Natural Language Generation Using NooJ

Max Silberztein, Université de Franche-Comté

COST Meeting

Lisbon, October 2021

The linguistic framework: NooJ

- Orthography, e.g. Uppercase letters in German, vowels in Arabic

- Morphology: spelling variants, inflection, derivation, agglutination

- Vocabulary:

- Syntax: local syntax, constituent, dependency grammars

- Transformational syntax: transformations and paraphrasing

- Semantics, e.g. Prolog-type semantic representations, XML-RDF-FOAF

NooJ linguistic resources

- Dictionaries
  - prefixes and suffixes, e.g. bioengineering, the hispano-filipino association
  - simple words, e.g. *table*, *eaten*
  - multiword units, e.g. *a red herring, as a matter of fact*
  - discontinous expressions, e.g. *to turn … off*, *to take … into account*
- Grammars: morphology, syntax and semantics
- All resources are neutral, i.e. can be used both by parsers and generators
  - Parsers apply a resource to a text → produce indices, statistical analyses, annotations, extractions, etc.
  - Generators apply a resource → produce words, phrases and/or sentences

3 types of formal grammars in Chomsky's hierarchy

- Dictionaries are compiled into **Acyclic Finite-State Transducers**

- Regular expressions are compiled into **Finite-State Transducers**

- Context-Free Grammars are compiled into **Recursive Finite-State Transducers**

- Context-Sensitive Grammars are compiled into **Recursive Finite-State Transducers with variables and constraints**

Notations

- Notation for dictionaries

love,VERB+Transitive+N0Hum+N1nr+FLX=ED+DRV=NOUN

- Notation for grammars

Sentence = :NP <VERB+Transitive> :NP ;

NP = <DET> (<ADJ> | <E>) <NOUN> ;

Notations

- Notation for dictionaries

love,VERB+Transitive+N0Hum+N1nr+FLX=ED+DRV=NOUN

⟶ *love, loved, loving, loves, lover, lovers*

- Notation for grammars

Sentence = :NP <VERB+Transitive> :NP ;

NP = <DET> (<ADJ> | <E>) <NOUN> ;

⟶ *The big dog saw the cat*

- Graphical notation for finite-state graphs, recursive graphs and recursive graphs enhanced with constraints

Notations

- Notation for dictionaries

love,VERB+Transitive+N0Hum+N1nr+FLX=ED+DRV=NOUN

⟶ *love, loved, loving, loves, lover, lovers*

- Notation for grammars

Sentence = :NP <VERB+Transitive> :NP ;

NP = <DET> (<ADJ> | <E>) <NOUN> ;

⟶ *The big dog saw the cat*

- Graphical notation for finite-state graphs, recursive graphs and recursive graphs enhanced with constraints

Graphical notation for grammars

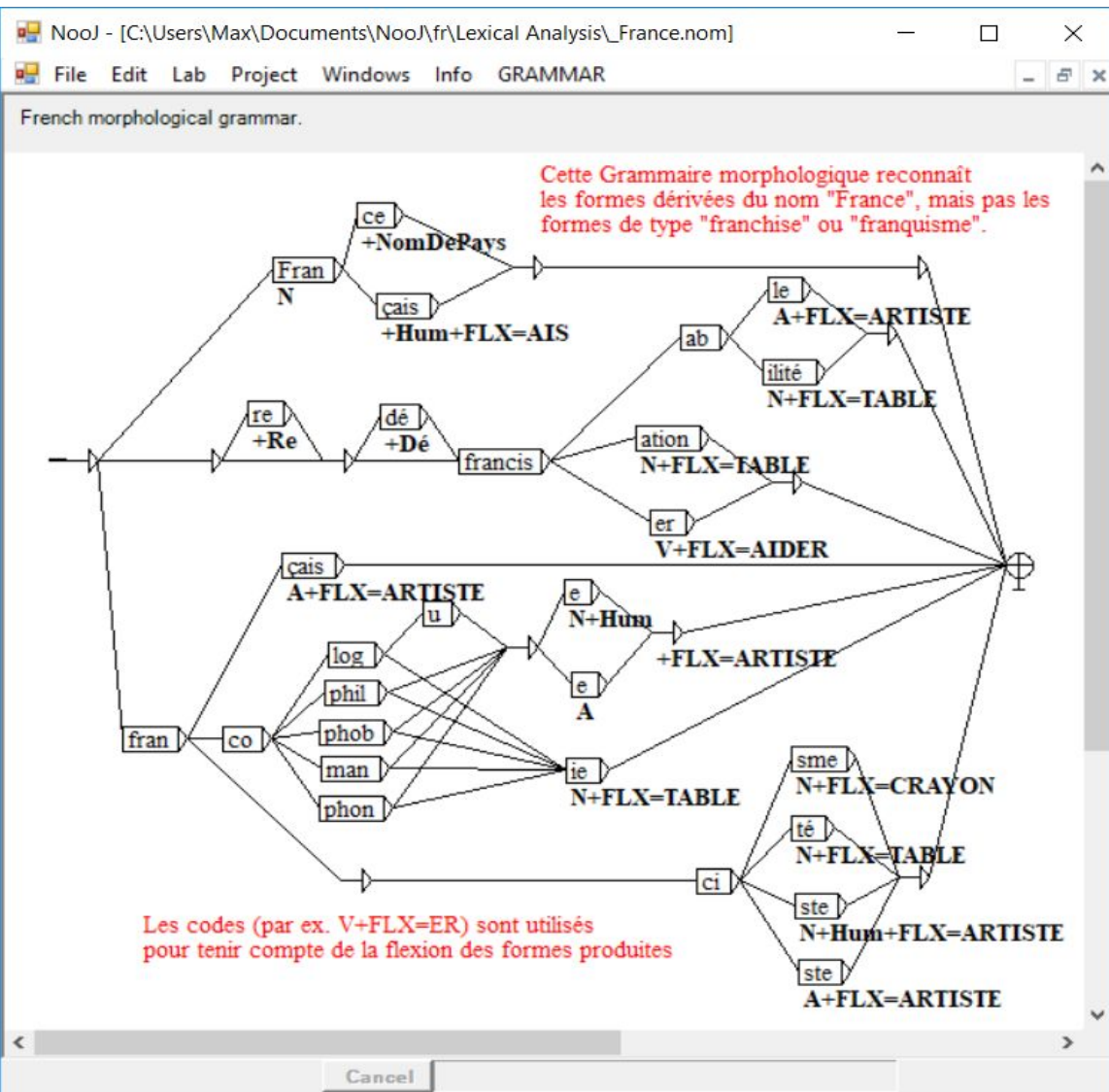One grammar constituted by multiple graphs:

Main graph

NP graph

VG graph
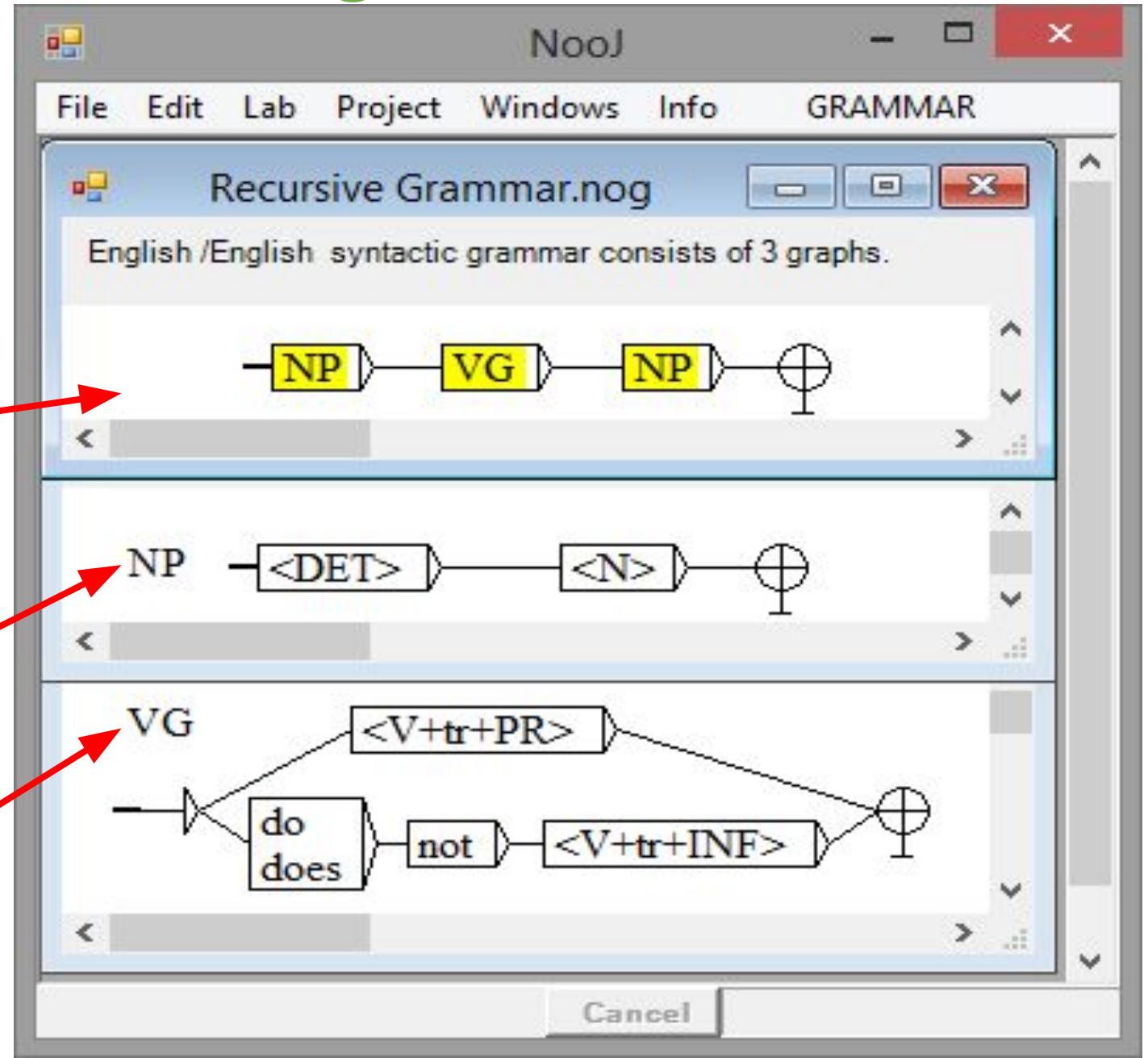
Neutral Resources

- The same exact resources are used both by a **parser** or by a **generator**

- NooJ's engine does not make a fundamental difference between **parsing** and **generating**:

  - From "*It is not Lea that he loves*" to "*Joe loves lea* **+Pron0+Focus1+Neg**"
    → **Analysis**

  - From "*Joe loves Lea* **+Pron0+Focus1+Neg**" to "*It is not Lea that he loves*"
    → **Generation**

A morphological grammar

Parsing:

A morphological grammar

Generating:

NooJ - [C:\Users\Max\Documents\NooJ\fr\Lexical Analysis_France.nom]

File Edit Lab Project Windows Info GRAMMAR

French morphological grammar.

