
the possible world"
"in which or in relation to which
this process is"
"performed?"
)
:OPERATORCODE KPML::TRIVIALDEFAULTCODE
:PARAMETERASSOCIATIONTYPES (CONCEPT)
:ANSWERSET (LOGICOTEMPORALCONDITION
NOTLOGICOTEMPORALCONDITION)
:TRIVIALDEFAULT NOTLOGICOTEMPORALCONDITION
)

(ASKOPERATOR
:NAME PRECEDE-Q
:DOMAIN KB
:PARAMETERS (FIRSTTIME SECONDTIME)
:ENGLISH ("Does the moment
or interval of time"
FIRSTTIME
"strictly precede the moment
or interval"
SECONDTIME
"
)
:OPERATORCODE KPML::PRECEDE-Q-CODE
:PARAMETERASSOCIATIONTYPES (CONCEPT CONCEPT)
:ANSWERSET (PRECEDES NOTPRECEDES)
:TRIVIALDEFAULT NOTPRECEDES
)

Figure 61: Primary Tense: system and chooser, relevant inquiries
(Cz, Bg, Ru)
In our ImD texts, the default tense is present. The logic of tense choices that is employed in the NIGEL implementation is described in detail in (Matthiessen, 1984).

In Figure 62 we show a grammatical structure which includes the tense information in the constituent Finite.

**2.6 Aspect**

A general discussion of aspect as a property of Slavic verbs has been presented in the SPEC2 deliverable (Andonova et al. 1999). On this basis, we specify a system of ASPECT as follows:

**ASPECT**

clause-simplex →

[perfective] (Process::perfective-verb)

[imperfective] (Process::imperfective-verb)

An analysis of the texts for the ImD provides us with the motivations for a choice between perfective and imperfective, which we can use to formulate a chooser:
• All processes in imperative clauses are realized by perfective verbs, so as the first branching inquiry in the chooser we can use COMMAND-Q – with the answer COMMAND, the choice is *perfective*.

• Processes in indicative clauses can be perfective or imperfective. The motivation for choosing one or the other lies roughly in ‘repeatability’ or ‘habituality’: repeated, habitual actions are typically realized in imperfective and actions that happen only once are realized in perfective. To cover this motivation we add the inquiry REPEATABLE-Q.

• Most of the finite clauses that are not imperative use imperfective verbs, so we can default the answer to REPEATABLE-Q to REPEATABLE. This leads to the choice of *imperfective-verb*. If the choice of *perfective* is intended, REPEATABLE-Q has to be included in the SPL input specification.

The implementations of the ASPECT system, the chooser and the new inquiry are shown in Figure 63.
Using this implementation we are able to generate the appropriate aspect forms occurring in the texts for the ImD. In (28) we show an example from text 1:
(28) **Clause complex (text 1)**

(a) En: Choose Element Properties to add elements to the style.

(b) Cz: Vyberte Vlastnosti prvků pro přidání elementů ke stylu.

Choose-imp.perf-asp. Element Properties to add-nominal elements to the style.

(c) Bg: Изберете Element Properties, за да добавите елементи към стила.

Choose-imp.perf-asp. Element Properties to add-ind.perf-asp elements to the style.

(d) Ru: Нажмите кнопку Element Properties, чтобы добавить элементы в стиль.

Choose-imp.perf-asp. the button Element Properties to add-infinitive elements to the style.

The SPL used in generating the Bulgarian variant is given below. The choice of perfective in the main clause is the consequence of the clause being in imperative mood. For the dependent clause, the inquiry REPEATABLE-Q effects the choice of aspect.

A grammatical structure including aspect information in the Finite constituent is given in Figure 64.

(EXAMPLE
 :NAME PERS-TEXT1-6
 :TARGETFORM "Изберете Element Properties, за да добавите елементи към стила."
 :LOGICALFORM
 (R / RST-PURPOSE
 :DOMAIN
 (D / DIRECTED-ACTION :LEX IZBERA
 :SPEECHACT IMPERATIVE
 :ACTEE (E / SOFTWARE-COMMAND :NAME "Element Properties"))
 :RANGE
 (C / DIRECTED-ACTION :LEX DOBAVIA
 :REPEATABLE-Q NONREPEATABLE
 :ACTEE (C1 / OBJECT :LEX ELEMENT
 :NUMBER PLURAL)
 :DESTINATION (P / OBJECT :LEX STIL
 :IDENTIFIABILITY-Q IDENTIFIABLE))
 )
2.7 Clause Complexity

In this chapter, we describe the implementations in the CLAUSECOMPLEX region, as relevant for the texts generated in the AGILE intermediate demonstrator. Our implementation efforts did not start from scratch, but have built upon the Nigel grammar for English. Therefore, the way clause complexity is implemented in the AGILE grammars mirrors the treatment in Halliday’s SFG (Halliday, 1985) to a large degree. A general discussion of clause complexity in SFG with respect to the AGILE project has been presented in the SPEC2 deliverable (Andonova et al., 1999). In the SPEC2 deliverable, we also discussed how Nigel implements SFG’s notion of clause complexity within the KPML framework, and how far the approach taken in the Nigel grammar for English can be adopted for generating sentences in Czech, Bulgarian, or Russian. The present chapter presents a self-contained account of the current implementations for our three languages, focusing on systems and choosers.

The region that is at the heart of generating clause complexes is CLAUSECOMPLEX. In this section we describe the core of this region’s network. First, let us show an example of a clause complex taken from the ImD text 1 (for more examples of various types of clause complexity see the deliverable SPEC2 (Andonova et al., 1999)). The simplex clauses of which the clause complex consists are printed on separate lines numbered (i) through (iii):
(29) Clause complex

(a) Cz:
   i) Vyberte OK,
      Choose-imp-2pl OK
   ii) abyste uložili vlastnosti elementu multičářy
       would-2pl save-pastparticiple properties-acc element-gen multiline-gen
   iii) a opustili dialogový panel Element Properties.
       and leave-pastparticiple dialogue box-acc Element Properties

(b) Bg:
   i) Изберете OK,
      Choose-imp-2pl OK
   ii) за да запишете характеристиките на елемента на мултитилията
       so that save-2pl properties of element of multiline-the
   iii) и да излезете от диалоговия прозорец Element Properties.
       and that leave-2pl from dialogue window Element Properties

(c) Ru:
   i) Нажмите кнопку OK,
      Choose-imp-2pl button-acc OK
   ii) чтобы сохранить стиль элементов мультитилин
       in-order-to save-inf style element-gen multiline-gen
   iii) и закрыть диалоговое окно Element Properties.
       and close-inf dialogue window-acc Element Properties

(d) En:
   i) Choose OK
   ii) to save the style of the multiline element
   iii) and to exit the Element Properties dialog box.

The topmost system of the CLAUSECOMPLEX region is CLAUSECOMPLEXITY. This system has as outputs the grammatical features clausecomplex and clausesimplex. The feature clausecomplex serves as input for the system TYPE-OF-INTERDEPENDENCE, which is formally specified as follows:

\[
\text{TYPE-OF-INTERDEPENDENCE:} \\
(clausecomplex) \rightarrow [\text{expansion}], [\text{projection}].
\]

The corresponding system and chooser implementations are shown in Figure 60. They are the same for our three languages as well as for English.
The ImD texts do not show any occurrence of projection, and neither does the rest of the AGILE corpus. Therefore, we do not consider that branch of the network any further, and we concentrate on the expansion branch.

Through expansion, two systems are triggered, namely EXPANSION-TYPE and EXPANSION-TAXIS, which are specified as follows (the corresponding implementations are shown in Figure 66; they are the same for our three languages as well as for English):

**EXPANSION-TYPE:**

\[
\text{(expansion)} \rightarrow \\
[\text{enhancement}] \quad (+\text{Enhancement}), \\
[\text{extension}] \quad (+\text{Extension}), \\
[\text{elaboration}] \quad (+\text{Elaboration}).
\]

**EXPANSION-TAXIS**

\[
\text{(expansion)} \rightarrow \\
[\text{general-hypotactic-expansion}], \\
[\text{paratactic-expansion}].
\]
The system EXPANSION-TAXIS accounts for the interaction of taxis and logico-semantic relations. The tactic dimension has its reflection in the grammatical structure through the following systems (see Figure 67 for the corresponding implementations, which again are the same for our three languages and for English):

**Parataxis:**

\[
\{\text{paratactic-expansion, quoting}\} \rightarrow \\
\{\text{parataxis}\} \\
(+\text{Initiating,} \\
+\text{Continuing}, \\
\text{Initiating ... Continuing}).
\]
HYPOTAXIS-ALPHA-COMPLEXITY:

(general-hypotactic-expansion) →
[complex-alpha-hypotactic-expansion]
(+Dependent,
 +Terminant,
 Terminant : full),
[hypotactic-expansion]

(GATE
 :NAME PARATAXIS
 :INPUTS (OR QUOTING PARATACTIC-EXPANSION)
 :OUTPUTS ((1.0 PARATAXIS
 (INSERT INITIATING)
 (INSERT CONTINUING)
 (PARTITION INITIATING CONTINUING)))
 :REGION CLAUSECOMPLEX
 :METAFUNCTION LOGICAL
)

(SYSTEM
 :NAME HYPOTAXIS-ALPHA-COMPLEXITY
 :INPUTS GENERAL-HYPOTACTIC-EXPANSION
 :OUTPUTS ((0.5 HYPOTACTIC-EXPANSION)
 (0.5 COMPLEX-ALPHA-HYPOTACTIC-EXPANSION
 (INSERT DEPENDENT)
 (INSERT TERMINANT)
 (PRESELECT TERMINANT FULL)))
 :CHOOSER HYPOTAXIS-ALPHA-COMPLEXITY-CHOOSER
 :REGION CLAUSECOMPLEX
 :METAFUNCTION LOGICAL
)

(CHOOSER
 :NAME HYPOTAXIS-ALPHA-COMPLEXITY-CHOOSER
 :DEFINITION (((ASK (MULTIPLE-PROCESS-Q PART1)
 (SINGLE (IDENTIFY PROCESS
 (PROCESS-ID PART1))
 (IDENTIFY WHERE-AM-I
 (WHERE-AM-I-ID))
 (IDENTIFY PROCESS
 (MODIFICATION-SPECIFICATION-ID WHERE-AM-I PROCESS))
 (+ IDENTIFY PROCESS
 (TERM-SPECIFICATION-ID PROCESS VERB))
 (IDENTIFY EVENRTIME
 (REFERENCE-TIME-ID PROCESS))
 (IDENTIFY SPEAKINGTIME
 (SPEAKING-TIME-ID SPEECHACT))
 (CHOOSE HYPOTACTIC-EXPANSION))
 (MULTIPLE
 (CHOOSE COMPLEX-ALPHA-HYPOTACTIC-EXPANSION))))
)

The above mentioned interaction between taxis and expansion types can be observed in example (29) above: a paratactic additive extension relation holds between (ii) and (iii), and a hypotactic causal-conditional enhancement relation holds between the (ii)-(iii) subcomplex and the simplex clause (i). For further examples of various types of paratactic and hypotactic expansion see the deliverable SPEC2 (Andonova et al., 1999).

The generation of a clause complex proceeds as follows. On the first traversal through these systems, the basic type of expansion relation and the type of interdependence are
determined. For the selected expansion relation a corresponding grammatical function is inserted into the grammatical structure, as is clear from the definition of the EXPANSION-TYPE system above, whereas the interdependency systems insert the elements relevant for the selected type of taxis (e.g. Initiating and Continuing for parataxis). On a subsequent traversal, these grammatical features are combined to act as inputs to systems detailing out the exact kind of clause complexity.

In most cases, a further traversal through the region then determines the exact kind of clause complexity, for enhancement for example in terms of Circumstantials (QUALIFYING-CONDITION). These systems introduce grammatical features with which constraints for systems in regions of lower rank are associated, concerned for example with the complexity of nominal groups (NOMINALGROUPCOMPLEXITY region) or prepositional phrases (CIRCUMSTANCE region). What is important about this observation is that the CLAUSECOMPLEX region is thus primarily concerned with classifying clauses, which to some extent influences the grammatical categories of the clauses involved, but leaving the more detailed realization to other regions.

As for variation in style as discussed in the TEXS2 deliverable (Kruijff-Korbayová et al. 1999), note that all clauses within a clause complex need to realize the content using the same style parameters. For instance in a hypotactic clause complex, if non-personal style in reflexive passive is chosen, then both the main clause and the dependent have to be realized in reflexive passive, as demonstrated in example (30) for Czech (a variant of (29a)):

(30)

i) Vybíre se OK,
    Choose-ind-1sg refl OK

ii) aby se uložily vlastnosti elementu multičáry
    so refl save-pastparticiple-3pl properties-nom element-gen multiline-gen

iii) a opustil se dialogový panel Element Properties.
    and leave-pastparticiple-3sg refl dialogue box-acc Element Properties

This is the same for other styles. It should be noted that in Czech, in the non-personal style using infinitive, one has to use reflexive passive in the dependent clause, because the dependent clause has to be finite. See the infinitive variant of (30) in (31) below:

(31)

i) Vybrat OK,
    Choose-inf OK

ii) aby se uložily vlastnosti elementu multičáry
    so refl save-pastparticiple-3pl properties-nom element-gen multiline-gen

iii) a opustil se dialogovy panel Element Properties.
    and leave-pastparticiple-3sg refl dialogue box-acc Element Properties

Even though a variety of types of expansion in combination with parataxis or hypotaxis have been encountered in the AGILE corpus, in the ImD, we have a narrower focus. The coverage in this phase includes the following clause complexity types:
paratactic extension (addition type)\(^6\)
paratactic enhancement (reason circumstantials)
hypotactic enhancement (manner and cause circumstantials)

We shall describe the implementations for these types of clause complexity in detail in the following sections. The other types of clause complexity are also present in our grammars, since we have inherited them from the Nigel grammar for English; and since the region of clause complexity is rather general, the implementations therefore apply to our three languages as well. Differences are encountered only at the level of realizing particular types of clauses.

2.7.1 Paratactic Extension

Parataxis is a relation between two elements in which neither is dependent on the other. In extension, the secondary clause adds something new to the meaning expressed in the primary. What is added may either be an addition (positive, negative or adversative), or a variation (replacive, subtractive or alternative). The type we cover in the ImD is positive addition. The following example shows the relevant sentences from one of the ImD texts in the personal style in imperative mood.

(32) positive addition (text 5)

(a) En: Specify the internal point and press Return.
(b) Cz: Určete vnitřní bod a stiskněte Enter.
   Specify-2pl internal-acc point-acc and press-2pl Return
(c) Bg: Въведете вътрешна точка и натиснете Return.
   Specify-2pl internal point and press-2pl Return
(d) Ru: Укажите внутреннюю точку и нажмите Return.
   Specify-2pl internal-acc point-acc and press-2pl Return

The relevant system is specified below. Its implementation is shown in Figure 68. Note that the respective connectives are inserted in this system. In order to generate the appropriate connectives in each language, one can either modify the insertions in each grammar, or one can use some universal names for the connectives, which are used in each of the grammars, and create the corresponding lexical entries in each lexicon. We use language-specific insertions in each grammar. In the following specification, we collapse the realizations (in the order En, Cz, Bg, Ru), typeset them in bold and separate them by "|".

\(^6\) Variation is present only at the level of groups.
EXTENDING-COORDINATION-TYPE:
(extend-coordination) →
[additive-coordination]
(+Coordinator,
 Coordinator^Extension,
 Coordinator ! and | a | и | и),

[alternative-coordination]
(+Correlator,
 Correlator^Extended,
 Correlator ! either | bud | или | или,
 +Coordinator,
 Coordinator^Extension,
 Coordinator ! or | nebo | или | илі),

[contrastive-coordination]
(+Coordinator,
 Coordinator ! but | ale | но | но,
 Coordinator^Extension).