Cette Grammaire morphologique reconnaît les formes dérivées du nom "France", mais pas les formes de type "franchise" ou "franquisme".

Les codes (par ex. V+FLX=ER) sont utilisés pour tenir compte de la flexion des formes produites

Untitled [Modified]

```
# Dictionary was generated automatically: 38 entries.
#
défranciser,V+FLX=AIDER
défrancisation,N+FLX=TABLE
défrancisable,A+FLX=ARTISTE
défrancisabilité,N+FLX=TABLE
Français,N+FLX=AIS
France,N
redéfranciser,V+FLX=AIDER
redéfrancisation,N+FLX=TABLE
redéfrancisable,A+FLX=ARTISTE
redéfrancisabilité,N+FLX=TABLE
refranciser,V+FLX=AIDER
refrancisation,N+FLX=TABLE
refrancisable,A+FLX=ARTISTE
```

NooJ

File   Edit   Lab   Project   Windows   Info   GRAMMAR

C:\Users\Max\Documents\NooJ\en\Projects_The Portrait Of A Lady.not

− 166 + / 457

Characters
Tokens
Digrams
Unknowns

□ Show Text Annotation Structure

Language is "English(en)".
Text Delimiter is: \n (NEWLINE)
Text contains 4572 Text Units (TUs).

"I'll settle it with her--at a quarter to seven." And Ralph looked at his watch again.

"I'm glad to be here at all," said the girl.

[Modified] C:\Users\Max\Documents\NooJ\en\Syntactic Analysis_Date.nog

English/English syntactic grammar consists of 20 graphs.

early
late

afternoon
morning
night

Monday, June 5th

on the 3rd of June
tomorrow
a few days ago
once
in a few days

in the afternoon

at 1532

at seven o'clock

Mon, 16 Mar 2003

at 7:10 am

a few years ago
in a few years

in May 2002

<ADV+Date

Concordance

Reset   Display: 5 ○ characters   before, and 5 after. Display: ☑ Matches ☐ Outputs
○ word forms

Text	Before	Seq.	After
	which he called his study.	At ten o'clock	Lord Warburton had c
	nothing was changed; what she	once	thought of him she alwa
	intimacy through which they had	once	passed? Isabel knew s
	strange impression she had received	in the afternoon	of her husband's being
	her short interview with Osmond	half an hour ago	was a striking example
	life. He said to her	one day	that she had too many
	tradition; he had told her	once	that the best thing in
	him believe that he had	once	wounded her greatly a
	't esteem me then. Say	at once	that you think me a
	'Understand what?' 'You told me	ten days ago	that you'd like to
	shall send it to-night.' '	At three o'clock in the morning	?' 'I mean later, in the
	pretend I'm as I	once	was.' 'Well, if you're
	should both know it when	once	they had really touched

Query   258/258

2.3 sec   Cancel

NooJ

File   Edit   Lab   Project   Windows   Info   GRAMMAR

C:\Users\Max\Documents\NooJ\en\Projects_The Portrait Of A Lady.not

- 166 + / 457

Characters
Tokens
Digrams
Unknowns

☐ Show Text Annotation Structure

Language is "English(en)".
Text Delimiter is: \n (NEWLINE)
Text contains 4572 Text Units (TUs).

"I'll settle it with her--at a quarter to seven." And Ralph looked at his watch again.

"I'm glad to be here at all," said the girl.

[Modified] C:\Users\Max\Documents\NooJ\en\Syntactic Analysis_Date.nog

English/English syntactic grammar consists of 20 graphs.

early
late

Monday, June 5th

afternoon
morning
night

on the 3rd of June
tomorrow
a few days ago
once
in a few days

in the afternoon

at 1532

at seven o'clock

Mon, 16 Mar 2003

at 7:10 am

a few years ago
in a few years

in May 2002

<ADV+Date

Concordance

Reset   Display: 5 ○ characters   before, and   5   after. Display: ☑ Matches ☐ Outputs
○ word forms

Text	Before	Seq.	After
which he called his study.	At ten o'clock		Lord Warburton had c
nothing was changed; what she	once		thought of him she alwa
intimacy through which they had	once		passed? Isabel knew s
strange impression she had received	in the afternoon		of her husband's being
her short interview with Osmond	half an hour ago		was a striking example
life. He said to her	one day		that she had too many
tradition; he had told her	once		that the best thing in
him believe that he had	once		wounded her greatly a
't esteem me then. Say	at once		that you think me a
'Understand what?' 'You told me	ten days ago		that you'd like to
shall send it to-night.' '	At three o'clock in the morning		?' 'I mean later, in the
pretend I'm as I	once		was.' 'Well, if you're
should both know it when	once		they had really touched

Query   258/258

2.3 sec   Cancel

English/English syntactic grammar consists of 20 graphs.

Monday, June 5th

NooJ

File Edit Lab Project Windows Info GRAMMAR
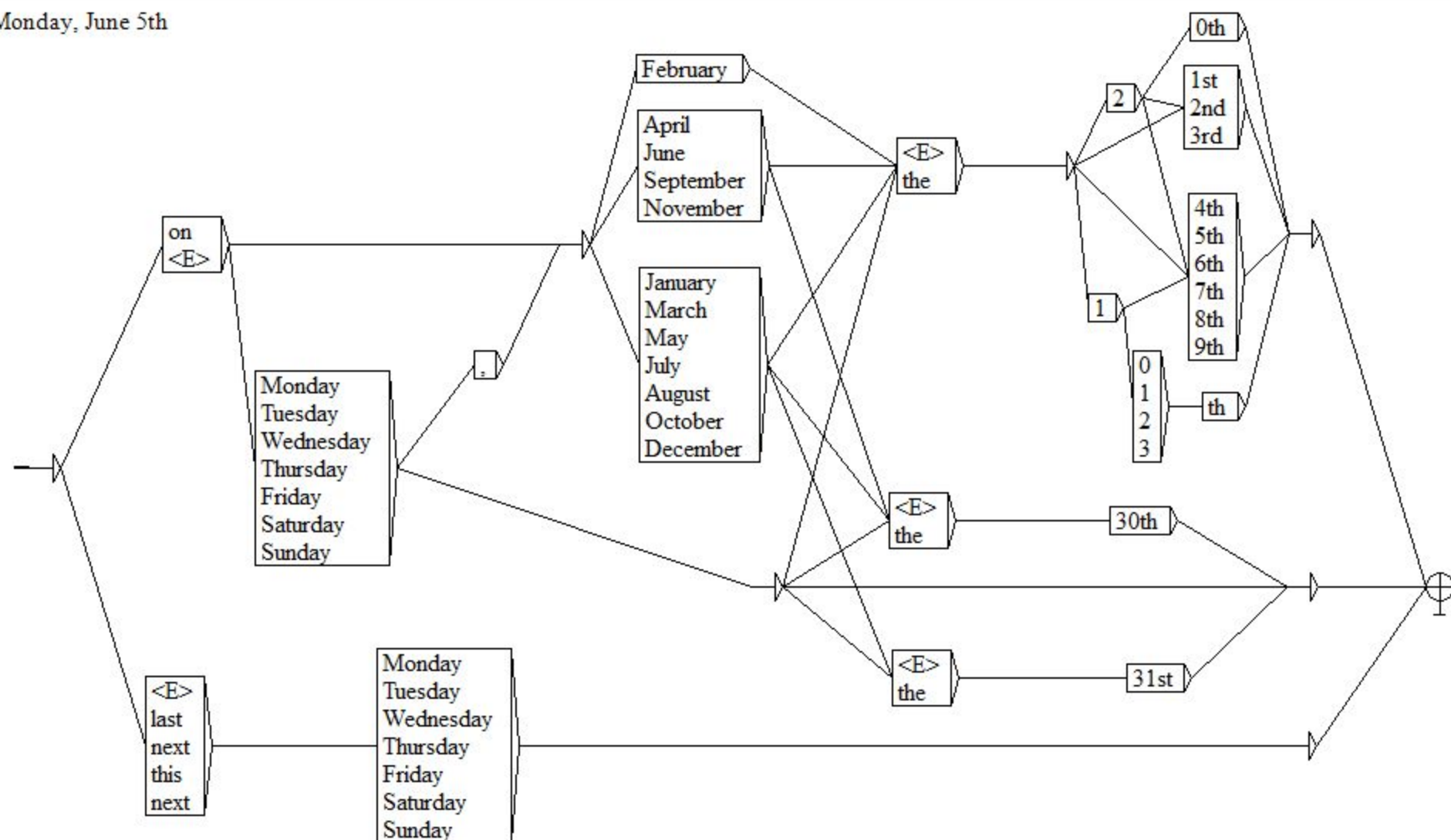
C:\Users\Max\Documents\NooJ\en\Projects_The Portrait Of A Lady.not

- [166] + / 457

Characters
Tokens
Digrams
Unknowns

Language is "English(en)".
Text Delimiter is: \n (NEWLINE)
Text contains 4572 Text Units (TUs).

☐ Show Text Annotation Structure

"I'll settle it with her--at a quarter to seven." And Ralph looked at his watch again.

"I'm glad to be here at all," said the girl.

[Modified] C:\Users\Max\Documents\NooJ\en\Syntactic Analysis_Date.nog

English/English syntactic grammar consists of 20 graphs.

early
late

afternoon
morning
night

Monday, June 5th

on the 3rd of June
tomorrow
a few days ago
once
in a few days

in the afternoon

at 1532

Mon, 16 Mar 2003

at seven o'clock

at 7:10 am

a few years ago
in a few years

in May 2002

<ADV+Date

Concordance

Reset   Display: [5] ○ characters before, and [5] after. Display: ☑ Matches ☐ Outputs
                  ● word forms

Text	Before	Seq.	After
	which he called his study.	At ten o'clock	Lord Warburton had c
	nothing was changed; what she	once	thought of him she alwa
	intimacy through which they had	once	passed? Isabel knew s
	strange impression she had received	in the afternoon	of her husband's being
	her short interview with Osmond	half an hour ago	was a striking example
	life. He said to her	one day	that she had too many
	tradition; he had told her	once	that the best thing in
	him believe that he had	once	wounded her greatly a
	't esteem me then. Say	at once	that you think me a
	'Understand what?' 'You told me	ten days ago	that you'd like to
	shall send it to-night.' '	At three o'clock in the morning	?' 'I mean later, in the
	pretend I'm as I	once	was.' 'Well, if you're
	should both know it when	once	they had really touched

Query   258/258

2.3 sec   Cancel

NooJ

File   Edit   Lab   Project   Windows   Info   DICTIONARY
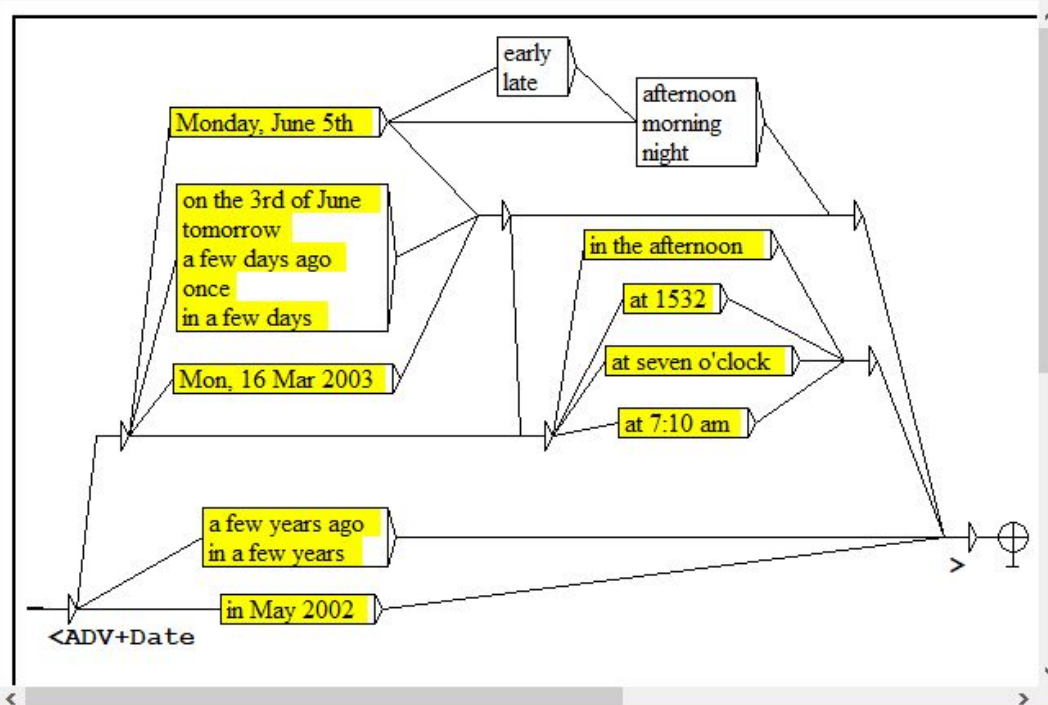
Generation for Date

C:\Users\Max\Documents\NooJ\en\Syntactic Analysis_Da

☑ Explore Embedded Graphs

☑ Produce sequences with symbols

☑ Stop after: 5   seconds

Generate Language

C:\Users\Max\Documents\NooJ\en\Syntactic Analysis\COST\Date.nog

English/English syntactic grammar consists of 20 graphs.

C:\Users\Max\Documents\NooJ\en\Syntactic Analysis\COST\Date_gen.dic

Dictionary contains 959245 entries

```
next Thursday at about seven o ' clock am,ADV+Date
next Thursday at about seven o ' clock a . m .,ADV+Date
next Thursday at about seven in the afternoon,ADV+Date
next Thursday at about seven in the morning,ADV+Date
next Thursday at about seven p . m .,ADV+Date
next Thursday at about seven pm,ADV+Date
next Thursday at about seven am,ADV+Date
next Thursday at about seven a . m .,ADV+Date
next Thursday at about six,ADV+Date
next Thursday at about six o ' clock,ADV+Date
next Thursday at about six o ' clock in the afternoon,ADV+Date
next Thursday at about six o ' clock in the morning,ADV+Date
next Thursday at about six o ' clock p . m .,ADV+Date
next Thursday at about six o ' clock pm,ADV+Date
next Thursday at about six o ' clock am,ADV+Date
next Thursday at about six o ' clock a . m .,ADV+Date
next Thursday at about six in the afternoon,ADV+Date
next Thursday at about six in the morning,ADV+Date
next Thursday at about six p . m .,ADV+Date
next Thursday at about six pm,ADV+Date
next Thursday at about six am,ADV+Date
next Thursday at about six a . m .,ADV+Date
next Thursday at about four,ADV+Date
next Thursday at about four o ' clock,ADV+Date
next Thursday at about four o ' clock in the afternoon,ADV+Date
next Thursday at about four o ' clock in the morning,ADV+Date
next Thursday at about four o ' clock p . m .,ADV+Date
next Thursday at about four o ' clock pm,ADV+Date
next Thursday at about four o ' clock am,ADV+Date
next Thursday at about four o ' clock a . m .,ADV+Date
next Thursday at about four in the afternoon,ADV+Date
next Thursday at about four in the morning,ADV+Date
next Thursday at about four p . m .,ADV+Date
next Thursday at about four pm,ADV+Date
next Thursday at about four am,ADV+Date
next Thursday at about four a . m .,ADV+Date
next Thursday at about three,ADV+Date
next Thursday at about three o ' clock,ADV+Date
next Thursday at about three o ' clock in the afternoon,ADV+Date
```

5 sec   Cancel
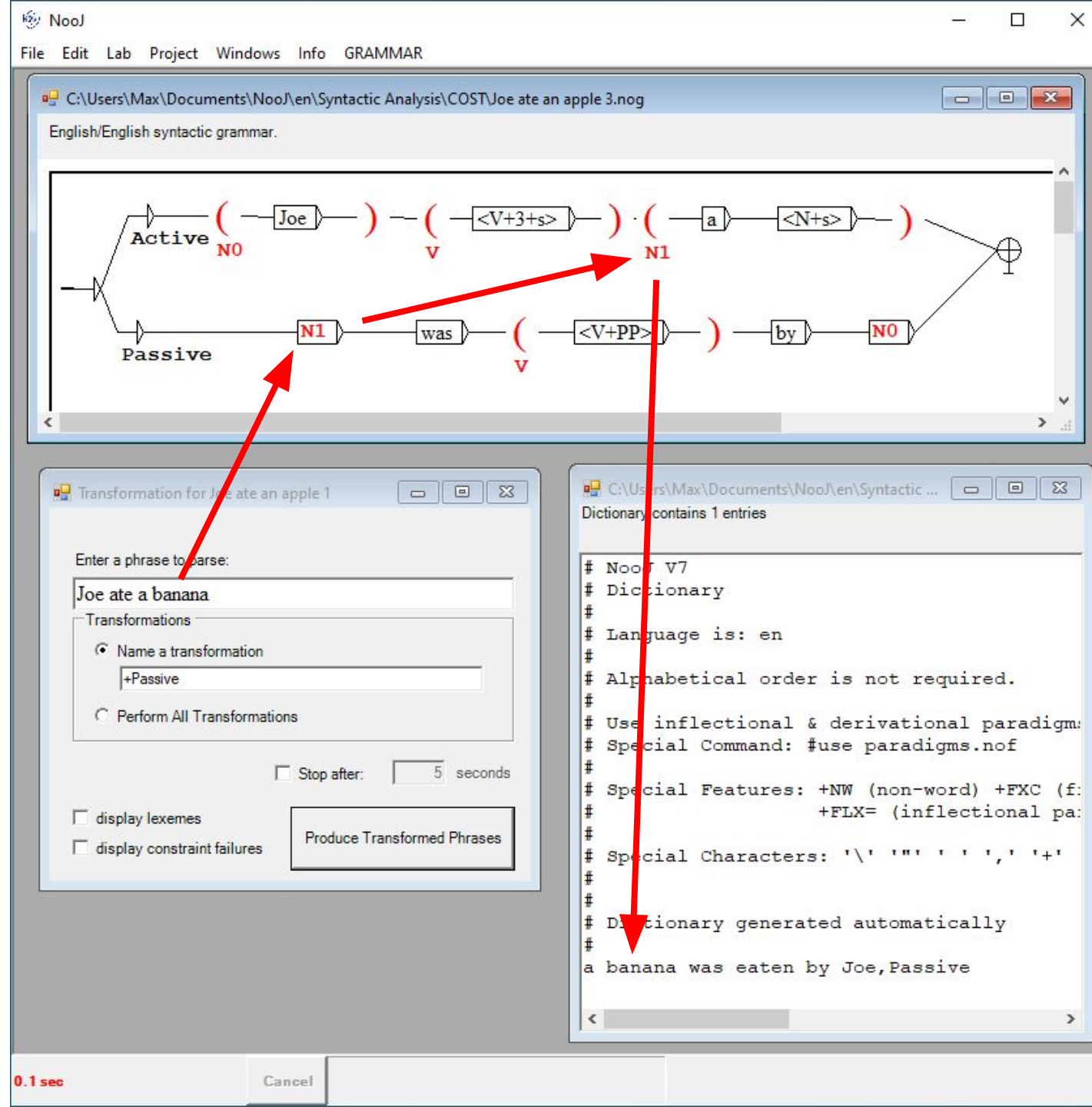
Principle

A grammar represents a set of sentences.