Note that while English and Czech have a pair of connectives for alternative coordination, one for the Extended and another for the Extension, both Russian and Bulgarian use the same word in both functions. So, in English, the pair is either-or, in Czech it is bud-nebo, and Russian as well as Bulgarian it is или-или.
Employing this implementation, we can generate sentences such as those in (32). The relevant concept which reflects the semantics of positive addition is conjunction. It is a logical relation, which can be used in an SPL as follows:

\begin{verbatim}
(EXAMPLE
 :SET-NAME IMDP-T5-Cz
 :NAME IMD-T5-imp-14
 :TARGETFORM "URČETE VNITŘNÍ BOD A STISKNĚTE RETURN "
 :LOGICALFORM
 (C / CONJUNCTION
 :DOMAIN
 (S1 / CREATIVE-MATERIAL-ACTION :LEX urc3it
 :SPEECHACT IMPERATIVE
 :ACTEE (P / OBJECT :LEX bod
 :IDENTIFIABILITY-Q notIDENTIFIABLE
 :PROPERTY-ASRIPTION (P / QUALITY :LEX vnitr3ni2) ) )
 :RANGE
 (S2 / CREATIVE-MATERIAL-ACTION :LEX stisknout
 :SPEECHACT IMPERATIVE
 :ACTEE (A / OBJECT :NAME return
 :IDENTIFIABILITY-Q NOTIDENTIFIABLE) ) )
\end{verbatim}

The grammatical structure of the generated sentence is shown in Figure 69.
2.7.2 Paratactic Enhancement

In the case of enhancement, one clause enhances the meaning of another by qualifying it by reference to time, place, manner, cause or condition (i.e., by giving circumstantial information). The type of paratactic enhancement included in the ImD is causal-coordination\(^7\) of type reason (meaning “because P so result Q”, where P is an action and Q is a goal to be achieved by action P), as exemplified in the following examples from the ImD texts.

\[(33)\] Reason causal-coordination (text 4)

(a) En: Choose OK and close the dialog box.

(b) Cz: Vyberte OK a uzavřete dialogový panel.
Choose-2pl OK and close-2pl dialog-acc box-acc

(c) Bg: Изберите OK и закройте диалоговое окно
Choose-2pl OK and close-2pl dialog-acc box-acc

(d) Ru: Нажмите кнопку OK и закройте диалоговое окно
Choose-2pl OK and close-2pl dialog-acc box-acc

The relevant system is specified below. We have to ensure that the action part is realized as the Enhancement and thus as initiating, and the Goal as the Enhanced and thus as

\(^7\) What is called causal-coordination here corresponds to what we referred to as causal-conditional in the SPEC2 deliverable (Andonova et al., 1999), where we closely followed Halliday's terminology (Halliday, 1985).
continuing. The corresponding implementations are shown in Figure 70. Note that here, also the respective connectives are inserted. We again collapse the realizations (in the order En, Cz, Bg, Ru), typeset them in bold and separate them by "|".

**QUALIFYING-COORDINATION-TYPE:**

\[
\text{(qualifying-coordination) } \rightarrow \\
\text{[causal-coordination]} \\
\text{(Enhancement/Initiating,)} \\
\text{Enhanced/Continuing,)} \\
\text{Coordinator ! and | a | и | и),)} \\
\text{[temporal-coordination]} \\
\text{(Coordinator ! then | pak | след това | затем).)}
\]

```plaintext
:SYSTEM
:NAME QUALIFYING-COORDINATION-TYPE
:INPUTS QUALIFYING-COORDINATION
:OUTPUTS (0.5 TEMPORAL-COORDINATION
LEXIFY COORDINATOR TEMP-SUCC-COOR
(CONFLATE ENHANCED INITIATING)
(CONFLATE ENHANCEMENT CONTINUING))
(0.5 CAUSAL-COORDINATION
(CONFLATE ENHANCEMENT INITIATING)
(CONFLATE ENHANCEMENT CONTINUING)
(LEXIFY COORDINATOR CAUS-COOR)))
:CHOOSER QUALIFYING-COORDINATION-TYPE-CHOOSER
:REGION CLAUSECOMPLEX
)

:CHOOSER
:NAME QUALIFYING-COORDINATION-TYPE-CHOOSER
:DEFINITION ((ASK (TEMPORAL-ENHANCEMENT-Q PART1 PART2)
NOTTEMPORALSUCCESSION
(ASK (CAUSAL-ENHANCEMENT-Q PART1 PART2)
(CAUSAL (CHOOSE CAUSAL-COORDINATION)
(ASK (CAUSAL-SEQUENCE-Q PART1 PART2)
(NOTCAUSES
(ASK (CAUSAL-SEQUENCE-Q PART2 PART1)
(CAUSES (COPYHUB PART2 INITIATING)
(COPYHUB PART1 CONTINUING)))))
(CAUSES (COPYHUB PART1 INITIATING)
(COPYHUB PART2 CONTINUING)))))))
(TEMPORALSUCCESSION (CHOOSE TEMPORAL-COORDINATION)
IDENTIFY PROCESS1 (PROCESS-ID PART1))
IDENTIFY PROCESS1TIME (REFERENCE-TIME-ID PROCESS1))
IDENTIFY PROCESS2 (PROCESS-ID PART2))
IDENTIFY PROCESS2TIME (REFERENCE-TIME-ID PROCESS2))
(ASK (PRECEDE-Q PROCESS1TIME PROCESS2TIME)
(NOTPRECEDES
(ASK (PRECEDE-Q PROCESS2TIME PROCESS1TIME)
(PRECEDES (COPYHUB PART2 INITIATING)
(COPYHUB PART1 CONTINUING))
(NOTPRECEDES (COPYHUB PART1 INITIATING)
(COPYHUB PART2 CONTINUING))))
(PRECEDES (COPYHUB PART1 INITIATING)
(COPYHUB PART2 CONTINUING)))))))
```

Figure 70: Qualifying-coordination type: system and chooser (Cz, Ru, Bg)
However, this implementation is not yet fully operational in the current versions of our grammars. We have not yet succeeded in the development of a proper linking between the Upper Model concepts and causal coordination. Therefore, even though the Upper Model contains the necessary concepts, and the grammar contains the necessary features, we have to modify the inquiry codes such that the concepts get properly realized.

For the time being, we generate sentences such as those in (33) by explicitly specifying conjunction in the SPL as follows:

(EXAMPLE
 SET-NAME IMDP-T4-Cz
 NAME IMD-T4-imp-2-5
 TARGETFORM "Vyberte OK a uzavřete dialogový panel"
 LOGICALFORM
 (c / conjunction
 Domain
 (S2 / DISPOSITIVE -MATERIAL-ACTION :LEX zavr3i2t
 :SPEECHACT IMPERATIVE
 :ACTEE (A / OBJECT :lex panel
 :IDENTIFIABILITY-Q NOTIDENTIFIABLE
 :Property-aScription (P / Quality :lex dialogovy2) ) )
 :Range
 (S1 / DISPOSITIVE-MATERIAL-ACTION :LEX vybrat
 :caused-process-q caused
 :SPEECHACT IMPERATIVE
 :ACTEE (P / OBJECT :NAME gui-ok ) ) )

The grammatical structure of the generated sentence is shown in Figure 71.
2.7.3 Hypotactic Enhancement

For the ImD, we consider the types of hypotactic enhancement listed in the table in Figure 72 below.

<table>
<thead>
<tr>
<th>Category</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manner</td>
<td>means N by means of M</td>
</tr>
<tr>
<td>Causal-coordination</td>
<td>cause: purpose because intention Q so action P</td>
</tr>
</tbody>
</table>

Figure 72: Types of hypotactic enhancement covered in intermediate prototype

The following examples from the ImD texts illustrate these types. We show examples where the dependent part is realized either by a finite or non-finite clause. Means and Purpose Circumstances can also be realized by nominalization, in which case it is a circumstantial complementation of the main verb rather than a dependent clause. See examples (34) below.
(34) **Purpose causal-coordination Circumstance (text 2)**

(a) En: Press Return to end the polyline.

(b) Cz:

(pers. imp., dep. finite)
Stiskněte Return, abyste křivku ukončili
Press-2pl Return would-2pl polyline-acc end-2pl-pastparticiple

(impers. refl., dep. finite)
Stisknejte Return, aby se křivka ukončila
Press-3sg refl Return would-3sg refl polyline-nom end-3sg-pastparticiple

(pers. imper., dep. finite)
Stiskněte Return, abyste křivku ukončili
Press-2pl Return, would-2pl polyline-acc end-2pl-pastparticiple
Press Return so that you would end the polyline.

(impers. refl., dep. finite)
Stisknejte Return, aby se křivka ukončila
Press-3sg refl Return, would-3sg refl polyline-nom end-3sg-pastparticiple
Return is pressed so that the polyline would be ended.

(c) Bg:

(pers. imper., dep. finite)
Натиснете Return, за да завършите полилиниятата.
Press-2pl Return so that end-2pl polyline

(d) Ru:

(pers. imper., dep. nonfinite)
Нажмите клавишу Return, чтобы завершить рисование полилиний.
Press-2pl key Return, in-order-to end drawing polyline-gen

(35) **Means (Manner) Circumstance (text 2)**

(a) En: Start the PLINE command using one of the following methods

(b) Bg:

(pers. imp., dep. finite)
Стартрайте командата PLINE, като използвате един от следните методи
Start-2pl command-the PLINE, by use-2pl one of following methods

(impers. refl., dep. finite)
Стартира се команда PLINE, като се използва един от следните методи
Start-3sg refl command-the PLINE, by refl use-3sg one of following methods

---

8 Neither the intermediate prototype texts nor the rest of the AGILE corpus contain occurrences of Manner Circumstance realized by a dependent clause in Czech.
Besides the realization of the Means or Purpose Circumstance by a dependent clause, it is also possible to realize it by a nominalization in some cases. This is demonstrated in the following examples:

(36) **Purpose nominalized Circumstance (text 2)**

(a) En: Press Return to end the polyline.

(b) Cz:

(pers. imper., rank shifted circumstance)
Stiskněte Return pro ukončení křivky
Press-2pl Return for ending polyline-gen

(impers. refl., rank shifted circumstance)
Stiskněte se Return pro ukončení křivky
Press-3sg refl Return for ending polyline-gen

(c) Bg:

(impers. refl., rank shifted circumstance)
Натиснете Return за завършване на полилинията
Press-3sg refl Return for ending of polyline

(37) **Means manner circumstance (text 2)**

(a) En: Start the PLINE command using one of the following methods

(b) Cz:

(pers. imper., rank shifted circumstance)
Spustíte příkaz KŘIVKA použitím jednoho z následujících způsobů
Start-2pl command PLINE using-instr one-instr of following-gen methods-gen

(impers. refl., rank shifted circumstance)
Spustíte se příkaz KŘIVKA použitím jednoho z následujících způsobů
Start-3sg refl command PLINE using-instr one-gen of following-gen methods-gen

Besides the realization of means by a dependent clause or by a rank shifted circumstance there is another possibility in Czech and Russian, similarly to English. One can realize the same content in the following way:
(38) *Means circumstantial complementation (text 2)*

(a) En: Start the PLINE command by one of these methods

(b) Cz:

(pers. imper.)
Spusťte příkaz KŘIVKA jedním z následujících způsobů
Start-2pl command PLINE one-instr of following-gen methods-gen

(impers. refl.)
Spusť se příkaz KŘIVKA jedním z následujících způsobů
Start-3sg refl command PLINE one-instr of following-gen methods-gen

(c) Ru:

(pers. imper.)
Запустите команду PLINE одним из следующих способов
Start-2pl command PLINE one-instr of following-gen methods-gen

This possibility is not available in Bulgarian, however. The realization of Means or Purpose by a circumstantial complementation rather than by a dependent clause needs to be accounted for in the transitivity region, which is not the focus of the present chapter.

Now we concentrate on the cases of realization by clause complexes. The relevant system is specified below, and its implementation is shown in Figure 73. They are the same for English and our three languages. What we have to ensure is the appropriate realization of the dependent clauses as finite or non-finite. This is handled in the region of DEPENDENCY.

**QUALIFYING-CONDITION-TYPE:**

(qualified-condition) $\rightarrow$
- [concessive-condition] (*Enhancement : concession-dependent)
- [conditional-condition] $\rightarrow$ (*Enhancement : conditional-dependent)
- [purposive-condition] (*Enhancement : purpose-dependent)
- [manner-condition] (*Enhancement : manner-dependent)
- [spatial-condition] (*Enhancement : spatial-dependent)
- [causal-condition] (*Enhancement : causal-dependent)
- [temporal-condition] (*Enhancement : temporal-dependent)
Figure 73: Qualifying-condition type: system and chooser (Cz, Ru, Bg)

With the current implementations, we are able to generate clause complexes like those in examples (34) and (35) above. We will now demonstrate the generation of purpose hypotactic enhancement clauses in Russian and in Bulgarian. As shown above, Russian realizes the purpose dependent clauses as non-finite. We use the following SPL to specify the semantics of the sentence in (34d):

(EXAMPLE
  :NAME   D1-TEXT2-12-RU
  :GENERATEDFORM "Nazhmite klavishu Return, chtoby zavershitj risovanie polilinii."
The generated grammatical structure for (34d) is depicted in Figure 74.

Figure 74: Generated structure for the sentence from “Нажмите клавишу Return, чтобы завершить рисование полилинии.” (example (34d))

In Bulgarian and in Czech, unlike in Russian, purpose dependent clauses are realized as finite. We use the following SPL to specify the semantics of the Bulgarian sentence in (34c):

(EXAMPLE
 :NAME   PERS-TEXT2-14
 :TARGETFORM   "Натиснете Return, за да завършите полилиният." 
 :LOGICALFORM
 (R / RST-PURPOSE
 :DOMAIN
 (P / DIRECTED-ACTION :LEX NATISNA
 :SPEECHACT IMPERATIVE
 :ASPECT-Q PERFECTIVE-ASPECT
 :ACTEE (D / OBJECT :NAME RETURN))
 :RANGE
 (E / DIRECTED-ACTION :LEX ZAVURSHA
 :ASPECT-Q PERFECTIVE-ASPECT
 :ACTEE
 (P2 / OBJECT :LEX POLILINIA :IDENTIFIABILITY-Q IDENTIFIABLE)))
 :SET-NAME   PERS-TEXT2)

The generated grammatical structure for (34c) is depicted in Figure 75.
Figure 75: Generated structure for the sentence from "Натиснете Return, за да завършите полилинията." (example (34c))
2.8 Determination

In this chapter, we describe the implementations in the region of DETERMINATION, as relevant for the ImD. In the SPEC2 deliverable (Andonova et al., 1999), we discussed the essential types of determination in Czech, Russian and Bulgarian in comparison to English, and the various possibilities of realization of the Deictic element in these languages in general, as well as with respect to instructional texts. The work reported on in the present chapter has a narrower focus: We concentrate on the realization of the Deictic element insofar it is encountered in the AGILE ImD texts.

As with other regions of our grammars, we build upon the Nigel grammar for English. We also discussed in the LSPEC2 deliverable (Andonova et al., 1990) how Nigel implements SFG’s notion of determination within the KPML framework, and how far the approach taken in the Nigel grammar for English can be adopted for generating sentences in Czech, Bulgarian, or Russian. Here, we present a self-contained account of the current implementations for our three languages.

Determination is one the aspects involved in nominal reference. The notion of specific determination means that a particular subset (class of things) is denoted and that it is identifiable both for the speaker and the hearer. Non-specific determination can either span over the entire set of denoted entities (total) or a subset thereof (partial).