One can generate all the sentences or only
the ones that have some properties
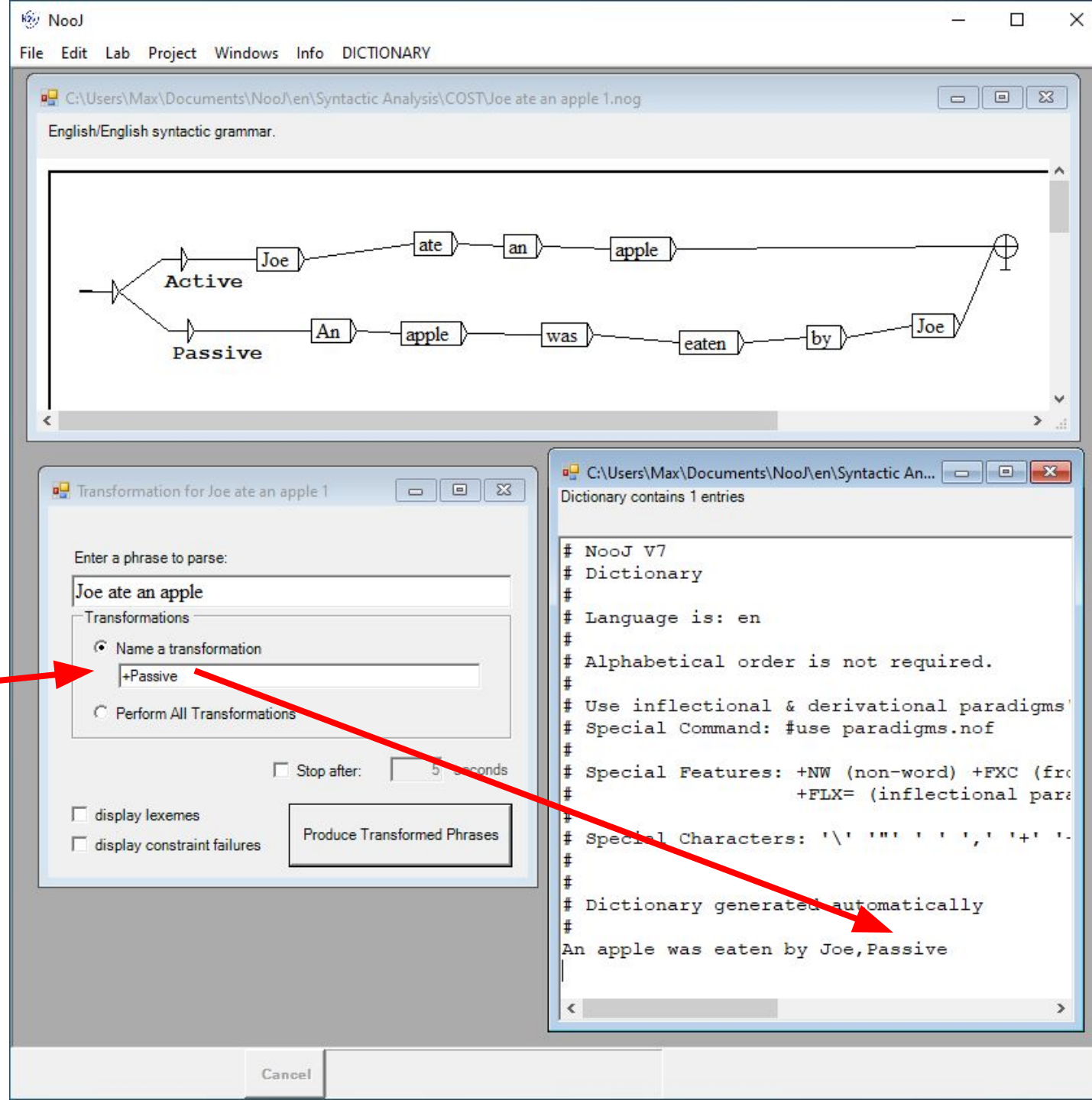
Principle
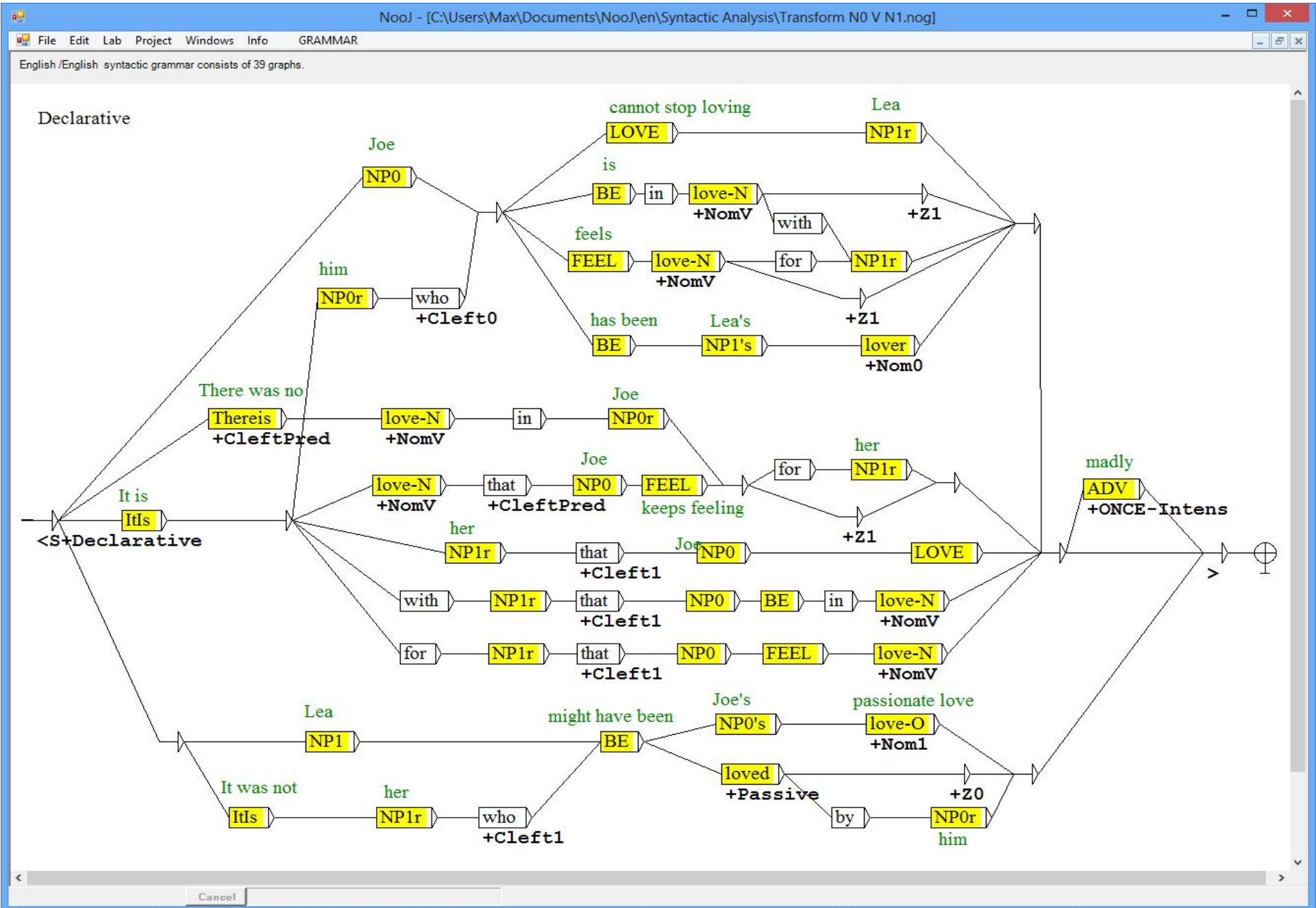
A grammar represents a set of sentences.

Variables can be used to produce more generic grammars

Multiple levels of linguistic resources

- From sentence "Joe loves Lea", to generate sentence "She is Joe's love", NooJ needs to perform various levels of linguistic processing:

  - *loves* should be lemmatized as *to love*
  - *to love* should be nominalized into *a love*
  - N_0 V N_1 can be rewritten as N_1 is N_0's V-n
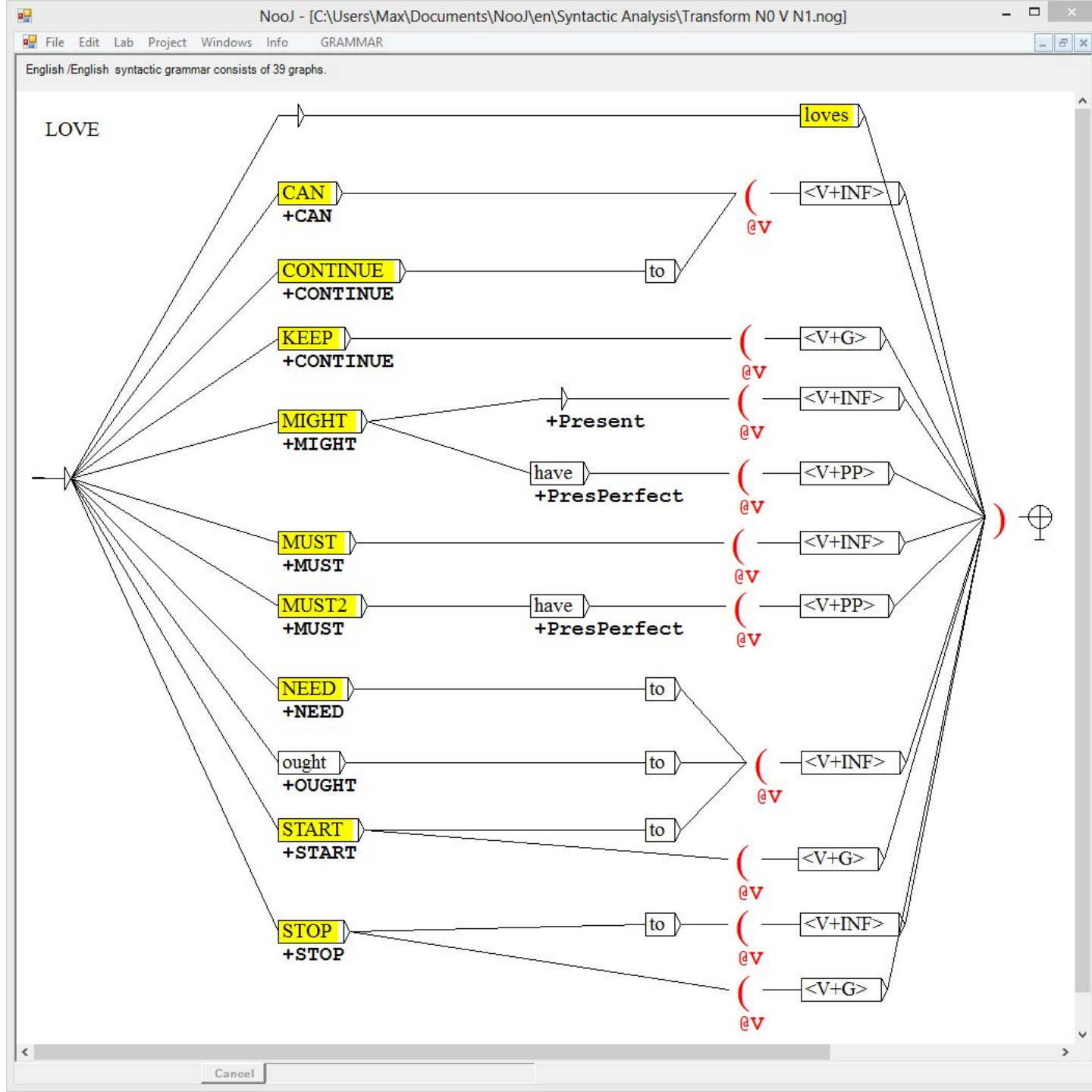 - *Lea* is a human feminine proper name, therefore it should be replaced with pronoun *She* in Subject position

Joe loves Lea

File   Edit   Lab   Project   Windows   Info   GRAMMAR

English /English syntactic grammar consists of 39 graphs.

Declarative

cannot stop loving
LOVE
Lea
NP1r

Joe
NP0

is
BE in **love-N** **+NomV** with **+Z1**

him
NP0r who **+Cleft0**

feels
FEEL **love-N** **+NomV** for **NP1r** **+Z1**

has been
BE Lea's **NP1's** lover **+Nom0**

There was no
Thereis **+CleftPred** **love-N** **+NomV** in Joe **NP0r**

Joe
love-N **+NomV** that **NP0** **+CleftPred** **FEEL** for her **NP1r** **+Z1**

It is
ItIs

keeps feeling

her
NP1r that **+Cleft1** Joe **NP0** **LOVE**

with
NP1r that **+Cleft1** **NP0** **BE** in **love-N** **+NomV**

for
NP1r that **+Cleft1** **NP0** **FEEL** **love-N** **+NomV**

madly
ADV **+ONCE-Intens**

<S+Declarative

Lea
NP1

might have been
BE

Joe's
NP0's

passionate love
love-O **+Nom1**

loved **+Passive** by **NP0r** **+Z0**
him

It was not
ItIs

her
NP1r who **+Cleft1**

Cancel

Joe loves Lea

File   Edit   Lab   Project   Windows   Info   GRAMMAR

English /English syntactic grammar consists of 39 graphs.

Declarative

cannot stop loving
LOVE

Lea
NP1r

Joe
NP0

is
BE in **love-N**
+NomV

with

+Z1

him
NP0r who
+Cleft0

feels
FEEL **love-N** for **NP1r**
+NomV

+Z1

has been
BE **NP1's** **lover**
Lea's   +Nom0

There was no
Thereis **love-N** in **NP0r**
+CleftPred +NomV   Joe

It is
ItIs

<S+Declarative

love-N that **NP0** **FEEL** for **NP1r**
+NomV +CleftPred Joe   her
       keeps feeling   +Z1

her
NP1r that **NP0**   **LOVE**
+Cleft1 Joe

with **NP1r** that **NP0** **BE** in **love-N**
+Cleft1   +NomV

for **NP1r** that **NP0** **FEEL** **love-N**
+Cleft1   +NomV

madly
ADV
+ONCE-Intens

Lea
NP1

might have been
BE

Joe's
NP0's **love-O**
passionate love
+Nom1

It was not
ItIs **NP1r** who
her +Cleft1

loved
+Passive by **NP0r**
+Z0   him

Cancel

File   Edit   Lab   Project   Windows   Info   GRAMMAR

English /English syntactic grammar consists of 39 graphs.

LOVE

loves

CAN
+CAN
(@**V**   <V+INF>

CONTINUE
+CONTINUE
to

KEEP
+CONTINUE
(@**V**   <V+G>

MIGHT
+MIGHT
+Present
(@**V**   <V+INF>

have
+PresPerfect
(@**V**   <V+PP>

MUST
+MUST
(@**V**   <V+INF>

MUST2
+MUST
have
+PresPerfect
(@**V**   <V+PP>

NEED
+NEED
to

ought
+OUGHT
to
(@**V**   <V+INF>

START
+START
to
(@**V**   <V+G>

STOP
+STOP
to
(@**V**   <V+INF>

(@**V**   <V+G>

Cancel

NooJ

File   Edit   Lab   Project   Windows   Info   DICTIONARY

C:\Users\Max\OneDrive\Textes\Mon livre\Resources anglaises\Ressources NooJ\Joe loves Lea.nog

English /English syntactic...

Declarative

Generation for Joe l...

C:\Users\Max\OneDrive\Textes...

☑ Explore Embedded Graphs
☐ Stop after: 5

Ge...

Dictionary contains 1234142 entries

```
It will not be her who should not need to be his love,S+Declarative+Future+Neg+Pro1+Cleft1+NEED+Neg+PresCon
It will not be her who should not need to be loved very much,S+Declarative+Future+Neg+Pro1+Cleft1+NEED+Neg+
It will not be her who should not need to be loved very much by Joe,S+Declarative+Future+Neg+Pro1+Cleft1+NE
It will not be her who should not need to be loved very much by him,S+Declarative+Future+Neg+Pro1+Cleft1+NE
It will not be her who should not need to be loved a lot,S+Declarative+Future+Neg+Pro1+Cleft1+NEED+Neg+Pres
It will not be her who should not need to be loved a lot by Joe,S+Declarative+Future+Neg+Pro1+Cleft1+NEED+N
It will not be her who should not need to be loved a lot by him,S+Declarative+Future+Neg+Pro1+Cleft1+NEED+N
It will not be her who should not need to be loved well,S+Declarative+Future+Neg+Pro1+Cleft1+NEED+Neg+PresC
It will not be her who should not need to be loved well by Joe,S+Declarative+Future+Neg+Pro1+Cleft1+NEED+Ne
It will not be her who should not need to be loved well by him,S+Declarative+Future+Neg+Pro1+Cleft1+NEED+Ne
It will not be her who should not need to be loved madly,S+Declarative+Future+Neg+Pro1+Cleft1+NEED+Neg+Pres
It will not be her who should not need to be loved madly by Joe,S+Declarative+Future+Neg+Pro1+Cleft1+NEED+N
It will not be her who should not need to be loved madly by him,S+Declarative+Future+Neg+Pro1+Cleft1+NEED+N
It will not be her who should not need to be loved passionately,S+Declarative+Future+Neg+Pro1+Cleft1+NEED+N
It will not be her who should not need to be loved passionately by Joe,S+Declarative+Future+Neg+Pro1+Cleft1
It will not be her who should not need to be loved passionately by him,S+Declarative+Future+Neg+Pro1+Cleft1
It will not be her who should not need to be loved,S+Declarative+Future+Neg+Pro1+Cleft1+NEED+Neg+PresCond+P
It will not be her who should not need to be loved by Joe,S+Declarative+Future+Neg+Pro1+Cleft1+NEED+Neg+Pre
It will not be her who should not need to be loved by him,S+Declarative+Future+Neg+Pro1+Cleft1+NEED+Neg+Pre
It will not be her who should not have needed to be Joe ' s little love,S+Declarative+Future+Neg+Pro1+Cleft
It will not be her who should not have needed to be Joe ' s mad love,S+Declarative+Future+Neg+Pro1+Cleft1+N
It will not be her who should not have needed to be Joe ' s passionate love,S+Declarative+Future+Neg+Pro1+C
It will not be her who should not have needed to be Joe ' s love,S+Declarative+Future+Neg+Pro1+Cleft1+NEED+
It will not be her who should not have needed to be his little love,S+Declarative+Future+Neg+Pro1+Cleft1+NE
It will not be her who should not have needed to be his mad love,S+Declarative+Future+Neg+Pro1+Cleft1+NEED+
It will not be her who should not have needed to be his passionate love,S+Declarative+Future+Neg+Pro1+Cleft
It will not be her who should not have needed to be his love,S+Declarative+Future+Neg+Pro1+Cleft1+NEED+Neg+
It will not be her who should not have needed to be loved very much,S+Declarative+Future+Neg+Pro1+Cleft1+NE
It will not be her who should not have needed to be loved very much by Joe,S+Declarative+Future+Neg+Pro1+Cl
It will not be her who should not have needed to be loved very much by him,S+Declarative+Future+Neg+Pro1+Cl
It will not be her who should not have needed to be loved a lot,S+Declarative+Future+Neg+Pro1+Cleft1+NEED+N
It will not be her who should not have needed to be loved a lot by Joe,S+Declarative+Future+Neg+Pro1+Cleft1
It will not be her who should not have needed to be loved a lot by him,S+Declarative+Future+Neg+Pro1+Cleft1
It will not be her who should not have needed to be loved well,S+Declarative+Future+Neg+Pro1+Cleft1+NEED+Ne
It will not be her who should not have needed to be loved well by Joe,S+Declarative+Future+Neg+Pro1+Cleft1+
It will not be her who should not have needed to be loved well by him,S+Declarative+Future+Neg+Pro1+Cleft1+
It will not be her who should not have needed to be loved madly,S+Declarative+Future+Neg+Pro1+Cleft1+NEED+N
It will not be her who should not have needed to be loved madly by Joe,S+Declarative+Future+Neg+Pro1+Cleft1
```

It is
ItI
<S+Declar

it was not   her   +Passive   +Z0

Cancel

Automatic Generation in Italian (S. Vietri, 2012)

Automatic Generation in French
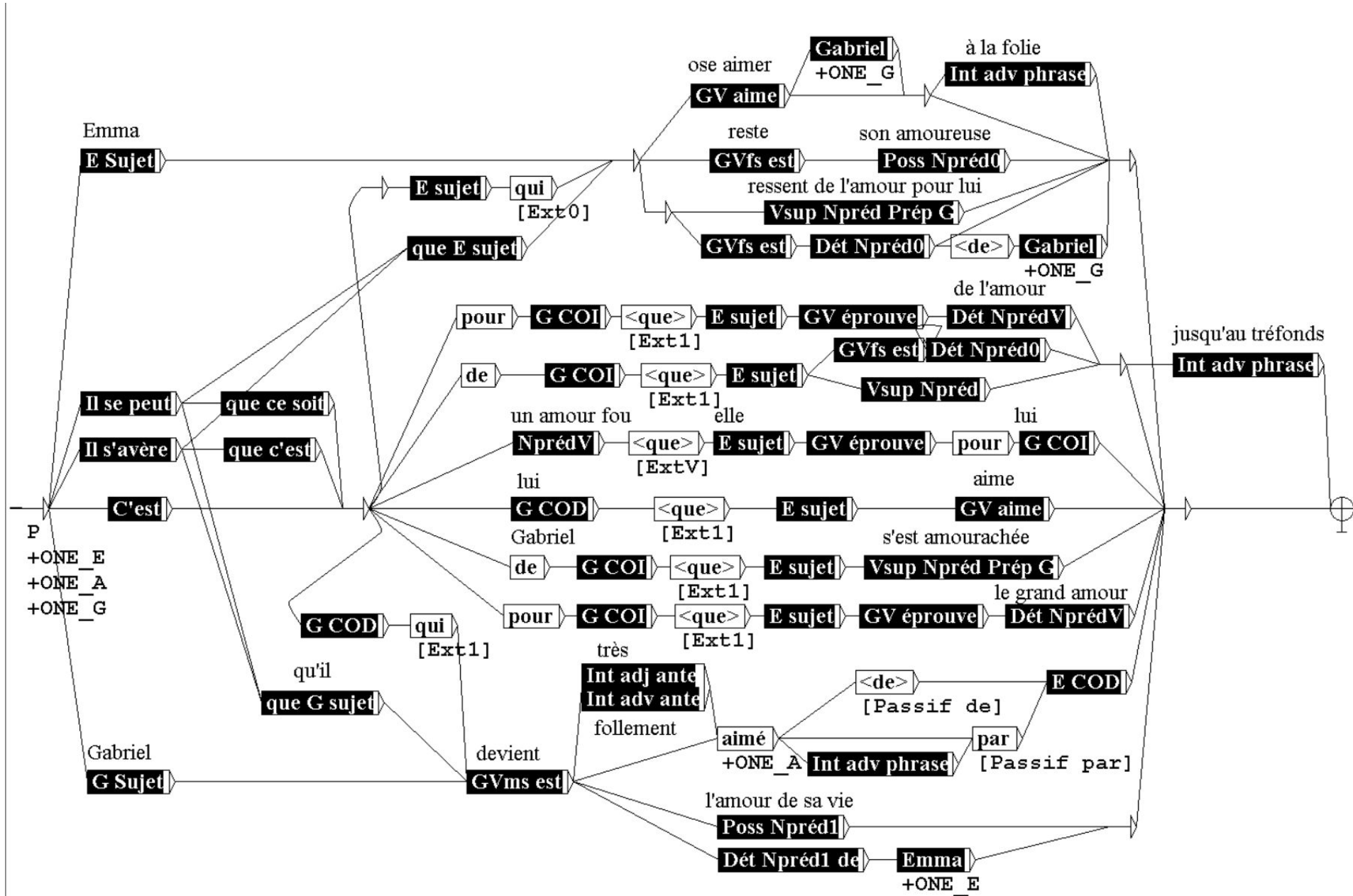
Automatic Generation in Portuguese (Barreiro et alii 2021)