In English, the function of determination is carried by the Deictic element, which indicates whether the class of things referred to by the nominal group is specific (unique) or non-specific (non-unique). The situation is similar in Slavic languages, as we discussed in the LSPEC2 deliverable (Andonova et al., 1999). However, there are differences. First of all, Czech and Russian do not have a definite or indefinite article. Bulgarian does not have an indefinite article, while it has a definiteness marker, which is realized as a suffix. Another characteristic of Slavic languages, especially Czech and Russian, is that specificity vs. non-specificity can be reflected by word order, which in turn reflects information structure (see the chapter on word order in this deliverable (Section 2.9), as well as LSPEC2 (Andonova et al., 1999) for detailed discussions).

The present chapter is structured as follows. We first discuss the issue of explicit vs. implicit Deictic element in Slavic languages (Section 2.8.1). Then we address explicit specific determination (Section 2.8.2). A particular issue discussed separately is the generation of the definite suffix in Bulgarian (Section 2.8.2.3). Then we turn to explicit non-specific determination (Section 2.8.3). We also briefly mention the generation of the Post-deictic element (Section 2.8.4). As we proceed, we provide examples of generating the various kinds of determination our grammars currently cover.

2.8.1 Explicit vs. Implicit Deictic Element

There is an important difference between English and Slavic languages concerning the realization of the Deictic element: Czech, Russian and Bulgarian differ from English in that they do not have articles, neither definite nor indefinite; Bulgarian, unlike Czech and Russian, has a counterpart to the English definite article. It is a morpheme, which marks specificity. It is attached as a suffix to the first element of a nominal group. In LSPEC2 (Andonova et al., 1999), we introduced the common term “applicator” to refer to the means of marking specificity and non-specificity, be they separate words or morphemes. We said
that the presence of any applicator is not syntactically obligatory in Slavic languages. The following examples taken from the ImD text 1 illustrate this:

(39)

(a) Cz: Zvolte barvu elementu
Select color-acc element-gen

(b) Ru: Выберите цвет элемента.
Select color-acc element-gen

(c) En: Select the element's color

In this example, color is unspecified and element is specific. None of the sentences in Russian or Czech contains any explicit realization of any Deictic element. The following example illustrates the use of a suffix to mark specificity in Bulgarian:

(40) Bg: Посочете цвета на елемента.
Select color-def of element-def
Select the color of the element.

Both nominal groups in (42) include a specific nonselective Deictic element, which is realized by the short form of the definite suffix, i.e. а.

The question that emerges is how to capture the cases where no explicit realization in the form of a Deictic element is present. One possible view is that similarly to English, all nominal groups contain a Deictic element, but it can be realized as an empty string. Under this view, a Deictic element is inserted whenever a nominal group is being generated. This is the view that is currently adopted in the implementations of the grammars for Russian and for Bulgarian.

An alternative view is that nominal groups do not have to contain a Deictic element, unless an explicit Deictic element is specified by the semantics. In the current implementation of the AGILE grammar for Czech, we decided to adopt this latter view. It enables us to concentrate the choice between explicit vs. implicit Deictic element in one system, no matter how complex the decision criteria may be. This solution is modular and therefore convenient from the point of view of grammar development and text planning.

So, in the Czech grammar implementation, we have created the following new system called DEICTIC-EXPLICITNESS in the DETERMINATION region in which the decision about inserting or not inserting the Deictic element is made (see Figure 76 for the system and chooser implementations):

DEICTIC-EXPLICITNESS
(NOMINAL-SPECIFIC; NOMINAL-NONSPECIFIC;
NOMINAL-RELATIVE; NOMINAL-INTERROGATIVE) →
[EXPLICIT-DEICTIC] (+DEICTIC)
[IMPLICIT-DEICTIC]

The input features of this system are generated in the NOUNTYPE region. The explicit Deictic element gets realized throughout a number of systems (see Sections 2.8.2 and 2.8.3).

The question when to insert an explicit Deictic element and when not to insert one is not trivial at all in the Slavic languages. Nominal groups in Czech and Russian and also nonspecific nominal groups in Bulgarian do not have to contain an explicit Deictic element
when specificity or non-specificity can be deduced by the hearer from the context or from general knowledge. Also, it is possible that the speaker does not make deicticity explicit because it is not important for the content she is communicating. When discussing determination in the SPEC2 deliverable (Andonova et al., 1999) we also pointed to the correlation of information structure and determination. In particular, in Czech and Russian, there is a tendency to interpret contextually bound nominal groups as specific. However, this is not more than a tendency.

\[
\text{(SYSTEM)}
\begin{align*}
\text{:NAME} & \text{ DEICTIC-EXPLICITNESS} \\
\text{:INPUTS} & \text{ (OR NOMINAL-SPECIFIC NOMINAL-NONSPECIFIC} \\
& \text{ NOMINAL-RELATIVE NOMINAL-INTERROGATIVE)} \\
\text{:OUTPUTS} & \text{ ((0.3 EXPLICIT-DEICTIC} \\
& \text{ (INSERT DEICTIC))} \\
& \text{ (0.7 IMPLICIT-DEICTIC))} \\
\text{:CHOOSER} & \text{ DEICTIC-EXPLICITNESS-CHOOSER} \\
\text{:REGION} & \text{ DETERMINATION )}
\end{align*}
\]

\[
\text{(CHOOSER)}
\begin{align*}
\text{:NAME} & \text{ DEICTIC-EXPLICITNESS-CHOOSER} \\
\text{:DEFINITION} & \text{ ((ASK (IDENTIFIABILITY-Q THING)} \\
& \text{ (IDENTIFIABLE (CHOOSE EXPLICIT -DEICTIC))} \\
& \text{ (NOTIDENTIFIABLE} \\
& \text{ (CHOOSE IMPLICIT-DEICTIC)))) )}
\end{align*}
\]

Figure 76 Deictic explicitness: system and provisional chooser (Cz)

At this point we provide a provisional implementation which is very simplified in regard to the decision whether or not to insert an explicit Deictic element. For the time being, we link this decision to identifiability in the following way: When an entity is considered identifiable, we insert an explicit Deictic element, when it is not identifiable, no Deictic element is inserted. Identifiability is usually specified in the SPL. If it is not specified, the default choice is not-identifiable. Even though this approach is simplified for Czech and Russian, it seems to be the right one for Bulgarian, where the definite suffix indeed does reflect identifiability.

The current implementation of the Czech grammar thus enables us to generate nominal groups without a Deictic element. We demonstrate the grammatical structure generated for the sentence in example (39) in Figure 77. It is obtained using the following SPL:

\[
\text{(EXAMPLE)}
\begin{align*}
\text{:NAME} & \text{ no-deictic} \\
\text{:SET-NAME} & \text{ Pokus} \\
\text{:TARGETFORM} & \text{ "Zvolte barvu elementu"} \\
\text{:LOGICALFORM} & \text{ (S / dispositive-material-action :LEX zvolit} \\
& \text{ :SPEECHACT Imperative} \\
& \text{:ACTEE} \\
& \text{ (P / Object :LEX barva} \\
& \text{ :Process-modification-q noprocess} \\
& \text{ :generalized-possession-inverse} \\
& \text{ (M / Object :LEX multic3a2ra)})}
\end{align*}
\]

\[\text{9 See LSPEC2 (Andonova et al., 1999) for the definition of contextual boundness.}\]
As mentioned above, we are also able to generate an explicit Deictic element. Let us now discuss the relevant implementations in more detail. We first discuss specific determination and then non-specific determination.

2.8.2 Specific Determination

The generation of a nominal group involving specific determination is entered through the feature **nominal-specific**. The first system on this path through the network is called SPECIFIC-TYPE. It is defined as follows (see Figure 78 for the corresponding implementations):

```
SPECIFIC-TYPE
(nominal-specific) →
[nonselective] Deictic ! Cz:Ten | Ru:Etot | Bg:
[possessive-selection]
  Deictic : nominal-group
  Deictic : genitive
[demonstrative-selection]
[demonstrative-sele
[time-specific] Deictic / Thing
```
We are currently interested only in the features nonselective and demonstrative-selection, because the others are not needed for the ImD. In Czech and Russian, the specific Deictic element is realized by a demonstrative pronoun. In Bulgarian, specific non-selective determination is reflected by the definite suffix. Let us now first describe the implementations for Czech and Russian (Section 2.8.2.1), and then turn to those for Bulgarian (Section 2.8.2.2).

### 2.8.2.1 Nonselective Specific Determination in Czech and Russian

The nonselective feature leads to a specific Deictic realized as follows: in Czech, it is realized by the demonstrative pronoun of neutral proximity, namely ten; in Russian, it is realized by the demonstrative pronoun of near proximity, namely etot. A modification of the examples shown above illustrates this:
2.8.2.2 Nonselective Specific Determination in Bulgarian

The nonselective feature leads to a specific Deictic realized by the definite suffix in Bulgarian. We use our external morphological module, in order to get the right word form. When a particular word in the generated structure has the feature definite-word, the morphological module returns the word with the definite suffix attached to it.

Therefore, the element of the nominal group which is to carry the definiteness marker must get the grammatical feature definite-word. One of the specifics of Bulgarian is the existence of a full and a short form of the article for the words having masculine gender. So, the final scheme is as follows:

- Nominal group in nominative case → definite-word plus full-suffix
- Nominal group in oblique case → definite-word plus short-suffix

In order to generate a determined noun in a nominal group we use the systems in Figure 79 Figure 76.

```
(GATE
 :NAME NOMINATIVE-NONSELECTIVE-NOUN
 :INPUTS (AND NONSELECTIVE NOMINATIVE
 NOT-STATUS-MODIFIED NOT-AGE-MODIFIED
 NOT-COLOUR-MODIFIED NOT-SIZE-MODIFIED
 NO-POST-DEICTIC)
 :OUTPUTS ((1.0 FULL-ARTICLE
 (INFLECTIFY THING DEFINITE-WORD-FA)))
 :REGION DETERMINATION
)
(GATE
 :NAME OBLIQUE-NONSELECTIVE-NOUN
 :INPUTS (AND NONSELECTIVE OBLIQUE
 NOT-STATUS-MODIFIED NOT-AGE-MODIFIED
 NOT-COLOUR-MODIFIED NOT-SIZE-MODIFIED
 NO-POST-DEICTIC)
 :OUTPUTS ((1.0 SHORT-ARTICLE
 (INFLECTIFY THING DEFINITE-WORD-SA)))
 :REGION DETERMINATION
)
```

Figure 79: Nominative-nonselective and Oblique-nonselective gates (Bg)

The input condition (AND OBLIQUE NONSELECTIVE) of the systems in Figure 79 above leads to the insertion of the full and short suffix form according to the the rules of the Bulgarian grammar.

In order to obtain a determined noun (head of the nominal group) only for the cases when the noun has the definite suffix, the input conditions of the systems NOMINATIVE-NONSELECTIVE-NOUN and OBLIQUE-NONSELECTIVE-NOUN are (nonselective
nominative not-status-modified not-age-modified not-colour-modified not-size-modified no-post-deictic) and (nonselective oblique not-status-modified not-age-modified not-colour-modified not-size-modified no-post-deictic), respectively. The mentioned input conditions are sufficient for the generation of the nominal groups in our texts, although they may not cover all the cases in the Bulgarian language in general.

The definite suffix is attached to the first element of a nominal group. This is achieved by using the systems shown in Figure 80. By means of the system ADJECTIVAL-GR-DETERMINATION-FA, we can generate the full suffix, and through the system ADJECTIVAL-GR-DETERMINATION-SA, we are able to generate the short suffix. Both systems use the chooser ADJECTIVAL-GR-DETERMINATION-CHOOSER.

We demonstrate the generation of the nonselective specific Deictic elements realized by definite suffixes in Bulgarian by showing the structure generated for the following sentence (see Figure 81):

\[(42)\]

Bg: Дилоговият прозорец Select Linetype се появява на екрана
Dialogue-def window Select Linetype refl appears on screen-def
The dialogue box Select Linetype appears on the screen.

We use the following SPL to generate this sentence:

\%(EXAMPLE
 :NAME NONPERS-TEXT1-11-1
 :LOGICALFORM
 (C / NONDIRECTED-ACTION :LEX POIAVIAVAM-SE
 :ASPECT-Q PERFECTIVE-ASPECT
 :ACTOR (C1 / OBJECT
 :property-ascription (q1 / quality :lex DIALOGOV)
 :LEX prozorec
 :CLASS-ASCRIPTION (L2 / SOFTWARE-COMMAND :NAME SELLINT)
 :IDENTIFIABILITY-Q IDENTIFIABLE )
 :SPATIAL-LOCATING
 (P / ONE-OR-TWO-D-LOCATION :LEX EKRAN
 :IDENTIFIABILITY-Q IDENTIFIABLE))
 :SET-NAME NONPERS-TEXT1)
\%

The important characteristics in the generated grammatical structure in Figure 81 are:

**definite-word-FA** for Quality;

absence of any characteristics for the Thing / Subject

**definite-word-SA** for the Minirange / Thing
(SYSTEM
 :NAME ADJECTIVAL-GR-DETERMINATION-FA
 :INPUTS (AND NOMINATIVE NONSELECTIVE (OR STATUS-MODIFIED AGE-MODIFIED COLOUR-MODIFIED SIZE-MODIFIED POST-DEICTIC))
 :OUTPUTS ((0.2 STATUS-FULL-ARTICLE (PRESELECT STATUS DEFINITE-WORD-FA)) (0.2 AGE-DETERMINATION (PRESELECT AGE DEFINITE-WORD-FA)) (0.2 COLOUR-DETERMINATION (PRESELECT COLOUR DEFINITE-WORD-FA)) (0.2 SIZE-DETERMINATION (PRESELECT SIZE DEFINITE-WORD-FA)) (0.2 POST-DEICTIC-DETERMINATION (PRESELECT POST-DEICTIC DEFINITE-WORD-FA)))
 :CHOOSER ADJECTIVAL-GR-DETERMINATION-CHOOSER
 :REGION DETERMINATION)
)

(SYSTEM
 :NAME ADJECTIVAL-GR-DETERMINATION-SA
 :INPUTS (AND OBLIQUE NONSELECTIVE (OR STATUS-MODIFIED AGE-MODIFIED COLOUR-MODIFIED SIZE-MODIFIED POST-DEICTIC))
 :OUTPUTS ((0.2 STATUS-DETERMINATION (PRESELECT STATUS DEFINITE-WORD-SA)) (0.2 AGE-DETERMINATION (PRESELECT AGE DEFINITE-WORD-SA)) (0.2 COLOUR-DETERMINATION (PRESELECT COLOUR DEFINITE-WORD-SA)) (0.2 SIZE-DETERMINATION (PRESELECT SIZE DEFINITE-WORD-SA)) (0.2 POST-DEICTIC-DETERMINATION (PRESELECT POST-DEICTIC DEFINITE-WORD-SA)))
 :CHOOSER ADJECTIVAL-GR-DETERMINATION-CHOOSER
 :REGION DETERMINATION)
)

(CHOOSER
 :NAME ADJECTIVAL-GR-DETERMINATION-CHOOSER
 :DEFINITION ((ASK (STATUS-MODIFICATION-Q THING) (STATUS (CHOOSE STATUS-DETERMINATION)) (NONSTATUS (ASK (SIZE-MODIFICATION-Q THING) (SIZE (CHOOSE SIZE-DETERMINATION)) (NONSIZE (ASK (COLOUR-MODIFICATION-Q THING) (COLOUR (CHOOSE COLOUR-DETERMINATION)) (NONCOLOUR (ASK (AGE-MODIFICATION-Q THING) (AGE (CHOOSE AGE-DETERMINATION)) (NONAGE (ASK (SELECTION-MODE-SPECIFIED-Q THING) (SPECIFIED (CHOOSE POST-DEICTIC-DETERMINATION)) (UNSPECFIED (CHOOSE POST-DEICTIC-DETERMINATION)))))))))))))
)

Figure 80: Adjectival group determination: systems and chooser (Bg)
2.8.2.3 **Demonstrative Specific Determination**

The **demonstrative-selection** feature in the SPECIFIC-TYPE system leads further to the DEMONSTRATIVE-NONQUESTIONING system, where we distinguish on the basis of proximity in all three languages. We should ideally distinguish between *unmarked, near* and *far*. However, for the purpose of the ImD the *near* and *far* features suffice (see Figure 82 for the implementations):

```
DEMONSTRATIVE-NONQUESTIONING
  {{demonstrative-specific-pronoun;
       demonstrative-selection}}
  --->
  [proximity-near]
  [proximity-far]
```
In the current versions of the grammars, the Deictic is lexified in the gates called THIS and THESE for near, and THAT and THOSE for far (see Figure 85 for the implementations). The following examples taken from the ImD text 1 illustrate a realization of the near feature:

(43)

(a) Cz: Pro vytvoření dalšího elementu tyto kroky opakujte
   For creating another element-gen these steps-acc repeat
(b) Bg: Повторите тези шаги, чтобы задать еще один элемент.
   Repeat these steps in-order-to specify more one element
(c) Ru: Повторите эти шаги, чтобы задать еще один элемент.
   Repeat these steps in-order-to specify more one element
(d) En: Repeat these steps to define another element.