eSPERTo - System for Paraphrasing in Editing and ReviSion of Text

Parameters

Demo mode ☐
Interface idiom [English ⌄]
Resources idiom [Portuguese ⌄]
Dictionary [PT-Dict_NEW ⌄]
Sample text [SAN ⌄]
Paraphrasing [Check all] [Uncheck all]
☐ Active > Passive
☐ Passive > Active
☐ Simple adverb > Compound
☐ Compound adverb > Simple
☐ Nominal/adjectival predicate > Verb
☐ Nominal/adjectival predicate >
Nominal/adjectival predicate
☐ Verb > Nominal/adjectival predicate
☐ Relative construct > Adjective
☐ Possessive > Relative construct
☐ Synonyms
☑ Human intransitive adjective
☑ Predicate nouns with Vsup fazer
☑ Predicate nouns with Vsup ser de
☐ PE > PB
☐ PB > PE
☐ SAL
☐ Informal > Formal
Debug ☐

[Process results]

Input file or text (click to show/hide)

Choose file: [Browse file]
Insert text in the text box

Recentemente, a professora iraquiana foi de uma grande ousadia quando fez o protesto à porta da universidade.

| houve na professora iraquiana |
| teve |
| Suggest your own paraphrase › |

[Process results]

Results (click to show/hide)

Recentemente, [a professora [**iraquiana**][foi de]]uma grande ousadia quando [Save paraphrased text]
[fez o protesto] à porta da uni

| protestou |
| Suggest your own paraphrase › |

| houve na professora iraquiana |
| que é iraquiana |
| que é do Iraque |
| de origem iraquiana |
| de naturalidade iraquiana |
| de nacionalidade iraquiana |
| iraquiana |
| do Iraque |
| Suggest your own paraphrase › |

# *Friend Of A Friend* (FOAF) Predicates

```
<http://example.org/Mark_Twain>
    <http://example.org/author>
<http://example.org/Huckleberry_Fin>.
```

- Classes of entities: *Agent, Document, Group, Image, Organization, Person, Project...*
- Set of properties: *account, age, based near, birthday, currentProject, familyName, gender, givenName, interest, knows, name, title...*

The generator

- Parses the RDF statement
  - entity, property/predicate, entity
  - Turtle notation

- Generates the corresponding
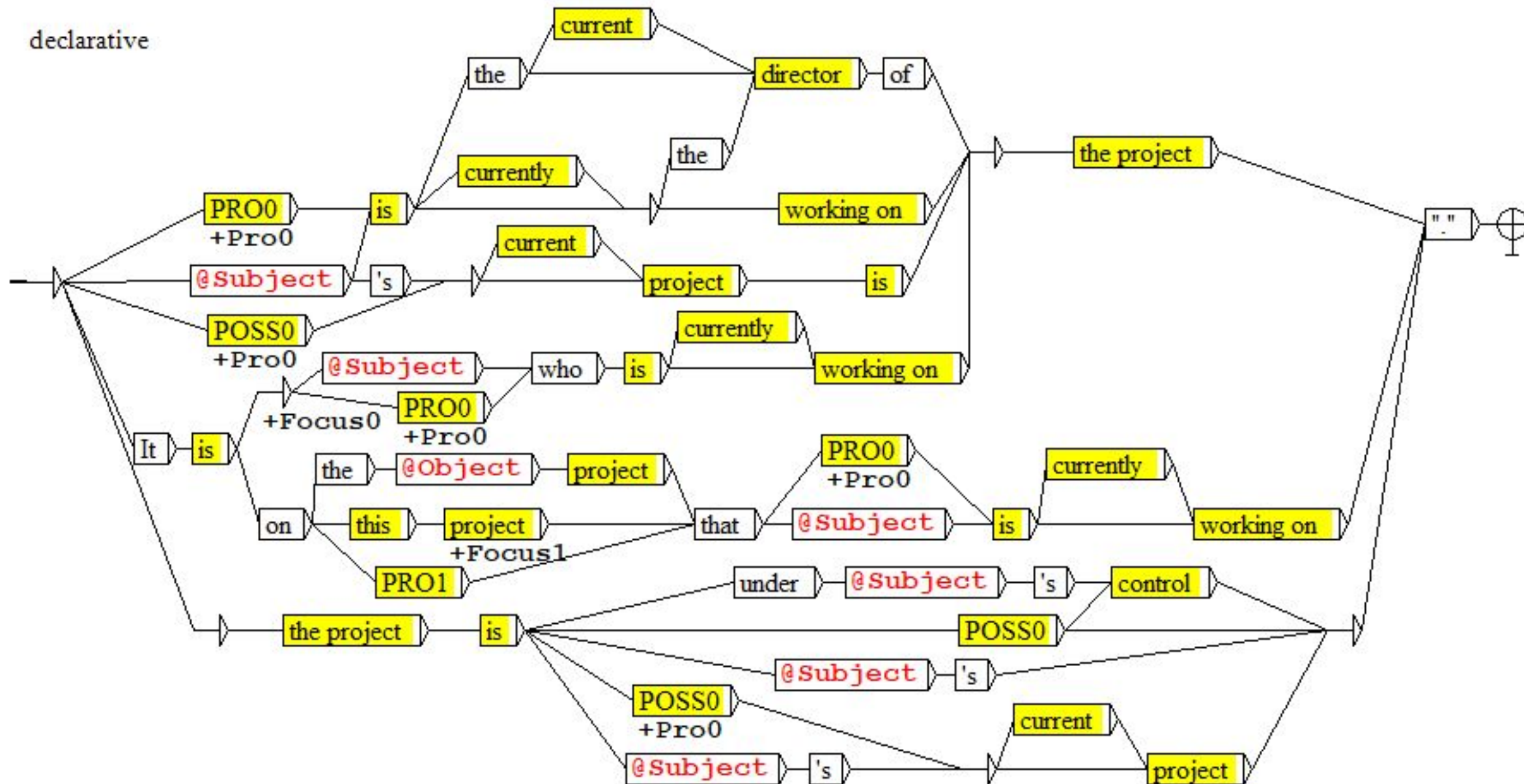 - declarative sentence
  - nominal phrase
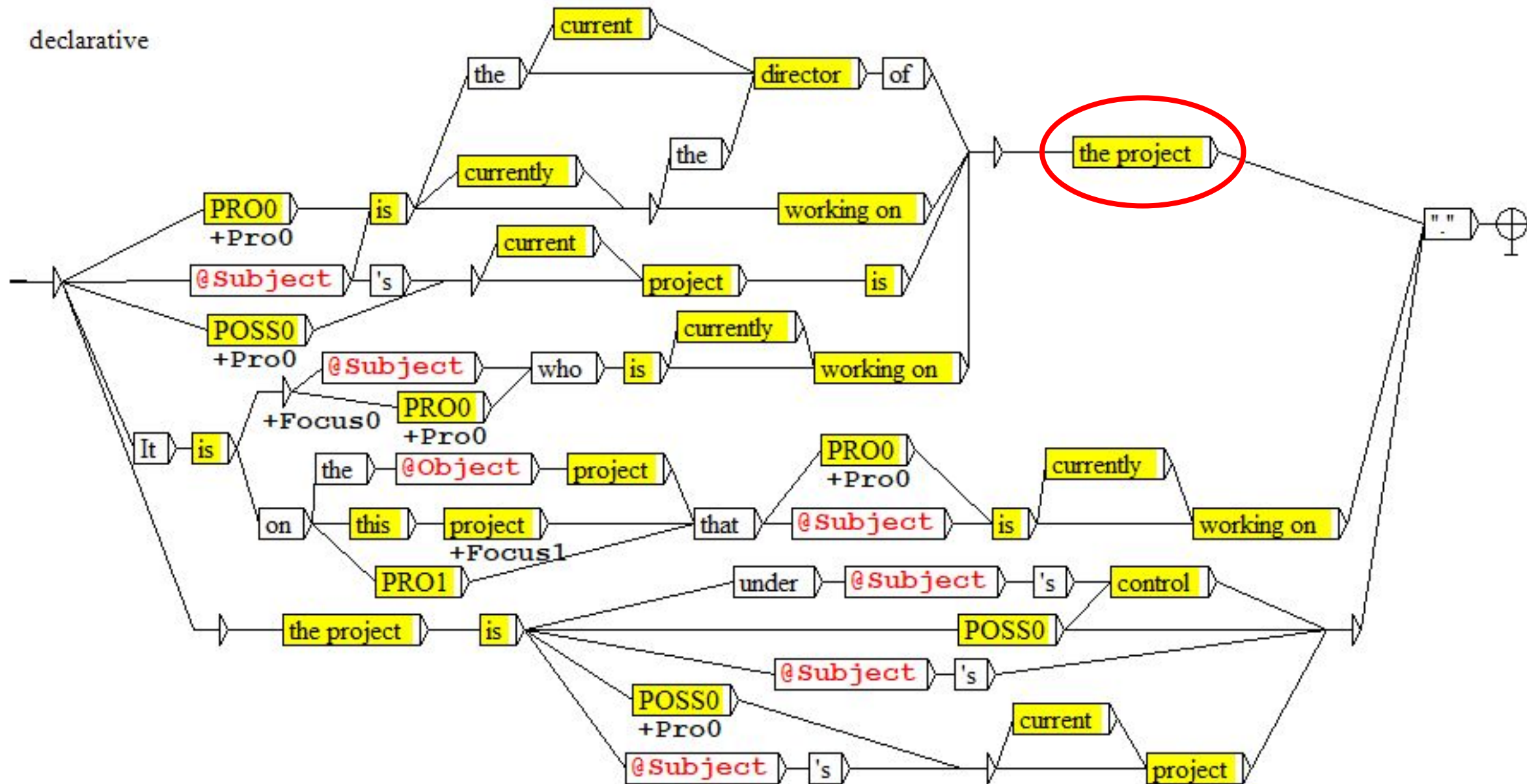 - question
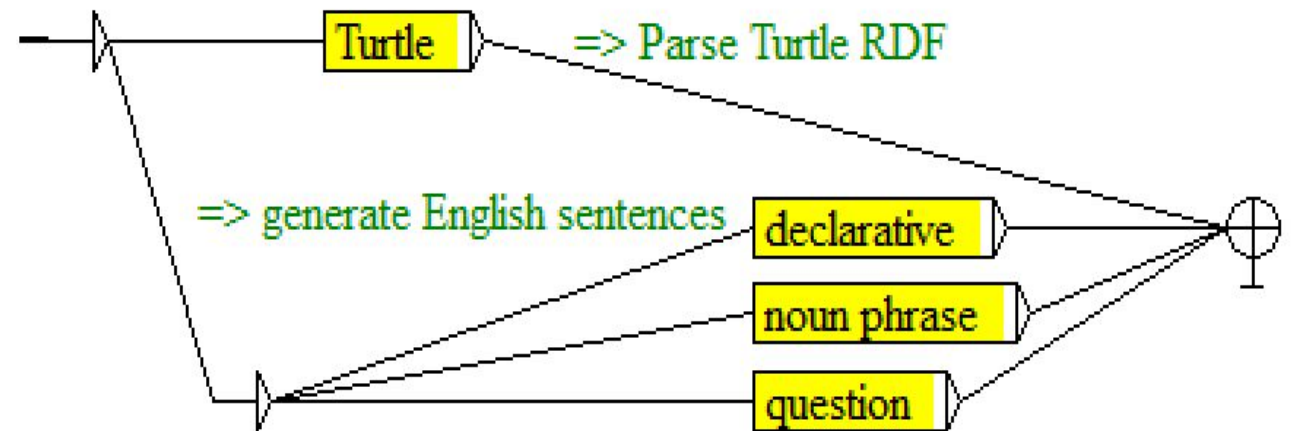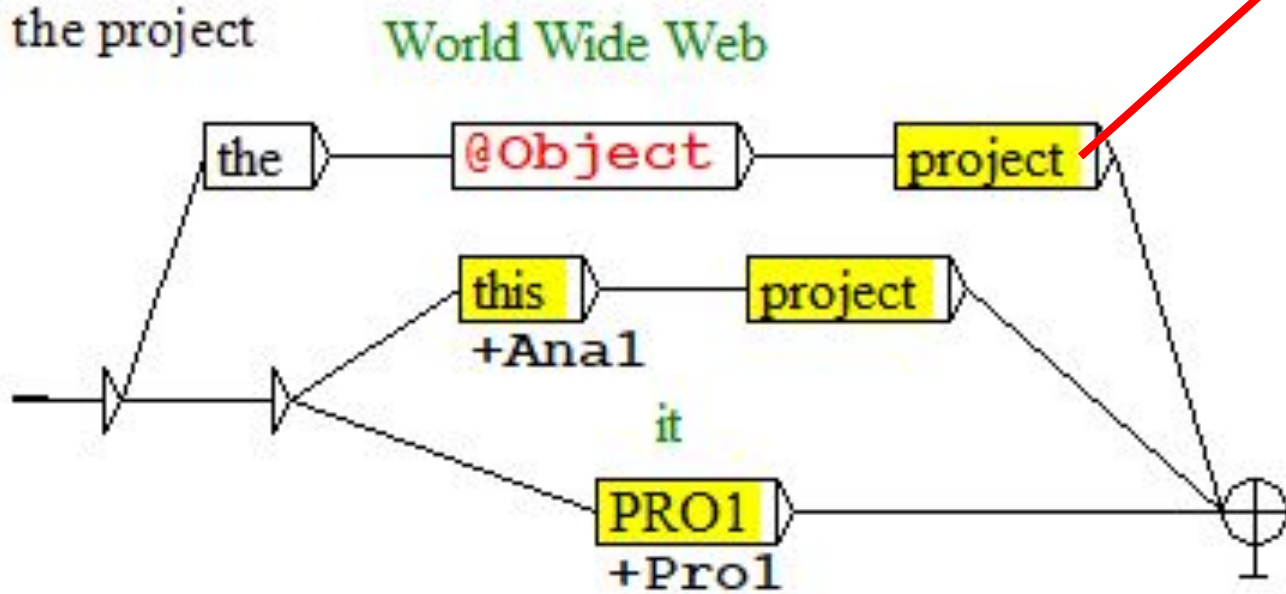
Parsing the FOAF statement (Turtle notation)
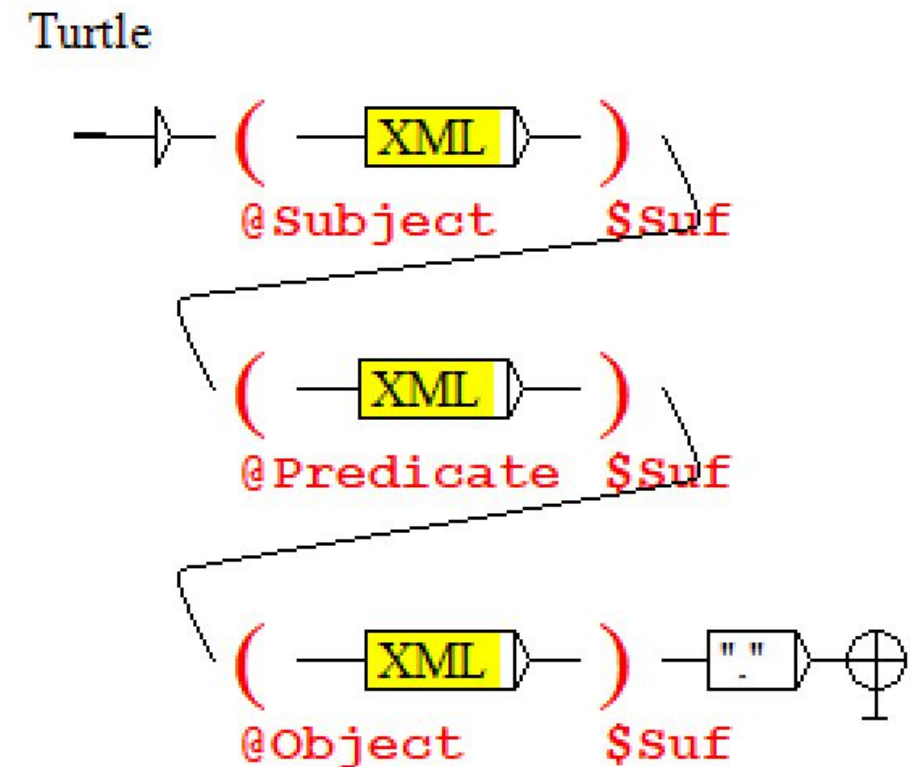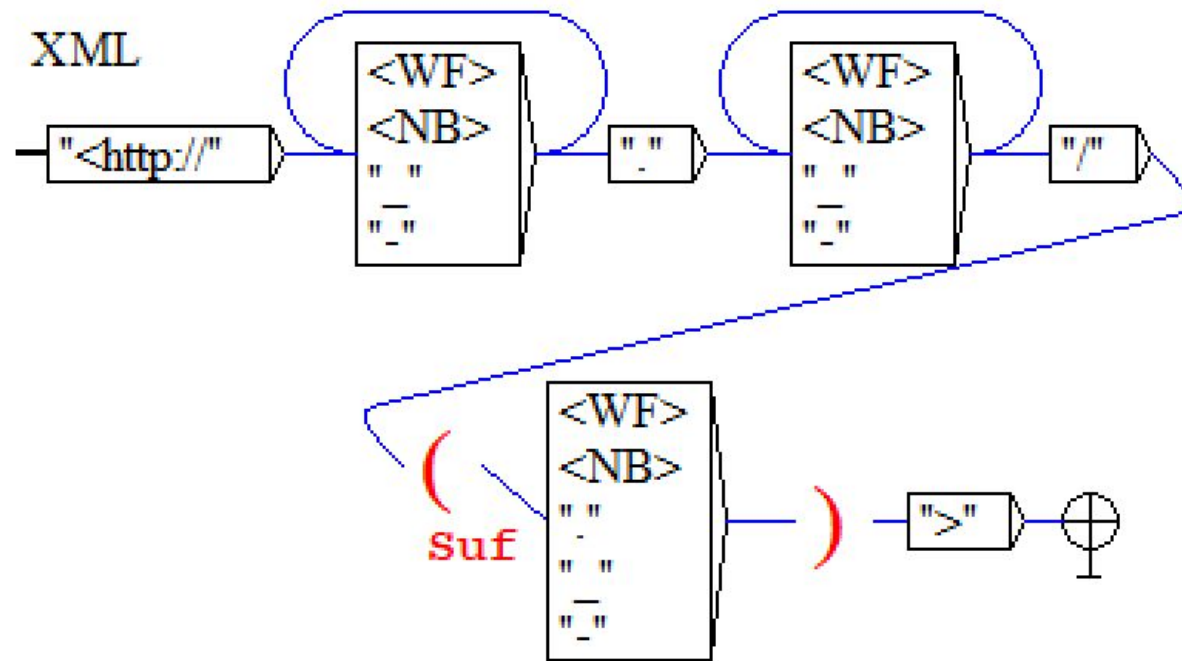
Declarative Sentences

Declarative Sentences

the project

project = *activity | affair | adventure | assignment | business | creation | enterprise | job | project | scheme | task | venture ;*