We demonstrate the grammatical structure including the Deictic realized by a demonstrative pronoun in Czech below, focusing on the following relevant portion of the sentence in (44):

(44)

Cz: Opakujte tyto kroky
   Repeat these steps-acc
   Repeat these steps.

The generated structure is depicted in Figure 83. It is obtained using the following SPL:

{(EXAMPLE
  :NAME deictic-near
  :SET-NAME Pokus
  :TARGETFORM "Opakujte tyto kroky."
  :LOGICALFORM
  (P / DIRECTED-ACTION :LEX opakovat
   :SPEECHACT IMPERATIVE
   :ACTEE (S / OBJECT :LEX krok
    :MULTIPLICITY-Q MULTIPLE
    :IDENTIFIABILITY-q identifiable
    :PROXIMITY-MODIFICATION-q proximity
    :PROXIMITY-MOD-Id (speaker / person :distance-q nondistant)
Figure 83: Generated structure for the Czech sentence “Opakujte tyto kroky” (example (44))

The structure generated for the Russian sentence in (43c) is shown in Figure 84.
When the Deictic element is realized by an adjective or a pronoun, it has to agree with the head noun in number and gender, and in Czech and Russian also in case.
2.8.3 Non-specific determination

The ImD texts also include instances of explicit realization of non-specific Deictic elements. In particular, Cz *jeden*, Bg *еди*, and Ru *оди* (En *one*) as used in the following examples extracted from the ImD text 2 are of this kind (for a discussion of this kind of determination, see the LSPEC2 deliverable (Andonova et al., 1999):

![GATE]

```plaintext
(GATE
:NAME   THIS
:INPUTS   (AND NEAR NONPLURAL)
:OUTPUTS  ((1.0 THIS
  (Czech: LEXIFY DEICTIC TENTO)
  (Russian: LEXIFY DEICTIC Etot)
  (Bulgarian: LEXIFY DEICTIC tozi)
  (INFLECTIFY DEICTIC SINGULAR-FORM)))
 :REGION   DETERMINATION )

(GATE
:NAME   THESE
:INPUTS   (AND NEAR PLURAL)
:OUTPUTS  ((1.0 THESE
  (Czech: LEXIFY DEICTIC TENTO)
  (Russian: LEXIFY DEICTIC ETOT)
  (Bulgarian: LEXIFY DEICTIC tezi
  (INFLECTIFY DEICTIC PLURAL-FORM)))
 :REGION   DETERMINATION )

(GATE
:NAME   THAT
:INPUTS   (AND FAR NONPLURAL)
:OUTPUTS  ((1.0 THAT
  (Czech: LEXIFY DEICTIC TAMTEN)
  (Russian: LEXIFY DEICTIC Tot)
  (Bulgarian: LEXIFY DEICTIC onezi)
  (INFLECTIFY DEICTIC SINGULAR-FORM)))
 :REGION   DETERMINATION )

(GATE
:NAME   THOSE
:INPUTS   (AND FAR PLURAL)
:OUTPUTS  ((1.0 THOSE
  (Czech: LEXIFY DEICTIC TAMTEN)
  (Russian: LEXIFY DEICTIC Tot)
  (Bulgarian: LEXIFY DEICTIC onezi)
  (INFLECTIFY DEICTIC PLURAL-FORM)))
 :REGION   DETERMINATION )
```

Figure 85 This, these, that, those: gate (Cz, Ru, Bg)
We demonstrate the generation of this kind of non-specific determination using the following simplified example (for the generated structure see Figure 86):

Cz: Vyberte jeden způsob.
Select-imp one method-acc
Select one of the methods.

This sentence can be generated using the following SPL:
(EXAMPLE
 :NAME deictic-one
 :SET-NAME Pokus
 :TARGETFORM "Vyberte jeden zpusob"
 :LOGICALFORM (S / dispositive-material-action
 :LEX vybrat
 :SPEECHACT Imperative
 :ACTEE
 (P / Object
 :LEX zpusob
 :determiner one-of ))

The last line in the SPL makes use of the following SPL macro:
(defspl-macro :determiner
 ((one-of
   :amount-attention-q nonminimalattention
   :current-representative-id ?s1
   :potential-representative-id ?s2
   :presuppose-existence-q presupposed
   :selection-particularity-q particular
   :set-totality-q (?s1 ?s2) partial)))

The feature that is responsible for the realization of the non-specific Deictic element is particular-restricted in the SINGULAR-RESTRICTED-TYPE system. The path to this system leads through the systems SELECTIVE-PARTIAL-TYPE, PARTIAL-TYPE and NONSPECIFIC-TYPE in region DETERMINATION, where the features restricted, selective-partial and partial are chosen, respectively. The input feature of the NONSPECIFIC-TYPE system is nominal-nonspecific, which is generated in the NOUNTYPE region. The implementations of the relevant systems and choosers in the DETERMINATION region are shown in Figure 87.

In the current implementation of the Czech grammar, there is a problem with the simplification concerning the generation of an explicit Deictic element only for identifiable elements, as described in Section 2.8.1. In order to handle the generation of the explicit non-specific Deictic elements, we have to improve the implementation of the DEICTIC-EXPLICITNESS-CHOOSER beyond that shown in Figure 76 in the future.
We have discussed the generation of the ‘one-of’ construction based on the assumption
that its semantics can be represented as involving a non-specific Deictic element.
Alternatively, one can generate these sentences as including a Numerative element rather
than a Deictic one. We demonstrate this possibility of representation using the following
Czech sentence:
Cz: Vyberte jeden z těchto způsobů.
Select-imp one-acc of these methods-gen
Select one of the methods.

The SPL is as follows:

(EXAMPLE
  :NAME    numerative-one
  :SET-NAME Pokus
  :TARGETFORM "Vyberte jeden z těchto způsobů"
  :LOGICALFORM (S / dispositive-material-action
    :LEX vybrat
    :SPEECHACT Imperative
    :ACTEE (P / Object
      :LEX zpusob
      :quantity-selection-q quantity
      :quantity-selection-id 1
      :number plural
      :determiner this)
    )))

The last line in the SPL makes use of the following SPL macro:
(defspl-macro :determiner
  {this
    :identifiability-q identifiable
    :proximity-modification-q proximity
    :proximity-mod-id (speaker / person
      :distance-q nondistant)})

The generated structure is shown in Figure 88.
2.8.4 Post-deictic Element

Besides the Deictic element, we also encounter the equivalents to the English Post-deictic elements in all three languages (see “following” in (45a-d)). These are realized by adjectives which have to agree with the head noun. These should be implemented in the system POST-DEICTICITY in the region POST-DEICTICITY.

However, we have not yet implemented the generation of Post-deictic elements for Slavic languages. Instead, we generate the counterparts of “following” as Qualities. In order to demonstrate the generation, we use the following Czech sentence:

(48) Cz: Vyberte jeden z těch následujících způsobů.
Choose one-acc of these-gen-following-gen methods-gen
Choose the following method.

This sentence is generated using the following SPL:

(EXAMPLE
 :NAME following
 :SET-NAME Pokus
 :TARGETFORM " Vyberte jeden z těch následujících způsobů"
 :LOGICALFORM (S / dispositive-material-action
The generated structure is shown in Figure 89.

2.9 Word Order

In this section, we describe how we handle word order in the current versions of the AGILE text generation system. It is known that Slavic languages exhibit a relatively high degree of word order freedom. Compared to languages like English or French, where clause constituents cannot be "moved around" with the same relative freedom without simultaneous changes in syntactic structure. However, different word order variants of a sentence, even though they are grammatically well-formed, do not necessarily have the same meaning and are generally not interchangeable in a given context. This means that in the process of automatic generation of continuous texts from an underlying representation of the content, we have to ensure that a semantically and contextually appropriate word order is chosen.

Various factors can be discerned in the language system in general that play an important role in expressing a given content in a linear form. For instance, English is an example of a language where word order is strongly constrained by grammatical structure. In such a language with a rather fixed word order, differences in information structure are often
reflected by varying the intonation pattern of a sentence or by the choice of definite vs. indefinite article with a nominal group. In Slavic languages, these effects are often achieved by varying word order in accordance to information structure.\textsuperscript{10}

The discussion in this section follows up on the discussion of word order in the SPEC2 deliverable (Andonova et al., 1999), where we presented a number of examples demonstrating the relevance of word ordering phenomena, and pointed out some similarities and differences among Czech, Russian and Bulgarian.

In order to account for the word ordering phenomena within the AGILE project, we decided to build upon the insights of existing linguistic theories. Currently we restrict ourselves to combining the following two approaches, where the first provides the basis and the second is used for a more elaborate treatment of word order phenomena in the Slavic languages:

- **Halliday's thematic structure** (Halliday, 1985), as developed in the Systemic Functional Grammar (SFG) framework, is chosen as the basis because SFG is the framework adopted in the Penman system (Bateman et al., 1990) on which our AGILE grammars, developed in the KPML environment (Bateman, 1997), are based;

- the **topic-focus articulation** approach developed within the framework of Functional Generative Description (FGD, Sgall et al., 1986) serves the elaboration of the SFG approach towards a more flexible treatment required for languages with a higher degree of free word order than English, especially because Halliday's approach is not sufficiently specific with respect to the ordering of non-thematic constituents.

We discussed these two approaches in detail in SPEC2. On the basis of that discussion, we also proposed a way in which to combine the insights of SFG and FGD concerning word order, and sketched the corresponding ordering algorithm in abstract terms. In the present report, we describe the algorithm in more detail, especially its input, its application and its implementation.

The motivation underlying the approach that we propose is to develop a rather general treatment of word ordering phenomena in Slavic languages. We would like to account for the fact that word ordering in Slavic languages is governed to a much larger extent by information structure than by constraints derived from grammatical structure. Our effort is thus aimed at a flexible linguistically appropriate treatment of word order in Slavic languages.

Considering the texts generated in the ImD of the AGILE project, it may perhaps seem that the approach we advocate is unnecessarily complex. It would be possible to say that the word order in the sentences that we are currently generating is the same as in English in most cases. For the cases where there is a difference we could include a few specific rules which would yield the desired results. Such an approach would be easy and straightforward. However, we do not want to adopt this purely engineering strategy. We prefer to take a step back and re-consider the way word order is handled in the tactical generators with the KPML grammars, even if it means that the development is more difficult and slower. What we try to obtain is a linguistically well-grounded approach that can be extended beyond the scope of the sentences in the ImD texts.

\textsuperscript{10} We use the term information structure as a general term embracing notions, such as Theme-Rheme, Given-New, information distribution and the like.
In addition, if we do develop the treatment of word order that uses information structure as the main guidance, we make it possible to put the various theories of information structure and word order to a practical test. This will obviously provide feedback for the improvement of the linguistic theories. In this way the work carried out within the AGILE project can have the extra value of contributing to a better understanding of word ordering principles involved in natural languages in general.

The remainder of the present chapter is structured as follows. We first briefly recapitulate the essential terminology that is used in our approach (Section 2.9.1). Then we turn to the details of the approach adopted in AGILE (Section 2.9.2). To provide the reader with and overall picture, we present the abstract word ordering algorithm (Section 2.9.3) and point out its placement within the entire process of text generation (Section 2.9.4). In Section 2.9.5 we discuss the placement of the reflexive particle in Bulgarian and in Czech. Finally, we summarize the issues we tackle in the implementation phase (Section 2.9.6).

2.9.1 Essential Terminology

Some of the considerations related to word order have been dealt with in the SFG framework, which we take as the starting point for developing the linguistic specifications in the AGILE project. We present the main word order-related SFG notions first.

2.9.1.1 Thematic and Information Structure in SFG

According to (Halliday, 1985), a clause as a message consists of a Theme combined with a Rheme, and in this configuration, the Theme is the ground from which the clause is taking off. As noted earlier, Halliday distinguishes between the thematic structure of a clause and the information structure. The latter is the distinction between Given and New within an information unit: the speaker presents information to the listener as recoverable (Given) or not recoverable (New). The thematic structure and information structure are closely related but not the same. Whereas the Theme contains the experiential item the speaker chooses to take as the point of departure, the Given is what the speaker believes the listener already knows or has accessible.\textsuperscript{11}

The notion of Theme tells us a number of things about “the first” position in the clause, but it does not tell us much about the word order of “the rest” of the clause. Presumably, Halliday leaves this to be decided by the grammatical structure, which is an approach sufficient for English. However, in languages with a high degree of free word order the grammar is not very strict about the placement of the elements of structure after the Theme. The examples we discussed in SPEC2 showed that ordering in our languages is to a great extent determined by what is presumed to be salient in the context. This means that ordering depends on information structure. These issues have been studied in detail in the Praguan FGD framework (Sgall et al., 1986). We incorporate the most essential ideas into the AGILE account of word order in Slavic languages.

\textsuperscript{11} Note that Theme in the Hallidayan description can embrace more than just the experiential element. The experiential element is referred as “topical”, and it is in fact the last element in “multiple themes”. For instance, in \textit{Well, then we don’t join in}, the Theme consists of \textit{well, then we}, where \textit{we} is the topical (experiential) element.
2.9.1.2 Topic-Focus Articulation in FGD

FGD works with a notion of information structure as a dichotomy called topic-focus articulation (TFA). TFA is defined on the basis of a distinction between contextually bound (CB) and non-bound (NB) items in a sentence (cf. (Sgall et al., 1986), or (Kruiff-Korbayová, 1998) for an overview). The motivation behind this distinction corresponds to that underlying the Given/New dichotomy in SFG. A CB item is assumed to convey some content that is accessible from the discourse context. Such an item may refer to an entity already explicitly referred to in the discourse, or an ‘implicitly evoked’ entity (cf. (Hajičová, 1993) for a summarizing discussion).

The ordering of NB items in a sentence follows the so-called systemic ordering (SO). SO is a language specific ordering of complementations, i.e. ‘arguments’ and ‘adjuncts’, of verbs, nouns, adjectives or adverbs which corresponds to neutral word order. It may differ from one language to another, but is considered constant within a given language. SO in Czech has been studied in detail (Sgall et al., 1986). The SOs of Russian and Bulgarian have not yet been studied in general. We expect the SOs for the main types of complementations in Russian and Bulgarian to be similar to the Czech one, though there can be slight differences (Andonova et al., 1999).