Constraints control Sentence Generation

No negative Sentence: -Neg

No pronoun for Subject: -Pro0

No Pronoun for Object: -Pro1
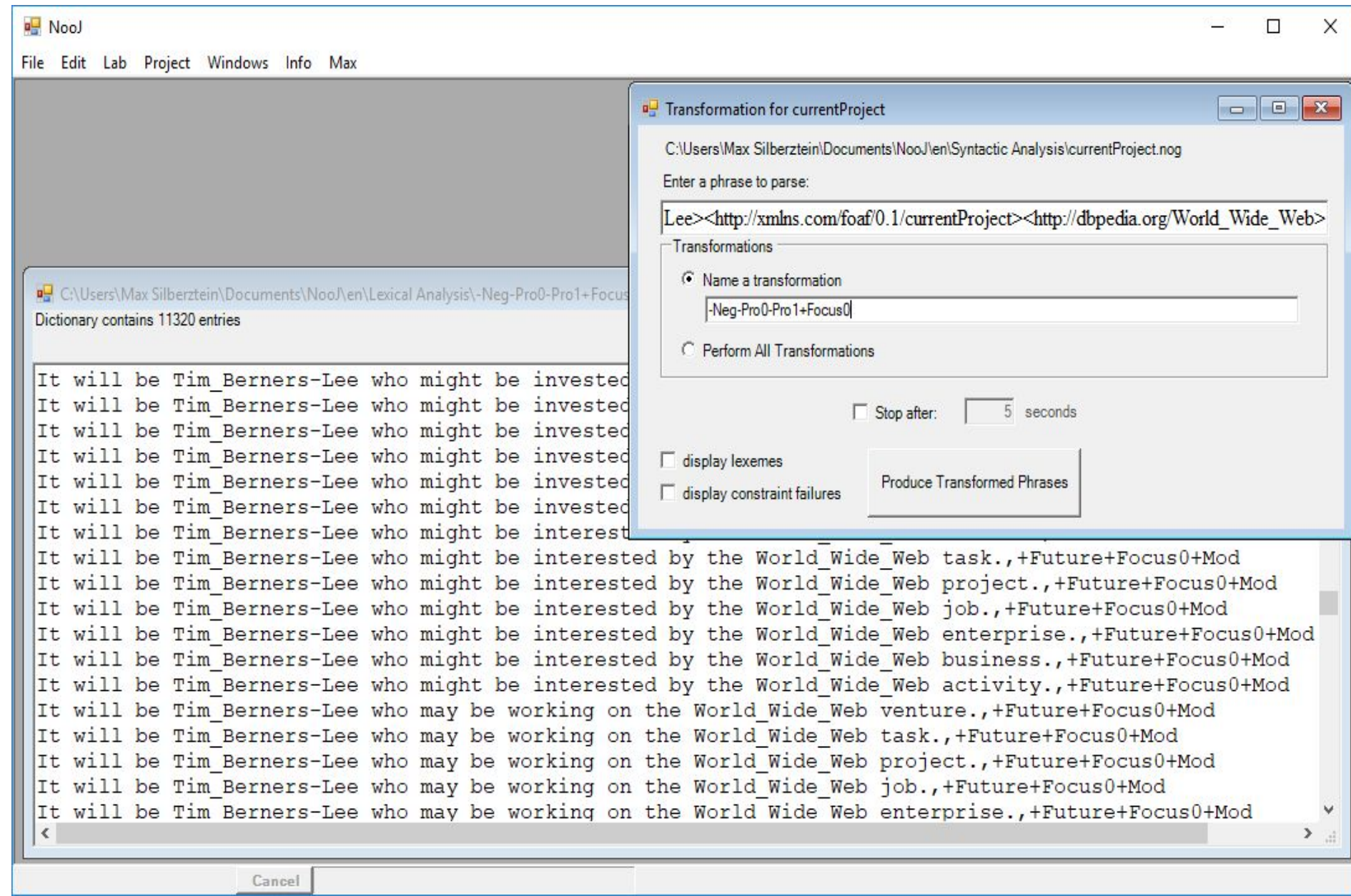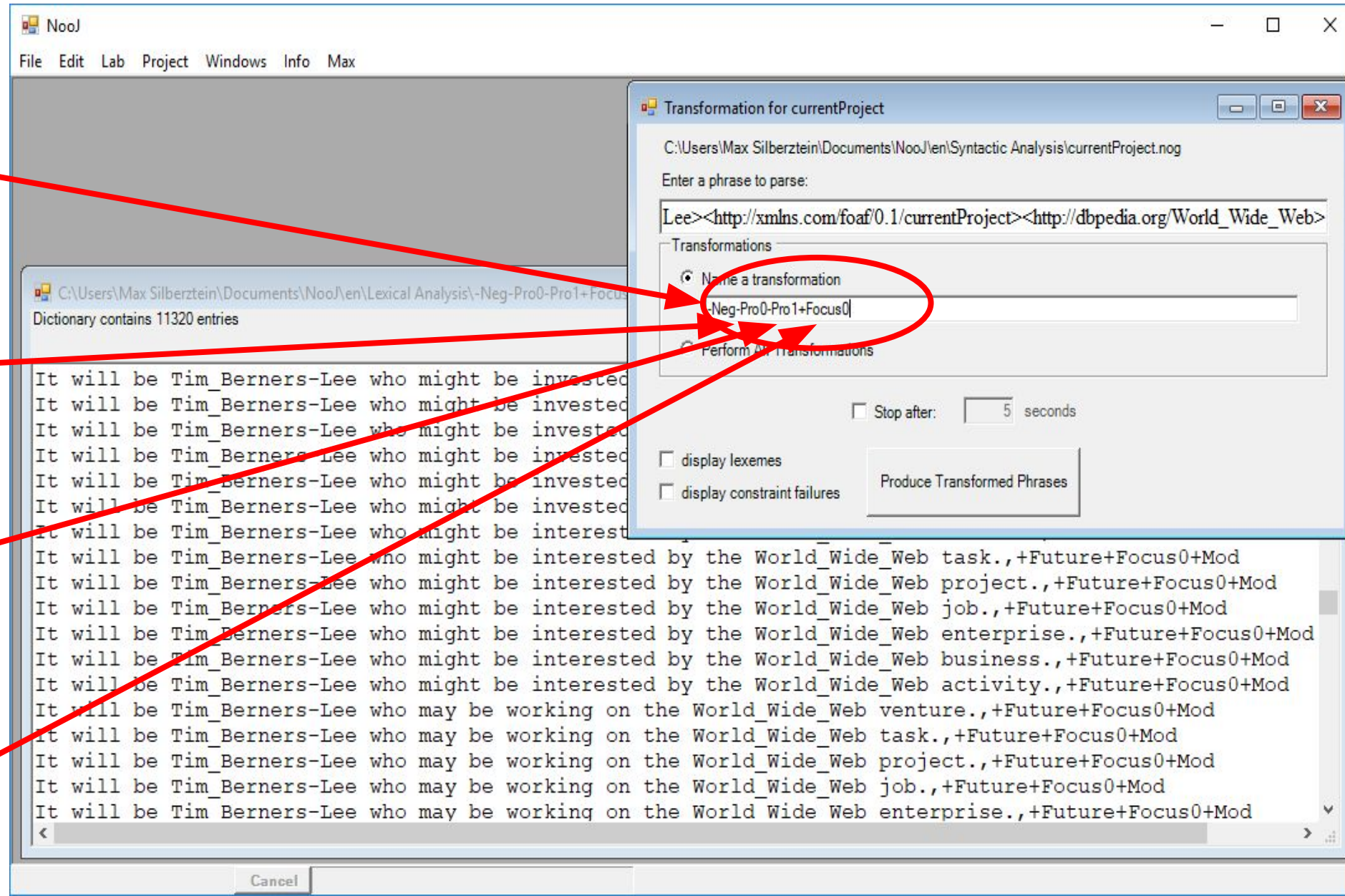
Put focus on Subject: +Focus0

Constraints control Sentence Generation

No negative Sentence: **-Neg**

No pronoun for Subject: **-Pro0**

No Pronoun for Object: **-Pro1**

Put focus on Subject: **+Focus0**

Problems and limitations

- Person's name, first name, last name, family name
- Project's name, accronym, variants:

Tim_Berners-Lee is currently working on the World_Wide_Web project.

<foaf:name xml:lang="en">**Tim Berners-Lee**</foaf:name>

<foaf:acronym xml:lang="en">**WWW**</foaf:acronym>

- Person's gender: NooJ needs to get an additional constraint: **+Mas** or **+Fem**

<foaf:gender xml:lang="en">**Male**</foaf:gender>

What exactly is a *project*?

Tim Berners-Lee is currently working on the World Wide Web (**project** | enterprise | program | ~~activity~~ | ~~affair~~ | ~~assignment~~ | ~~business~~ | creation | design | ~~job~~ | ~~management~~ | ~~scheme~~ | ~~task~~ | ~~venture~~)

Steve Jobs is currently working on the iPhone (adventure | ~~affair~~ | business | creation | **design** | project | ~~scheme~~ | ~~task~~ | venture)

Larry Page is currently working on the Alphabet Inc. Company (adventure | affair | business | **creation** | scheme | task | venture)

Jürgen E. Schrempp is currently working on the Mercedes-Chrysler (adventure | business | creation | task | **merger** | scheme | venture)

What does the *person* do exactly?

- Steve Jobs is the *designer*, or the *mastermind*, or the *leader* of the iPhone project

- Larry Page is the *founder*, or the *originator*, or the *father* of the Alphabet Inc. Company

- *Jürgen E. Schrempp* is the *artisan*, or the *architect*, or the *facilitator* of the Mercedes-Chrysler merger

Perspectives

- Can already generate (in a controlled way) over 50,000 sentences for the **currentProject** FOAF predicate

- One can easily add more sentences, e.g.:

Tim Berners-Lee has the WWW as his current project
One project that Steve Jobs is invested in right now is the iPhone
The Chrysler-Daimler merger takes Jürgen E. Schrempp's time now
The Alphabet Inc. Company has Larry Page's current attention

- One can easily add questions, e.g.:

Who is currently involved in this project? What is she involved in? When has he been involved in that project? How much is he involved in that project? Why is she involved in that project? Where does he work for this project? Will she continue to work on this project? Has he been working on that project? Does she work on that project? ...

(**Over 3 million questions** for sentence: *Joe loves Lea*!)

Conclusions

- It is possible to build a linguistic system that produces a large number of paraphrases from a given sentence in English, French, Italian and Portugal

- It is also possible to build a linguistic system that generates English sentences from semantic predicates (e.g. RDF statements)

- The set of potential sentences is huge: one controls it is via operators, such as +Pro1, +Focus0 or +Nominalization

- FOAF Entities such as **Person** or **currentProject** are not precise enough for the linguistic module to produce only correct sentences (e.g. boss? / designer? / director?)