The FGD claims concerning word order can be summarized as follows:

- The main principle of word order in Czech is that the Topic precedes the Focus. Since the Topic may be empty (esp. in discourse-initial sentences) or may be deleted on the surface due to ellipsis, it is possible that the surface form of some sentences only consists of the realizations of elements belonging to the Focus.
- In the primary cases when the Topic consists of the CB elements, and the Focus of the NB ones, one can say that the CB elements precede the NB elements. A more general formulation of this principle uses the degrees of the so-called communicative dynamism (CD, Sgall et al., 1986): in primary cases, CD and the surface word order correspond to each other quite closely, at least within clauses. So, the ordering from left to right in the surface realization corresponds to the increasing degrees of CD.

There are the following exceptions to this principle in Czech:

- Clitics: they have to be placed in the so-called Wackernagel's position, characterized roughly as the position between the first and the second element in a clause.\(^\text{12}\)
- The main verb: its preferred default (unmarked) placement is after, but not necessarily immediately following, the surface Subject, if there is one.

In the next section we show how the SFG and FGD ideas concerning information structure can be used in an integrated approach to generate contextually appropriate ordering of clause elements.

2.9.2 The Approach in AGILE

As the starting point for specifying the principles of word ordering in the context of AGILE, we combine the FGD-based strategy which reflects information structure with the possibility of thematization in the SFG spirit. For Czech and Russian, we need to allow for more

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\(^\text{12}\) Naturally, this leaves to be defined what ‘first element’ means. It is easy to show that ‘first element’ does not equate to ‘first constituent’, since the element can be of arbitrary complexity. We use the notion of Theme for this purpose (see below).
freedom in word order (i.e., a looser relation between ordering and grammatical structure) than in Bulgarian (see the LSPEC2 deliverable, Andonova et al., 1999).

We propose to preserve the SFG notion of Theme (as well as the possibility of multiple theme within which the experiential element is called topical). This conception appears useful in any language in order to account for text structuring concerns across sentences within connected spans of texts. For instance, the decision what to chose as a ‘point of departure’ can be motivated by a particular style chosen for the text, in which case it is not necessary to look for a motivation for a particular ordering based on information structure. The following Czech examples adapted from the AGILE ImD text 1 illustrate ordering motivated by text organization. The order in (49a) and (50a) can be attributed to a marked Theme, whereas in (49b) and (50b) the unmarked Theme corresponds to the Process (since Subject is not realized in the imperative):

(49) Thematic spatial-location (Czech)

(a) Z dialogového panelu Color Selection zvolte barvu elementu
    From dialogue box-gen Color Selection choose-imp color-acc element-gen
    “From the Color Selection dialogue box, choose the element’s color.”

(b) Zvolte barvu elementu z dialogového panelu Color Selection.
    Choose-imp color-acc element-gen from dialogue box-gen Color Selection
    “Choose the element’s color from the Color Selection dialogue box.”

(50) Thematic purpose circumstance (Czech)

(a) Pro přidání elementů ke stylu vyberte Element Properties.
    For add-nom elements to style-dat select-imp Element Properties
    “In order to add elements to the style select Element Properties.”

(b) Vyberte Element Properties pro přidání elementů ke stylu.
    Select-imp Element Properties for add-nom elements to style-dat
    “Select Element Properties in order to add elements to the style.”

If the information structure in terms of contextual boundness or non-boundness of the structure elements is considered the same in both the (a) and (b) variants, the difference in word order can be attributed to a different text organization strategy. The order in (49a) can be achieved by thematization of the spatial-location of the action performed by the user, and the order in (50a) can be achieved by thematization of the purpose of an action performed by the user. The decisions about text organization and the consequent thematization are to be made in the text planning phase, i.e. by the text structuring module in the AGILE system (see the TExM2 deliverable, Kruijff et al., 1999).

For the ordering of non-thematic constituents within a clause, which is not determined by the syntactic structure, we use notions adopted from FGD, namely the distinction between contextual boundness (CN) and non-boundness (NB) in combination with the so-called systemic ordering (SO).

Contextual boundness is treated as a local feature, i.e., a complex CB constituent can contain ‘locally’ contextually NB constituents, and vice versa. For instance, a complex sentence can contain one CB and one NB clause, and within each of them, elements are discerned as locally CB vs. NB. Also within a complex nominal group which is, e.g., NB as

---

13 The relation between text style and the choice of Theme is discussed also in (Teich et al., 1996).
a whole, some parts can be CB. As an example of this, consider the following sequence of sentences in Czech adapted from the ImD text 1:

(51)

Přidejte element. Nejdříve zvolte barvu tohoto elementu | jeho barvu
Add-imp element-acc. First select color-acc this element-gen | its color-acc.
"Add an element. First select the element’s | its color.”

The nominal groups barva tohoto elementu (color of this element) or jeho barva (its color) consist of a Thing (barva) related by “generalized ownership” relation to another Thing (element or it). The entire nominal groups as such are NB, however, the modifiers corresponding to the owner, i.e. tento element (this element) or jeho (its), are (locally) CB.

2.9.3 Word Ordering Algorithm

On the basis of the above mentioned insights, we formulate an abstract ordering algorithm, as shown in Figure 90. The Theme is determined by text organization. In the AGILE system, this means it is determined by the Text Structuring Module system (see the TExM2 deliverable, Kruijff et al., 1999) and the element that is to be thematized is explicitly marked as such in the SPL. If no element is explicitly chosen as Theme in the SPL or by the grammar, the thematic position is filled by the first CB element. For the ordering of the non-thematic constituents within a clause, which is not determined by the syntactic structure, we use systemic ordering in combination with the CB/NB distinction. The NB elements are ordered by SO. The ordering of the CB elements can be (i) specified on the basis of the context, (ii) restricted by the grammatical structure, (iii) follow SO. The verb is placed between the last CB and the first NB element, unless it is itself the Theme.

```plaintext
Given a list Γ of ordering constraints imposed by the grammar,
Given a list L1 of constituents that need to be ordered,
Given a list Δ giving communicative dynamism of cb constituents,

create empty lists LC and LN
% LC is going to contain cb constituents (γ),
% LN nb constituents (η)
repeat for each element E in L1
  if E is CB,
    then add E into LC,
    else add E into LN.
  if the verb is CB,
    then Order the verb at the end of LC
    Order the remainder according to Δ
  else Order all elements in LC according to Δ
% Thus, if eᵢ < eⱼ in Δ, then eᵢ < eⱼ in LC except for the verb.
if Γ ≠ ∅ then
  Order elements in L1 using ordering constraints in Γ
% These constraints may, for example, involve ordering
% “heavy” constituents at the end of the clause.
```

Figure 90: Abstract algorithm for word order
The proposed ordering algorithm as such is the same for all the three languages under consideration. What may differ is first of all the systemic ordering, and therefore the default ordering of non-bound elements. Further differences between the languages are encountered in the constraints on which elements can be ordered rather freely and which elements are subject to ordering requirements posed by the syntactic structure.

In order to show the role of this algorithm within the entire process of text generation in AGILE, we recapitulate our text planning strategy and the interface between the text planner and the sentence generator in Section 2.9.5.

One particular problem concerns the placement of clitics in Slavic languages. In the sentences we have been analyzing and generating in AGILE so far, we have been considering the placement of the reflexive particle, i.e. se in Czech and ce in Bulgarian.\(^{14}\) The reflexive particle is used either with reflexive tautum verbs, or in the reflexive passive construction used for the non-personal style of conveying instructions in Czech and Bulgarian. In both languages, clitics are supposed to occur in the so-called Wackernagel’s position (Avgustinova and Oliva, 1995). But there are some differences between these two languages in this respect, which deserve further study. We describe our current implementations concerning the placement of the reflexive particle in Bulgarian and in Czech in the next section.

### 2.9.4 Placement of Particles

#### 2.9.4.1 Placement of the reflexive particle in Bulgarian

In Bulgarian, clitics should either directly follow or directly precede the Finite element in a clause. Since we do not consider any clitics other than the reflexive particle ce at this point, we do not have to deal with their mutual ordering and can simply say that ce either directly follows or directly precedes the Finite element.

The ordering of ce after the Finite occurs in the cases where Finite appears clause-initial, i.e. it is conflated with Theme. The ordering of ce before Finite occurs in the cases where Finite is not conflated with Theme, that is, some other element occupies the thematic position. The following examples extracted from the ImD text 1 (non-personal style) illustrate the placement of ce in Bulgarian in a few cases of reflexive passive constructions. Namely, in a simple indicative clause with thematized verb (52), in a clause with a thematized spatial-locative element expressed by a complex prepositional phrase (53), in a main clause in a clause complex beginning with a temporal Conjunct (54), and in a dependent clause, also beginning with a Conjunct (55):

(52)

Избира ce Color.
Selects refl Color.
“One selects Color.”

(53)

От функционалния ред Properties или меню Data ce избира Multiline Styles.
From tool bar Properties or menu Data refl chooses Multiline

\(^{14}\) In Russian, the reflexive particle is attached as a suffix to the verb, so no specific ordering issues arise.
Styles.
“From the Properties toolbar or Data menu one chooses Multiline Styles.”

(54)
Първо се отваря диалоговият прозорец Multiline Styles, …
First refl opens dialogue window Multiline Styles, …
“First one opens the dialogue box Multiline Styles, …”

(55)
като се използва един от следните методи.
by refl uses one of following methods.
“by using one of the following methods.”

When we disregard the placement of other clitics, the placement of the reflexive particle ce in Bulgarian after or before the Finite element can be captured as follows (the corresponding implementations are shown in Figure 91):

**MEDIO-PASSIVE-ORDER:**

(MEDIO-PASSIVE) →

[finite-reflexiveparticiple] Finite^Reflexiveparticiple
[reflexiveparticiple-finite] Reflexiveparticiple^Finite

```
{SYSTEM
  :NAME MEDIO-PASSIVE-ORDER
  :INPUTS (MEDIO-PASSIVE)
  :OUTPUTS ((0.5 FINITE-REFLEXIVEPARTICLE
               (ORDER FINITE REFLEXIVEPARTICLE))
            (0.5 REFLEXIVEPARTICLE-FINITE
               (ORDER REFLEXIVEPARTICLE FINITE)))
  :CHOOSER MEDIO-PASSIVE-ORDER-CHOOSER
  :REGION VOICE
}
{CHOOSER
  :NAME MEDIO-PASSIVE-ORDER-CHOOSER
  :DEFINITION ((DEFAULTCHOOSE FINITE-REFLEXIVEPARTICLE))
}
```

Figure 91: Medio-passive order: system and chooser for Bulgarian

### 2.9.4.2 Placement of the reflexive particle in Czech

In Czech, the situation is more complicated than in Bulgarian, because the position of clitics is not fixed directly next to the Finite element. They are placed at the Wachernagel’s position. In order to describe the placement of clitics in our grammars, we use the notion of Theme. We propose to place clitics after the Theme. If there is more than one clitic, their mutual order is determined by the grammar. In our current discussion, we concentrate on the placement of the reflexive particle se.

We illustrate the various possible placements of se in Czech by examples. (56) through (58) correspond to the Bulgarian examples Bulgarian in (52) through (55) above, and show se in a simple indicative clause with thematized verb (56), in a clause with a thematized spatial-locative element expressed by a complex prepositional phrase (57) and a clause beginning by a temporal conjunct (58):
Incidentally, the reflexive particle is placed next to the Finite element in these Czech sentences, i.e., exactly the same as in Bulgarian. The reflexive particle is always going to be placed directly after the Finite element whenever the Finite element is included in the Theme. However, when the Finite element is not included in the Theme, the reflexive particle does not need to appear immediately preceding it. The following modifications of the above examples demonstrate such cases when other elements appear between the reflexive particle and the Finite element in Czech:

In (59), the Theme consists of a temporal Conjaunct. The reflexive particle follows the Theme. It is itself followed by a spatial-locative Circumstance, after which comes the Finite element and finally the Subject. In (60), the Theme consists of a spatial-locative Circumstance. It is followed by the reflexive particle, which is itself followed by a temporal Circumstance, after which there is the Finite element followed by the Subject. In (61), the Theme again consists of a temporal Conjaunct, which is followed by the reflexive particle. After it come the Subject then an Instrument Circumstance. The Finite element is placed at the end of the sentence.
Our proposal to place clitics, and in particular the reflexive particle *se*, after the Theme, is captured in the following formal specification (the corresponding implementations are shown in Figure 92):

**MEDIO-PASSIVE-ORDER:**

$(\text{AND THEME-ORDER (OR MEDIO-PASSIVE REFLEXIVE-TANTUM)}) \rightarrow$

$[\text{theme-reflexiveparticiple}] \text{ theme}^\text{reflexiveparticiple}$

The input feature **theme-order** ensures that this system only applies when there actually is a Theme, the other input features capture the cases of a reflexive passive construction or a reflexive-tantum verb.

```plaintext
{SYSTEM
 :NAME   MEDIO-PASSIVE-ORDER
 :INPUTS  (AND THEME-ORDER
            (OR MEDIO-PASSIVE REFLEXIVE-TANTUM))
 :OUTPUTS ((1.0 THEME-REFLEXIVEPARTICLE
            (ORDER THEME REFLEXIVEPARTICLE)))
 :REGION   VOICE
}
```

Figure 92: Medio-passive order: gate for Czech

Let us close this discussion with an example of a generated sentence in Czech. The SPL from which we generate is shown in Figure 93, and the generated grammatical structure is shown in Figure 94.
2.9.5 The Role of Word Ordering Within Text Generation

The text generation scenario in the AGILE system is as follows: using an authoring interface, a user of the system specifies as input an A-box, and obtains as output a text realizing that A-box, in a particular text style.
The A-box serves as input to the Text Structuring Module (TSM) which yields a set of formulas in a Sentence Planning Language (SPL) for the sentences to be generated to convey the given content, in a particular text style. To guide the text planning done by the TSM, we employ text structure elements that correspond to identifiable parts in an A-box configuration, and text templates that specify particular text styles.

The TSM is described in detail in the TEXS2 (Kruijff-Korbayová et al., 1999) and TEXM2 (Kruijff et al., 1999) deliverables. The essential ideas can be summarized as follows. The major component is formed by the systemic networks for text structuring. Following (Bateman, 1997), we construct a region that defines an additional level of linguistic resources for the level of genre. The region enables the composition of text structures in a way that is very similar to the way the lexico-grammar builds up grammatical structures. Using KPML to implement the means for text structuring facilitates the interaction between global level text generation (strategic generation) and lexico-grammatical expression (tactical generation).\(^\text{15}\)

The organization of the region reflects the viewpoint that text templates and text structure elements are essentially orthogonal ideas. Therefore it consists of two parts. One part of the region deals with interpreting the A-box in terms of text structure elements. By traversing the network that the systems of this part make up, we obtain a text structure for the A-box conforming to the way the A-box structures the content. The other part of the region imposes constraints on the realization of the text structure elements that are being introduced by traversing the other part of the region. Naturally it will depend on our choice of a particular text template (style) which constraints will be imposed. These choices are made through interaction between the user and the system.

After a text structure is made by traversing the systemic networks, we divide the A-box into smaller A-boxes that can be associated with the text structure elements of which the text structure is composed. In KPML, this can easily be done using so-called ID-inquiries. Finally, SPLs are generated, using these “smallest-size” A-boxes and the realization constraints imposed by text templates.

The SPLs then serve as input to the language-specific tactical generators that generate sentences. It is here, in the specification of the semantics of individual sentences, that the issue of generating contextually appropriate word order arises.

The idea that we implement is that the SPLs contain information about contextual boundness vs. non-boundness of each clause element. When the corresponding syntactic constituents are generated, the ordering algorithm sketched above applies. So for instance, once all the constituents of a clause have been created, their ordering is determined. As we stated above, grammatical constraints on the ordering are taken into account first. The ordering according to information structure, i.e. contextual boundness vs. non-boundness, is applied next. Finally, if the ordering of some elements is still undecided, defaults are applied. Such ordering process takes place at every level of grammatical structure. Thus, what is being ordered are (i) clauses in a complex sentence, (ii) elements of individual simplex clauses, i.e. prepositional phrases, nominal groups, adverbs, (iii) elements within each nominal group, etc.

\(^{15}\) In this way we try to overcome the notorious problem known as the generation gap in which a text planning module lacks control over the fine-grained distinctions that are available in the grammar. In our case, both text planning and sentence planning are integrated into one and the same system, in which text planning resources are represented at one stratum and sentence planning resources at another.
The current approach thus handles ordering after the determination of syntactic structure and after the completion of generation of syntactic constituents at a given level, e.g. the clause. Word order is currently the only reflection of the information structure of the sentences we generate.

2.9.6 Summary

As stated earlier, there are essentially three sources of ordering constraints that we need to work with:

- ordering imposed by the grammatical structure; examples of strict constraints are that a preposition precedes the accompanying nominal group, the placement of clause connectives, the positioning of clitics with respect to other clause constituents but also their mutual ordering, etc.
- ordering derived on the basis of information structure; using ‘<’ for linear precedence, it can be schematized as follows: Theme < Clitics < Rest-CB < Verb < Rest-NB; this ordering sometimes needs to be reconciled with general ordering preferences, for instance the preference for “verb secondness”
- ordering defaults which apply on elements unordered on the basis of the above principles; systemic ordering can be incorporated through defaults

Grammatical constraints are handled in the grammar by using ordering statements in the relevant systems. What we do in comparison to English in order to enable information structure to take its share in word order is to use less of such grammar-based ordering constraints. For example, in Czech and Russian, we relax the placement of Subject before Finite, or the placement of a Direct Complement after Finite in an indicative clause in active voice. We also allow the ordering of the verb’s arguments and of the circumstances to follow information structure.

The text structuring module determines which elements are CB, and this information is encoded explicitly in the SPL. Without an explicit CB statement, the default is NB. On the basis of the CB/NB distinction in the SPL, we make sure that the status of a syntactic element generated through the grammar is determined as either CB or NB.

This information can than be used by the ordering algorithm to order those elements which have not been ordered by grammatical constraints. This ordering takes place when one traversal through the network has produced a single level of structure.

Finally, the ordering defaults can be applied, which basically encode systemic ordering for each of the languages. In addition, some basic defaults are present to ensure that there is at most one ordering for every generated grammatical structure.

3. Conclusions and future work

We have presented implementations of the grammars for Bulgarian, Czech and Russian with which it is possible to generate texts with stylistic variation for the ImD. Analyses of these texts and of instruction manuals more generally revealed the main areas of grammar that had to be treated in this round of implementation: transitivity and minor transitivity, diathesis (voice), mood, tense, aspect, clause-complexity, determination and word order. These are the core areas a computational grammar must cover, if it is to be a resource that can be used to generate natural text.

The methodology we have adopted has been once again that of resource sharing. To support resource sharing, not only with English, but among the three languages under
investigation in the AGILE project, we have adopted a style of work in which language-
specific biases are avoided. The work has been distributed across sites according to
phenomena (BAS: mood, tense, aspect; CU: clause complexity, determination, word order;
RRIAI: transitivity, minor transitivity, diathesis) rather than according to individual
languages. We have thus worked in a truly contrastive-linguistic fashion, trying to make use
of cross-linguistic commonalities among Bulgarian, Czech and Russian as much as possible
and at the same time identifying areas of divergence and treating them in a principled way.
Without this style of carrying out the implementational work in task 7.2 of the project and
using a suitable platform to do so, a fast prototyping of tactical generators for these three
languages would not have been possible. We now have available basic coverage grammars
for all three languages with which texts of the complexity and variation given in the
appendix can be generated.

The challenge for the particular implementation platform we use for grammar
development - the KPML system - has been to cope with a set of languages typologically
different from the languages treated within the system before. The experience in AGILE
feeds back to the KPML system a number of insights about gaps in the system that become
particularly obvious because we deal with typologically different languages. One area that
has been dealt with in the present deliverable is word order – a notorious problem for
implementations of languages with flexible word order, such as Czech and Russian, and to a
somewhat lesser degree Bulgarian. Also, some areas, such as e.g., aspect, had not been
treated at all before in any grammar implementation using KPML. Another area, which is on
the agenda for the next round of implementation, is agreement - a rather complex
phenomenon in all of the three languages we deal with here.

Future work will be guided by the goal of making the current grammar implementations
more robust. This includes:

• Fleisching out the existing grammar systems and developing test suites (sets of SPLs) for
each area in focus.
• Elaborating solutions to other problems encountered in dealing with highly inflectional
languages (e.g., agreement).

Also, given that the goal of the next phase in AGILE is to generate a hyper-document in
which different genres (instruction manual, ready-reference, short descriptions of each
functionality of a CAD/CAM system) are interlinked, additional types of linguistic variation
will have to be covered.
References


Appendices: Intermediate Prototype Texts

We present first the English base texts extracted from the AutoCAD manual and modified so that we would be able to generate them in the intermediate prototype phase, and so that they exhibit the intended variation of +/- side effect: (a) versions with side-effects, (b) without.. Sometimes (i) and (ii) versions are presented where the expressed content differs.

The Bulgarian, Czech and Russian texts corresponding to the English base ones are shown in text style alternations.

In Bulgarian, we have included two possible styles: personal in imperative mood in 2nd person plural (polite form), and non-personal in indicative mood using medio-passive voice (with a reflexive particle).

In Czech, we have included three styles: personal in imperative mood as in Bulgarian, personal in indicative mood in 1st person plural and non-personal in indicative mood using reflexive passive voice.

In Russian, we have included the personal style in imperative mood as in Bulgarian and Czech. The non-personal style in indicative mood is realized in the same way as in Bulgarian, using medio-passive voice.

In all the styles, we present the (a) and (b) alternatives for +/- side effects, and the occasional (i) and (ii) versions differing in content.
To create a multiline style

First open the Multiline Styles dialog box using one of these methods:

**Windows**: From the Object Properties toolbar or the Data menu, choose Multiline Style.

**DOS and UNIX**: From the Data menu, choose Multiline style.

1. Choose Element Properties to add elements to the style.
2. In the Element Properties dialog box, enter the offset of the multiline element.
3. Select Add to add the element.
4. Choose Color.
   (a) The Select Color dialog box appears. Select the element's color.
   (b) Then select the element's color from the Select Color dialog box.
5. Choose Linetype.
   (a) The Select Linetype dialog box appears. Select the element's linetype.
   (b) Then select the element's linetype from the Select Linetype dialog box.
6. Repeat these steps to define another element.
7. Choose OK to save the style of the multiline element and to exit the Element Properties dialog box.
**IMD Text 2: page 46**

To draw a line and arc combination polyline

First draw the line segment.

1. Start the PLINE command using one of these methods:
   - **Windows**: From the Polyline flyout on the Draw toolbar, choose Polyline.
   - **DOS and UNIX**: From the Draw menu, choose Polyline.

2. Specify the start point of the line segment.

3. Specify the endpoint of the line segment.

4. Enter a to switch to Arc mode.
   - (a) The Arc mode confirmation dialog box appears. Select OK.
   - (b) Then select OK in the Arc mode confirmation dialog box.

5. Specify the endpoint of the arc.

6. Enter l to return to Line mode.
   - (a) The Line mode confirmation dialog box appears. Select OK.
   - (b) Then select OK in the Line mode confirmation dialog box.

7. (i) Enter the distance of the line in relation to the endpoint of the arc.
    Enter the angle of the line in relation to the endpoint of the arc.
    (ii) Enter the distance and angle of the line in relation to the endpoint of the arc.

8. Press Return to end the polyline.

**IMD Text 3: page 58**

To draw an arc by specifying three points.

Start the ARC command using one of these methods:

- **Windows**: From the Arc flyout on the Draw toolbar, choose 3 Points.
- **DOS and UNIX**: From the draw menu choose Arc. Then choose 3 Points.

1. Specify the start point by entering endp and selecting the line so the arcs snaps to the endpoint of the line.

2. Specify the second point by entering poi and selecting a point to snap to.

3. Specify the endpoint.
To specify the properties of a multil ine and save the style.

(a) From the Data menu, choose Multiline Style. The Multiline Style dialog box appears.

(b) From the Data menu, choose Multiline Style.

First specify the properties of the multil ine.

1. (a) Choose Multiline Properties. The Multiline Properties dialog box appears.
   (b) In the Multiline Styles dialog box, choose Multiline Properties.

2. (i) In the Multiline Properties dialog box, select Display Joints to display a line at the vertices of the multil ine.
   (ii) Select Display Joints to display a line at the vertices of the multil ine.

3. Under Caps, select a line or an arc for the startpoint of the multil ine. Then select a line or an arc for the endpoint of the multil ine. Lastly, enter an angle.

4. Under Fill, select On to display a background color.

5. Choose Color. Then select the background fill color from the Select Color dialog box.

6. (a) Choose OK to return to the Multiline Styles dialog box. The Multiline Properties dialog box disappears.
   (b) Choose OK to return to the Multiline Styles dialog box.

Now save the style.

1. Under Name, enter the name of the style.

2. Under Description, enter a description.

3. Select Add to add the style to the drawing.

4. Select Save to save the style to a file.

5. Choose OK and close the dialog box.
IMD Text 5: page 75

To define a boundary set in a complex drawing

1. Open the Boundary Hatch dialog box using one of these methods:
   - **Windows**: From the Hatch flyout on the Draw toolbar, choose Hatch.
   - **DOS and UNIX**: From the Draw menu, choose Hatch

2. Under Boundary choose Advanced.
   (a) The Advanced Options dialog box appears. Choose Make New Boundary Set.
   (b) In the Advanced Options dialog box, choose Make New Boundary Set.

3. At the Select Objects prompt, specify the corner points for the boundary set and press Return.

4. In the Advanced Options dialog box, choose OK.

5. In the Boundary Hatch dialog box, choose Pick Points.

6. Specify the internal point and press return.

7. In the Boundary Hatch dialog box, choose Apply to apply the hatch.
• Bulgarian

B.1. Personal + imperative

IMD Text 1

Създаване стил на мултилиния

Първо отворете диалоговия прозорец Multiline Styles, като използвате един от следните методи:

Windows: От функционалния ред Object Properties или менюто Data изберете Multiline Style.

DOS и UNIX: От менюто Data изберете Multiline Style.

1. Изберете Element Properties, за да прибавите елементи към стила.
2. В диалоговия прозорец Element Properties въведете отместването на елемента на мултилинята.
3. Изберете Add, за да добавите елемента.
4. Изберете Color.
   (a) Диалоговият прозорец Select Color се появява на екрана. Посочете цвета на елемента.
   (b) След това, в диалоговия прозорец Select Color посочете цвета на елемента.
5. Изберете Linetype.
   (a) Диалоговият прозорец Select Linetype се появява на екрана. Посочете вида на линията на елемента.
   (b) След това, в диалоговия прозорец Select Linetype посочете вида на линията на елемента.
6. Повторете тези стъпки, за да дефинирате друг елемент.
7. Изберете OK, за да запишете характеристиките на елемента на мултилинията и да излезете от диалоговия прозорец Element Properties.
### IMD Text 2

<table>
<thead>
<tr>
<th>Чертане на полилиния, съставена от отсечки и дъги</th>
</tr>
</thead>
<tbody>
<tr>
<td>Първо начертайте отсечката.</td>
</tr>
<tr>
<td>1. Стартирайте командата LINE, като използвате един от следните методи:</td>
</tr>
<tr>
<td><strong>Windows:</strong> От плаващото меню Polyline на функционалния ред Draw изберете Polyline.</td>
</tr>
<tr>
<td><strong>DOS и UNIX</strong> От менюто Draw изберете Polyline.</td>
</tr>
<tr>
<td>2. Задайте началната точка на отсечката.</td>
</tr>
<tr>
<td>3. Задайте крайната точка на отсечката.</td>
</tr>
<tr>
<td>4. Въведете a, за да превключите на режим</td>
</tr>
<tr>
<td>(a) Появява се диалоговият прозорец на режима <strong>Arc</strong>. Изберете OK.</td>
</tr>
<tr>
<td>(b) След това изберете OK в диалоговия прозорец на режима <strong>Arc</strong>.</td>
</tr>
<tr>
<td>5. Задайте крайната точка на дъгата.</td>
</tr>
<tr>
<td>6. Въведете l, за да се върнете в режим <strong>Line</strong>.</td>
</tr>
<tr>
<td>(a) Появява се диалоговият прозорец на режима <strong>Line</strong>. Изберете OK.</td>
</tr>
<tr>
<td>(b) След това изберете OK в диалоговия прозорец на режима <strong>Line</strong>.</td>
</tr>
<tr>
<td>7. (i) Въведете дължината на отсечката от крайната точка на дъгата. Въведете въгла на отсечката спрямо крайната точка на дъгата.</td>
</tr>
<tr>
<td>(ii) Въведете дължината и въгъла на отсечката спрямо крайната точка на дъгата.</td>
</tr>
<tr>
<td>8. Натиснете <strong>Return</strong>, за да завършите полилинията.</td>
</tr>
</tbody>
</table>

### IMD Text 3

<table>
<thead>
<tr>
<th>Чертане на дъга по три точки</th>
</tr>
</thead>
<tbody>
<tr>
<td>Стартирайте командата <strong>ARC</strong>, като използвате един от следните методи:</td>
</tr>
<tr>
<td><strong>Windows</strong> От плаващото меню <strong>Arc</strong> на функционалния ред Draw изберете 3_Points.</td>
</tr>
<tr>
<td><strong>DOS и UNIX</strong> От менюто Draw изберете <strong>Arc</strong>. След това изберете 3_Points.</td>
</tr>
<tr>
<td>1. Задайте началната точка, като въведете <strong>endp</strong> и посочите линията, така че дъгата да се захване за крайната точка на линията.</td>
</tr>
<tr>
<td>2. Задайте втората точка, като въведете <strong>poi</strong> и посочите точка на захващане.</td>
</tr>
<tr>
<td>3. Задайте крайната точка.</td>
</tr>
</tbody>
</table>
IMD Text 4

Задаване характеристиките на мултилиния и записване на стила

(a) От менюто Data изберете Multiline Style. Появява се диалоговият прозорец Multiline Style.

(b) От менюто Data изберете Multiline Style.

Първо задайте характеристиките на мултилинията

1. (a) Изберете Multiline Properties. Появява се диалоговият прозорец Multiline Properties.
   (b) От диалоговия прозорец Multiline Styles изберете Multiline Properties.

2. (i) От диалоговия прозорец Multiline Properties изберете Display joints, за да се появи линия във върховете на мултилинията.
   (ii) Изберете Display joints, за да се появи линия във върховете на мултилинията.

3. От подменюто Caps изберете линия или дъга за началото на мултилинията. След това изберете линия или дъга за края на мултилинията. Накрая въведете върх.

4. Изберете On от подменюто Fill, за да видите основния цвят.

5. Изберете Color. След това посочете основен запълващ цвят от диалоговия прозорец Select Color.

6. (a) Изберете OK, за да се върнете в диалоговия прозорец Multiline Styles. Диалоговият прозорец Multiline Properties се затваря.
   (b) Изберете OK, за да се върнете в диалоговия прозорец Multiline Styles.

Сега запишете стила.

1. В полето Name въведете име на стила.
2. В полето Description въведете описание.
3. Изберете Add, за да добавите стила към чертежа.
4. Изберете Save, за да запишете стила във файл.
5. Изберете OK и затворете диалоговия прозорец.
 IMD Text 5

1. Отворете диалоговия прозорец Boundary Hatch, като използвате един от следните методи:

Windows От плаващото меню Hatch на функционалния ред Draw изберете Hatch.

DOS и UNIX От менюто Draw изберете Hatch.

2. От подменюто Boundary изберете Advanced.
   (a) Появява се диалоговият прозорец Advanced Options. Изберете Make New Boundary Set.
   (b) От диалоговия прозорец Advanced Options изберете Make New Boundary Set.

3. След подсказвашцото съобщение Select Objects задайте ъгловите точки на областта за щриховане и натиснете Return.

6. Изберете OK в диалоговия прозорец Advanced Options.

7. От диалоговия прозорец Boundary Hatch изберете Pick Points

8. Посочете вътрешна точка и натиснете Return.

9. От диалоговия прозорец Boundary Hatch изберете Apply, за да получите щриховката.
B.2. Non-personal + indicative

IMD Text 1

<table>
<thead>
<tr>
<th>Създаване стил на мултилиния</th>
</tr>
</thead>
<tbody>
<tr>
<td>Първо се отваря диалоговият прозорец Multiline Styles, като се използва един от следните методи:</td>
</tr>
</tbody>
</table>

**Windows:** От функционалния ред Object Properties или менюто Data се избира Multiline Style.

**DOS и UNIX:** От менюто Data се избира Multiline Style.

1. За да се прибавят елементи към стила се избира Element Properties.
2. В диалоговия прозорец Element Properties се въвежда отместването на елемента на мултилинията.
3. Избира се Add за добавяне на елемента.
4. Избира се Color.
   (a) Диалоговият прозорец Select Color се появява на екрана.
   В него се посочва цветът на елемента.
   (b) След това, в диалоговия прозорец Select Color се посочва цветът на елемента.
5. Избира се Linetype.
   (a) Диалоговият прозорец Select Linetype се появява на екрана.
   В него се посочва видът на линията на елемента.
   (b) След това, в диалоговия прозорец Select Linetype се посочва видът на линията на елемента.
6. Повтарят тези стъпки, за да се дефинира друг елемент.
7. Избира се OK за записване характеристиките на елемента на мултилинията и за излизане от диалоговия прозорец Element Properties.
СМД Text 2

Чертеже на полилинии, съставена од отсечки и диги

Първо се чертае отсечката.

1. Стартира се команда PLINE, каде се използва един од следните методи:
   **Windows:** От плаващото меню Polyline на функционалниот ред Draw се избира Polyline.
   **DOS и UNIX:** От менюто Draw се избира Polyline.

2. Задава се началната точка на отсечката.

3. Задава се крайната точка на отсечката.

4. Ввежда се a за превключване на режим Arc.
   (a) Появява се диалоговият прозорец на режима Arc. От него се избира OK.
   (b) След това в диалоговия прозорец на режима Arc се избира OK.

5. Задава се крайната точка на дигата.

6. Ввежда се l за връщане в режим Line.
   (a) Появява се диалоговият прозорец на режима Line. От него се избира OK.
   (b) След това в диалоговия прозорец на режима Line се избира OK.

7. (i) Ввежда се дължината на отсечката од крайната точка на дигата. Ввежда се ъгълт на отсечката спрямо крайната точка на дигата.
    (ii) Ввеждат се дължината и ъгълт на отсечката спрямо крайната точка на дигата.

8. Натиска се Return за завършване на полилиниот.
IMD Text 3

Чертане на дъга по три точки

Стартира се командата ARC, като се използва един от следните методи:

Windows: От плаващото меню Arc на функционалния ред Draw се избира 3_Points.

DOS и UNIX: От менюто Draw се избира Arc. След това се избира 3_Points.

1. Задава се началната точка, като се въвежда endp и се посочва линията, така че дъгата да се захване за крайната точка на линията.

2. Задава се втората точка, като се въвежда poi и се посочва точка на захващане.

3. Задава се крайната точка.
### IMD Text 4

<table>
<thead>
<tr>
<th>Задаване характеристиките на мултилиния и записване на стила</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) От менюто Data се избира Multiline Style. Появява се диалоговият прозорец Multiline Style.</td>
</tr>
<tr>
<td>(b) От менюто Data се избира Multiline Style.</td>
</tr>
<tr>
<td>Първо се задават характеристиките на мултилинията</td>
</tr>
<tr>
<td>1. (a) Избира се Multiline Properties. Появява се диалоговият прозорец Multiline Properties.</td>
</tr>
<tr>
<td>(b) От диалоговия прозорец Multiline Styles се избира Multiline Properties.</td>
</tr>
<tr>
<td>2. (i) От диалоговия прозорец Multiline Properties се избира Display joints, за да се появи линия във върховете на мултилинията.</td>
</tr>
<tr>
<td>(ii) Избира се Display joints, за да се появи линия във върховете на мултилинията.</td>
</tr>
<tr>
<td>3. От подменюто Caps се избира линия или дъга за началото на мултилинията. След това се избира линия или дъга за края на мултилинията. Накрая се въвежда ъгъл.</td>
</tr>
<tr>
<td>4. Избира се On от подменюто Fill, за да се появи основният цвят.</td>
</tr>
<tr>
<td>5. Избира се Color. След това се посочва основен запълващ цвят от диалоговия прозорец Select Color.</td>
</tr>
<tr>
<td>6. (a) Избира се OK за връщане в диалоговия прозорец Multiline Styles. При това диалоговият прозорец Multiline Properties се затваря.</td>
</tr>
<tr>
<td>(b) Избира се OK за връщане в диалоговия прозорец Multiline Styles.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Сега се записва стилът</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. В полето Name се въвежда име на стила.</td>
</tr>
<tr>
<td>2. В полето Description се въвежда описание.</td>
</tr>
<tr>
<td>3. Избира се Add за добавяне на стила към чертежа.</td>
</tr>
<tr>
<td>4. Избира се Save за записване на стила във файл.</td>
</tr>
<tr>
<td>5. Избира се OK за затваряне на диалоговия прозорец.</td>
</tr>
</tbody>
</table>
Definirane na oblast za crkunje v složen črtaj

1. Otvara se dijalogovni prozor Boundary Hatch, kot se izpolzva eni od slednihat metodii:

Windows Od pлаващего меню Hatch na funkcionalnii red Draw se izbira Hatch.

DOS i UNIX Ot menioto Draw se izbira Hatch.

2. Ot podmenioto Boundary se izbira Advanced.
   (a) Poyavja se dijalogovni prozor Advanced Options. Ot nogo se izbira Make New Boundary Set.
   (b) Ot dijalogovia prozor Advanced Options se izbira Make New Boundary Set.

4. Sled podskazvashcheto soobshchenie Select Objects se zadavat tslovite tocki na oblastta za crkunje i se natiskga Return.

5. V dijalogovia prozor Advanced Options se izbira OK.

6. Ot dijalogovia prozor Boundary Hatch se izbira Pick Points.

7. Poschva se vtrechna tocka i se natiska Return.

8. Ot dijalogovia prozor Boundary Hatch se izbira Apply za poluchavanje na crkunjatet.
Czech

C.1. Personal + imperative

IMD Text 1, pages 47-48

<table>
<thead>
<tr>
<th>Vytvoření stylu multičáry</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nejdříve otevřete dialogový panel Styly multičár jednou z následujících metod:</td>
</tr>
<tr>
<td><strong>Windows:</strong> Z nástrojového panelu Vlastnosti objektů nebo z menu Data vyberte <em>Styl multičár</em>.</td>
</tr>
<tr>
<td><strong>DOS a UNIX:</strong> Z menu Data vyberte <em>Styl multičár</em>.</td>
</tr>
<tr>
<td>1. Vyberte <em>Vlastnosti prvku</em> pro přidání elementů ke stylu.</td>
</tr>
<tr>
<td>2. V dialogovém panelu Vlastnosti prvku zadejte rozměr posunutí multičáry.</td>
</tr>
<tr>
<td>3. Vyberte <em>Přidat</em> pro přidání elementu.</td>
</tr>
<tr>
<td>4. Vyberte <em>Barva</em>.</td>
</tr>
<tr>
<td>(a) Poté zvolte barvu elementu z dialogového panelu Výběr barvy.</td>
</tr>
<tr>
<td>(b) Objeví se dialogový panel Výběr barvy. Zvolte barvu elementu.</td>
</tr>
<tr>
<td>5. Vyberte <em>Typ čáry</em>.</td>
</tr>
<tr>
<td>(a) Poté zvolte typ čáry daného elementu z dialogového panelu Výběr typů čár.</td>
</tr>
<tr>
<td>(b) Objeví se dialogový panel Výběr typů čár. Zvolte typ čáry daného elementu.</td>
</tr>
<tr>
<td>6. Pro vytvoření dalšího elementu tyto kroky opakujte.</td>
</tr>
<tr>
<td>7. Vyberte OK pro uložení vlastností elementu multičáry a pro opuštění dialogového panelu Vlastnosti multičáry.</td>
</tr>
</tbody>
</table>
Nakreslení křivky kombinované z přímek a oblouků
Nejdříve nakreslíme rovný segment.
1. Spusťte příkaz KŘIVKA jedním z následujících způsobů:
Windows: Z plovucího ikonového menu Křivka na nástrojovém panelu Kresli vyberte Křivka.
DOS a UNIX: Z menu Kresli vyberte Křivka.
2. Určete počáteční bod rovného segmentu.
3. Určete koncový bod rovného segmentu.
4. Pro přepnutí do režimu kreslení oblouků zadejte o.
   (a) Objeví se dialogový panel Potvrzení režimu kreslení oblouků. Vyberte OK.
   (b) Poté vyberte OK v dialogovém panelu Potvrzení režimu kreslení oblouků.
5. Určete koncový bod oblouku.
6. Zadejte e pro návrat do režimu kreslení úseček.
   (a) Objeví se dialogový panel Potvrzení režimu kreslení úseček. Vyberte OK.
   (b) Poté vyberte OK v dialogovém panelu Potvrzení režimu kreslení úseček.
7.
   (i) Zadejte vzdálenost úsečky ve vztahu ke koncovému bodu oblouku. Zadejte úhel úsečky ve vztahu ke koncovému bodu oblouku.
   (ii) Zadejte vzdálenost a úhel úsečky ve vztahu ke koncovému bodu oblouku.
8. Stiskněte ENTER pro ukončení křivky.

Nakreslení oblouku určením tří bodů
Spusťte příkaz Oblouk jedním z následujících způsobů:
Windows: Z plovucího ikonového menu Oblouk na nástrojovém panelu Kresli vyberte 3 body.
DOS a Unix: Z menu Kresli vyberte Oblouk. Pak vyberte 3 body.
1. Určete počáteční bod zadáním kon a vybráním čáry, takže oblouk se přichytí ke koncovému bodu.
2. Určete druhý bod zadáním bod a vybráním bodu pro přichycení.
3. Určete koncový bod.
Určení vlastností multičáry a uložení stylu
(a) Z menu Data vyberte Styl multičár. Objeví se dialogový panel Styly multičar.
(b) Z menu Data vyberte Styl multičár.

Nejdříve určete vlastností multičár.

1. (a) Vyberte Vlastnosti multičár. Objeví se dialogový panel Vlastnosti multičár.
   (b) V dialogovém panelu Styly multičár vyberte Vlastnosti multičár.

2. (i) V dialogovém panelu Vlastnosti multičár vyberte Zobraz klouby pro zobrazení čáry ve vrcholech multičár.
   (ii) Vyberte Zobraz klouby pro zobrazení čáry ve vrcholech multičár.


4. Pod Vyplnění vyberte Ano pro zobrazení barvy pozadí.

5. Vyberte Barva. Pak z dialogového panelu Výběr barvy zvolte barvu pro vyplnění pozadí.

6. (a) Vyberte OK pro návrat do dialogového panelu Styly multičár. Dialogový panel Vlastnosti multičár zmizí.
   (b) Vyberte OK pro návrat do dialogového panelu Styly multičár.

Nyní styl uložte.

1. Pod Jméno zadejte název stylu.
2. Pod Popis zadejte popis.
3. Vyberte Přidat k přidání vytvořeného stylu k výkresu.
4. Vyberte Uložit pro uložení stylu do souboru.
5. Vyberte OK a uzavřete dialogový panel.
**IMD Text 5, p. 73**

<table>
<thead>
<tr>
<th>Definování hraniční množiny v komplexním výkrese</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Otevřete dialogový panel Hraniční šrafování jedním z následujících způsobů:</td>
</tr>
<tr>
<td><strong>Windows:</strong> Z plovoucího ikonového menu Šrady na nástrojovém panelu Kresli vyberte Šrady.</td>
</tr>
<tr>
<td><strong>DOS a Unix:</strong> Z menu Kresli vyberte Šrady.</td>
</tr>
<tr>
<td>2. Pod Hranice šrafování vyberte Pokročilé.</td>
</tr>
<tr>
<td>(a) Objeví se dialogový panel Pokročilé možnosti. Vyberte Tvořit novou hraniční množinu.</td>
</tr>
<tr>
<td>(b) V dialogovém panelu Pokročilé možnosti vyberte Tvořit novou hraniční množinu.</td>
</tr>
<tr>
<td>3. Při výzvě Výběr objektů určete rohové body hraniční množiny a stiskněte Enter.</td>
</tr>
<tr>
<td>4. V dialogovém panelu Pokročilé možnosti vyberte OK.</td>
</tr>
<tr>
<td>5. V dialogovém panelu Hraniční šrafování vyberte Výběr objektů.</td>
</tr>
<tr>
<td>6. Určete vnitřní bod a stiskněte Enter.</td>
</tr>
<tr>
<td>7. V dialogovém panelu Hraniční šrafování vyberte Aplikovat pro vyšrafování plochy.</td>
</tr>
</tbody>
</table>

---

16 The Czech manual says *V dialogovém panel Hraniční šrafování vyberte Šrafuj pro vyšrafování plochy*, however, such a specific verb does not correspond to the English “apply” which can be used in varied contexts. We therefore modified the text towards this context-independent realization. Moreover, “šrafuj” is a 2nd person singular form, i.e., a realization of a familiar address which does not fit into the contexts in non-presonal style and also not into personal style where we are consistently using the polite form of address.
C.2. Personal + indicative (1st person plural)

IMD Text 1

Vytvoření stylu multičáry
Nejdříve otevřeme dialogový panel Styly multičár jednou z následujících metod:

**Windows:** Z nástrojového panelu Vlastnosti objektů nebo z menu Data vybereme *Styl multičáry.*

**DOS a UNIX:** Z menu Data vybereme *Styl multičáry.*

1. Vybereme *Vlastnosti prvků* pro přidání elementů ke stylu.
2. V dialogovém panelu Vlastnosti prvků zadáme rozměr posunutí multičáry.
3. Vybereme *Přidat* pro přidání elementu.
4. Vybereme *Barva.*
   (a) Poté zvolíme barvu elementu z dialogového panelu Výběr barvy.
   (b) Objeví se dialogový panel Výběr barvy. Zvolíme barvu elementu.
5. Vybereme *Typ čáry.*
   (a) Poté zvolíme typ čáry daného elementu z dialogového panelu Výběr typů čar.
   (b) Objeví se dialogový panel Výběr typů čar. Zvolíme typ čáry daného elementu.
6. Pro vytvoření dalšího elementu tyto kroky opakujeme.
7. Vybereme OK pro uložení vlastností elementu multičáry a pro opuštění dialogového panelu Vlastnosti multičáry.
**IMD Text 2**

**Nakreslení křivky kombinované z přímek a oblouků**

Nejdříve nakreslíme rovný segment.

1. Spustíme příkaz KŘIVKA jedním z následujících způsobů:
   - **Windows:** Z plovcového ikonového menu Křivka na nástrojovém panelu Kresli vybereme Křivka.
   - **DOS a UNIX:** Z menu Kresli vybereme Křivka.

2. Určíme počáteční bod rovného segmentu.

3. Určíme koncový bod rovného segmentu.

4. Pro přepnutí do režimu kreslení oblouků zadáme o.
   - (a) Objeví se dialogový panel Potvrzení režimu kreslení oblouků. Vybereme OK.
   - (b) Poté vybereme OK v dialogovém panelu Potvrzení režimu kreslení oblouků.

5. Určíme koncový bod oblouku.

6. Zadáme e pro návrat do režimu kreslení úseček.
   - (a) Objeví se dialogový panel Potvrzení režimu kreslení úseček. Vybereme OK.
   - (b) Poté vybereme OK v dialogovém panelu Potvrzení režimu kreslení úseček.

   - (i) Zadáme vzdálenost úsečky ve vztahu ke koncovému bodu oblouku.
   - (ii) Zadáme úhel úsečky ve vztahu ke koncovému bodu oblouku.

8. Stiskneme ENTER pro ukončení křivky.

**IMD Text 3**

**Nakreslení oblouku určením tří bodů**

Spustíme příkaz Oblouk jedním z následujících způsobů:

- **Windows:** Z plovcového ikonového menu Oblouk na nástrojovém panelu Kresli vybereme 3 body.
- **DOS a Unix:** Z menu Kresli vybereme Oblouk. Pak vybereme 3 body.

1. Určíme počáteční bod zadáním kon a vybráním čáry, takže oblouk se přichytí ke koncovému bodu.

2. Určíme druhý bod zadáním bod a vybráním bodu pro přichycení.

3. Určíme koncový bod.
IMD Text 4

Určení vlastností multičáry a uložení stylu

(a) Z menu Data vybereme Styl multičáry. Objeví se dialogový panel Styly multičár.
(b) Z menu Data vybereme Styl multičáry.

Nejdříve určíme vlastnosti multičáry.

1. (a) Vybereme Vlastnosti multičáry. Objeví se dialogový panel Vlastnosti multičáry.
   (b) V dialogovém panelu Styly multičár vybereme Vlastnosti multičáry.

2. (i) V dialogovém panelu Vlastnosti multičáry vybereme Zobraz klouby pro
   zobrazení čáry ve vrcholech multičáry.
   (ii) Vybereme Zobraz klouby pro zobrazení čáry ve vrcholech multičáry.

3. Pod Zakončení zvolíme úsečku nebo oblouk pro počáteční bod multičáry. Poté
   vybereme úsečku nebo oblouk pro koncový bod multičáry. Nakonec zadáme úhel.

4. Pod Vypnění vybereme Ano pro zobrazení barvy pozadí.

5. Vybereme Barva. Pak z dialogového panelu Výběr barvy zvolíme barvu pro
   vyplnění pozadí.

6. (a) Vybereme OK pro návrat do dialogového panelu Styly multičár. Dialogový
   panel Vlastnosti multičáry zmizí.
   (b) Vybereme OK pro návrat do dialogového panelu Styly multičář.

Nyní styl uložíme.

1. Pod Jméno zadáme název stylu.
2. Pod Popis zadáme popis.
3. Vybereme Přidat k přidání vytvořeného stylu k výkresu.
4. Vybereme Uložit pro uložení stylu do souboru.
5. Vybereme OK a uzavřeme dialogový panel.
IMD Text 5

**Definování hraniční množiny v komplexním výkrese**

1. Otevřeme dialogový panel Hranicni šrafování jedním z následujících způsobů:

**Windows:** Z plovoucího ikonového menu Šrafy na nástrojovém panelu Kresli vybereme Šrafy.

**DOS a Unix:** Z menu Kresli vybereme Šrafy.

2. Pod Hranici šrafování vybereme Pokročilé.
   (a) Objeví se dialogový panel Pokročilé možnosti. Vybereme Tvořit novou hraniční množinu.
   (b) V dialogovém panelu Pokročilé možnosti vybereme Tvořit novou hraniční množinu.

3. Při výzvě Výběr objektů určíme rohové body hraniční množiny a stiskneme Enter.

4. V dialogovém panelu Pokročilé možnosti vybereme OK.

5. V dialogovém panelu Hranicni šrafování vybereme Výběr objektů.

6. Určíme vnitřní bod a stiskneme Enter.

7. V dialogovém panelu Hranicni šrafování vybereme Aplikovat pro vyšrafování plochy.
C.3. Non-personal + indicative in reflexive passive

IMD Text 1

Vytvoření stylu multičáry

Nejdříve se otevře dialogový panel Styly multičár jednou z následujících metod:

Windows: Z nástrojového panelu Vlastnosti objektů nebo z menu Data se vybere Styl multičáry.

DOS a UNIX: Z menu Data se vybere Styl multičáry.

1. Vyberte se Vlastnosti prvků pro přidání elementů ke stylu.
2. V dialogovém panelu Vlastnosti prvků se zadá rozměr posunutí multičáry.
3. Vyberte se Přidat pro přidání elementu.
4. Vyberte se Barva.
   (a) Poté se zvolí barva elementu z dialogového panelu Výběr barvy.
   (b) Objeví se dialogový panel Výběr barvy. Zvolí se barva elementu.
5. Vyberte se Typ čáry.
   (a) Poté se zvolí typ čáry daného elementu z dialogového panelu Výběr typů čar.
   (b) Objeví se dialogový panel Výběr typů čar. Zvolí se typ čáry daného elementu.
6. Pro vytvoření dalšího elementu se tyto kroky opakují.
7. Vyberte se OK pro uložení vlastností elementu multičáry a pro opuštění dialogového panelu Vlastnosti multičáry.
IMD Text 2

Nakreslení křivky kombinované z přímeck a oblouků
Nejdříve se nakreslí rovný segment.
1. Spustí se příkaz KŘIVKA jedním z následujících způsobů:
   **Windows:** Z plovoucího ikonového menu Křivka na nástrojovém panelu Kresli se vybere Křivka.
   **DOS a UNIX:** Z menu Kresli se vybere Křivka.
2. Určí se počáteční bod rovného segmentu.
3. Určí se koncový bod rovného segmentu.
4. Pro přepnutí do režimu kreslení oblouků se zadá 0.
   (a) Objeví se dialogový panel Potvrzení režimu kreslení oblouků. Vybere se OK.
   (b) Poté se vybere OK v dialogovém panelu Potvrzení režimu kreslení oblouků.
5. Určí se koncový bod oblouku.
6. Zadá se e pro návrat do režimu kreslení úseček.
   (a) Objeví se dialogový panel Potvrzení režimu kreslení úseček. Vybere se OK.
   (b) Poté se vybere OK v dialogovém panelu Potvrzení režimu kreslení úseček.
7. (i) Zadá se vzdálenost úsečky ve vztahu ke koncovému bodu oblouku. Zadá se úhel úsečky ve vztahu ke koncovému bodu oblouku.
   (ii) Zadá se vzdálenost a úhel úsečky ve vztahu ke koncovému bodu oblouku.
8. Stiskne se ENTER pro ukončení křivky.

IMD Text 3

Nakreslení oblouku určením tří bodů
Spustí se příkaz Oblouk jedním z následujících způsobů:
   **Windows:** Z plovoucího ikonového menu Oblouk na nástrojovém panelu Kresli se vybere 3 body.
   **DOS a Unix:** Z menu Kresli se vybere Oblouk. Pak se vybere 3 body.
1. Určí se počáteční bod zadáním kon a vybráním čáry, takže oblouk se přichytí ke koncovému bodu.
2. Určí se druhý bod zadáním bod a vybráním bodu pro přichycení.
3. Určí se koncový bod.
Určení vlastností multičáry a uložení stylu

(a) Z menu Data se vybere Styl multičár. Objeví se dialogový panel Styly multičár.
(b) Z menu Data se vybere Styl multičár.

Nejdříve se určí vlastnosti multičár.

1. (a) Vybere se Vlastnosti multičár. Objeví se dialogový panel Vlastnosti multičár.
   (b) V dialogovém panelu Styly multičár se vybere Vlastnosti multičár.

2. (i) V dialogovém panelu Vlastnosti multičár se vybere Zobraz klouby pro zobrazení čáry ve vrcholech multičár.
   (ii) Vybere se Zobraz klouby pro zobrazení čáry ve vrcholech multičár.

3. Pod Zakončení se zvolí úsečka nebo oblouk pro počáteční bod multičár. Poté se vybere úsečka nebo oblouk pro koncový bod multičár. Nakonec se zadá úhel.

4. Pod Vyplnění se vybere Ano pro zobrazení barvy pozadí.

5. Vybere se Barva. Pak se z dialogového panelu Výběr barvy zvolí barvu pro vyplnění pozadí.

6. (a) Vybere se OK pro návrat do dialogového panelu Styly multičár. Dialogový panel Vlastnosti multičárů zmizí.
   (b) Vybere se OK pro návrat do dialogového panelu Styly multičár.

Nyní se styl uloží.
1. Pod Jméno se zadá název stylu.
2. Pod Popis se zadá popis.
3. Vybere se Přidat k přídání vytvořeného stylu k výkresu.
4. Vybere se Uložit pro uložení stylu do souboru.
5. Vybere se OK a uzavře se dialogový panel.
IMD Text 5

**Definování hraniční množiny v kkomplexním výkrese**

1. Otevře se dialogový panel Hraniční šrafování jedním z následujících způsobů:

   **Windows**: Z plovoucí ikonového menu Šrafy na nástrojovém panelu Kresli se vybere Šrafy.

   **DOS a Unix**: Z menu Kresli se vybere Šrafy.

2. Pod Hranice šrafování se vybere Pokročilé.
   (a) Objeví se dialogový panel Pokročilé možnosti. Vybere se Tvořit novou hraniční množinu.
   (b) V dialogovém panelu Pokročilé možnosti se vybere Tvořit novou hraniční množinu.

3. Při výzvě Výběr objektů se určí rohové body hraniční množiny a stiskne se Enter.
4. V dialogovém panelu Pokročilé možnosti se vybere OK.
5. V dialogovém panelu Hraniční šrafování se vybere Výběr objektů.
6. Určí se vnitřní bod a stiskne se Enter.
7. V dialogovém panelu Hraniční šrafování se vybere Aplikovat pro vyšrafování plochy.
**Russian**

**IMD Text 1: pages 47-48**

**Чтобы создать стиль мультилинии**

Сначала откройте диалоговое окно Multiline Styles одним из следующих способов:

**Windows:** В панели инструментов Object Properties или в меню Data выберите пункт Multiline Style.

**DOS & UNIX:** В меню Data выберите пункт Multiline Style.

1. Нажмите кнопку Element Properties, чтобы добавить элементы в стиль.
2. В диалоговом окне Element Properties введите смещение первого элемента линии.
3. Нажмите кнопку Add, чтобы добавить этот элемент.
4. Выберите пункт Color. Затем выберите цвет элемента в диалоговом окне Select Color.

Выберите пункт Color. На экране появится диалоговое окно Select Color. Выберите в нем цвет элемента.

5. (a) Выберите пункт Linetype. На экране появится диалоговое окно Select Linetype. Выберите в нем тип линии элемента.
   (b) Выберите пункт Linetype. Затем выберите тип линии элемента в диалоговом окне Select Linetype.

6. Повторите эти шаги, чтобы задать еще один элемент.

7. Нажмите кнопку OK, чтобы сохранить стиль элементов мультилинии и закрыть диалоговое окно Element Properties.
**IMD Text 2: page 46**

Чтобы нарисовать полилинию, состоящую из отрезков прямых и дуг

Сначала нарисуйте отрезок прямой.

1. Запустите команду PLINE одним из следующих способов:

**Windows**: В палитре Polyline на панели инструментов Draw выберите пункт Polyline.

**DOS & UNIX**: В меню Draw выберите пункт Polyline.

2. Укажите начальную точку отрезка прямой.

3. Укажите конечную точку отрезка прямой.

4. (a) Нажмите клавишу а, чтобы перейти в режим Arc. На экране появится диалоговое окно Arc mode. Нажмите OK.

   (b) Нажмите клавишу а, чтобы перейти в режим Arc. Затем нажмите OK в диалоговом окне Arc mode.

5. Укажите конечную точку дуги.

6. (a) Нажмите клавишу I, чтобы вернуться в режим Line. На экране появится диалоговое окно Line mode. Нажмите OK.

   (b) Нажмите клавишу I, чтобы вернуться в режим Line. Затем нажмите OK в диалоговом окне Line mode.

7. (a) Укажите расстояние линии по отношению к конечной точке дуги.

   Укажите угол линии по отношению к конечной точке дуги.

   (b) Укажите расстояние и угол линии по отношению к конечной точке дуги.

8. Нажмите клавишу Return, чтобы завершить рисование полилинии.

**IMD Text 3: page 58**

Чтобы нарисовать дугу по трем заданным точкам

Запустите команду ARC одним из следующих способов:

**Windows**: В палитре ARC на панели инструментов Draw выберите пункт 3 Points.

**DOS & UNIX**: В меню Draw выберите пункт ARC. Затем выберите пункт 3 Points.

1. Чтобы указать начальную точку дуги, введите start и задайте линию, к конечной точке которой привязана дуга.

2. Чтобы указать вторую точку, введите end и задайте точку для привязки дуги.

3. Укажите конечную точку.
Чтобы определить свойства мультилинии и сохранить ее стиль

(a) В меню Data выберите пункт Multiline Style. На экране появится диалоговое окно Multiline Style.

(b) В меню Data выберите пункт Multiline Style.

Сначала определите свойства мультилинии.

1. (a) Выберите пункт Multiline Properties. На экране появится диалоговое окно Multiline Properties.
   (b) В диалоговом окне Multiline Styles, выберите пункт Multiline Properties.

2. (i) В диалоговом окне Multiline Properties выберите пункт Display joints, чтобы отобразить линию у вершин мультилинии.
   (ii) Выберите пункт Display joints, чтобы отобразить линию у вершин.

3. В окне Caps задайте прямую или дугу для начальной точки мультилинии.
   Затем задайте прямую или дугу для конечной точки мультилинии. Наконец задайте угол.

4. В окне Fill нажмите On, чтобы показать цвет фона.

5. Нажмите кнопку Color. Затем в диалоговом окне Select Color укажите цвет фона.

6. (a) Нажмите кнопку OK, чтобы вернуться в диалоговое окно Multiline Styles.
    Диалоговое окно Multiline Properties исчезнет с экрана.
   (b) Нажмите кнопку OK, чтобы вернуться в диалоговое окно Multiline Styles.

Теперь сохраните стиль.

1. В пункте Name задайте имя стиля.

2. В пункте Description задайте описание стиля.

3. Нажмите кнопку Add, чтобы добавить стиль мультилинии к рисунку.

4. Нажмите кнопку Save, чтобы сохранить стиль в файл.

5. Нажмите кнопку OK и закройте диалоговое окно.
### Чтобы определить набор границ в сложном рисунке

1. Откройте диалоговое окно Boundary Hatch одним из следующих способов:

   **Windows:** В палитре Hatch на панели инструментов Draw выберите пункт Hatch.

   **DOS & UNIX:** В меню Draw выберите пункт Hatch.

2. (a) В пункте Boundary нажмите кнопку Advanced. На экране появится диалоговое окно Advanced Options. Нажмите кнопку Make New Boundary Set.

   (b) В пункте Boundary нажмите кнопку Advanced.

3. В диалоговом окне Advanced Options нажмите кнопку Make New Boundary Set.

4. В окне запроса Select Objects укажите граничные точки набора границ и нажмите Return.

5. В диалоговом окне Advanced Options нажмите OK.

6. В диалоговом окне Boundary Hatch нажмите кнопку Pick Points.

7. Укажите внутреннюю точку и нажмите Return.

8. В диалоговом окне Boundary Hatch нажмите кнопку Apply, чтобы применить штриховку.