



# 15. Unrestricted Grammars

This series of tutorials is based upon work from COST Action  
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# Unrestricted Grammars

- Unrestricted grammars are equivalent to Type 0 Generative Grammars in Chomsky-Schützenberger's hierarchy
- Unrestricted grammars can be more powerful than regular, context-free and context-sensitive grammars.
- They can recognize any recursively enumerated language (therefore, any possible natural language) and can be processed by Turing machines.
- Head-driven Phrase Structure Grammars (HPSG) are equivalent to unrestricted grammars.

# Unrestricted Grammars in NooJ

- Unrestricted grammars are similar to context-sensitive grammars; they also contain variables and constraints.
- They can be used to replace matching text (recognized by the grammar input) with the corresponding grammar output
- The grammar output can be anything, *e.g.*, transformation of the text, paraphrases, semantic representations, etc.
- If associated with multilingual dictionaries, unrestricted grammars can produce translations

# Unrestricted Grammars in NooJ

- Unrestricted grammars contain variables that can be copied to the output, e.g.:

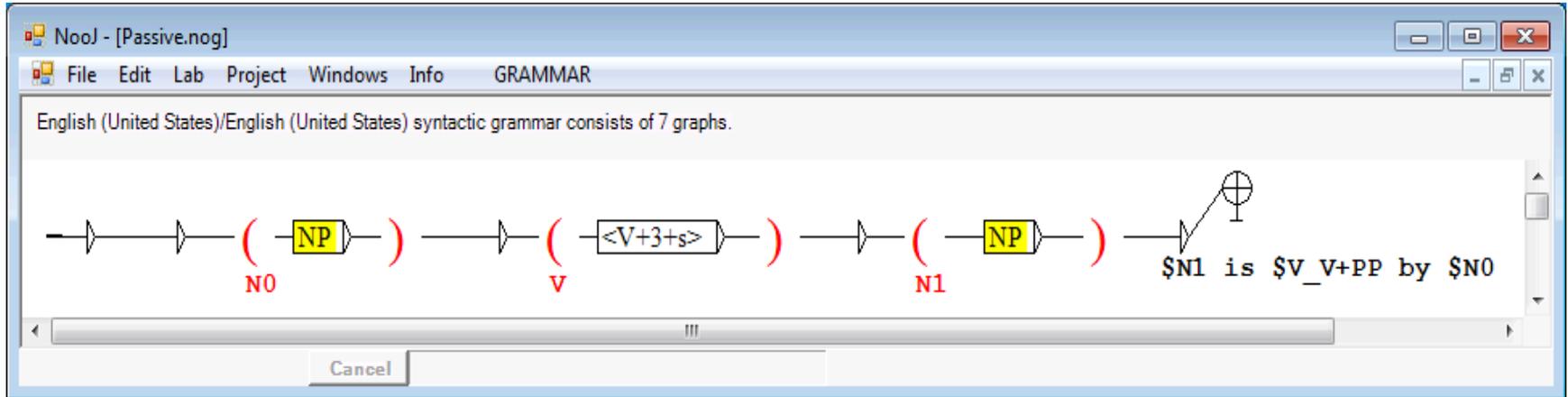
(S1 Joe arrived). (S2 Eva left)/S1 and S2  
*Joe arrived. Eva left. → Joe arrived and Eva left*

- Morphological operators can be applied to variables, e.g.:

He (V eats)/They want to \$V\_  
*He eats → They want to eat*

# Transformations

## A simple transformation



*Joe sees Mary* → *Mary is seen by Joe*

- In the dictionary, the entry **see**, **V+FLX=SEE** represents the forms *see* (+STD), *sees* (+PR+3+s), *saw* (+PRET), *seen* (+PP), *seing* (+G)
- If **\$V** = “sees”, then **\$V\_** = “see” (the lexical entry),
- then **\$V\_V** represents all the verbal forms associated with see, i.e., “see”, “sees”, “saw”, “seen” and “seing”
- then **\$V\_V+PP** = “seen”



# Unrestricted Grammars

eSPERTo: System for Paraphrasing in Editing and Revision of Text

(A. Barreiro, C. Mota, INESC-ID)

## Parameters

Demo mode

Interface idiom English ▾

Resources idiom Portuguese ▾

Dictionary PT-Dict\_NEW ▾

Sample text SAN ▾

Paraphrasing

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

## Input file or text (click to show/hide)

Choose file:

Insert text in the text box

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

Inquestionavelmente, a mulher é parecida com o irmão.

## Results (click to show/hide)

Recentemente, [ a jornalista [ iraquiana ] ] foi de [ ] uma grande ousadia quando [ fez o protesto ] à porta da universidade. **[ a mulher é parecida com o irmão ]**.

houve na jornalista iraquiana  
que é iraquiano  
que é do Iraque  
de origem iraquiana  
de naturalidade iraquiana  
de nacionalidade iraquiana  
iraquiano  
do Iraque

o irmão é parecido com a mulher  
a mulher e o irmão são parecidos

# Transformations

How many simple transformations are there?

[Pron-0] John ate an apple = He ate an apple

[Pron-1] John ate an apple = John ate it

[Pron-2] John gave an apple to Marie = John gave her an apple

[Passive] John ate an apple = an apple was eaten by John

[Negation] John ate an apple = John did not eat an apple

[Cleft-0] John ate an apple = it is John who ate an apple

[Cleft-1] John ate an apple = it is an apple that John ate

[Question-0] John ate an apple = Who ate an apple?

[Question-1] John ate an apple = What did John eat?

[Question-V] John ate an apple = What did John do?

[Nom-0] John loves apples = John is an apple lover

[Nom-V] John gave the card to Mary = The card is John's gift to Mary

...

# Transformations

## On grammar per transformation?

The image displays three screenshots of the NooJ software interface, illustrating syntactic grammar transformations. Each screenshot shows a window titled "NooJ - [Transformation.nog]" with a menu bar (File, Edit, Lab, Project, Windows, Info, GRAMMAR) and a text area containing a syntactic graph and its corresponding natural language output.

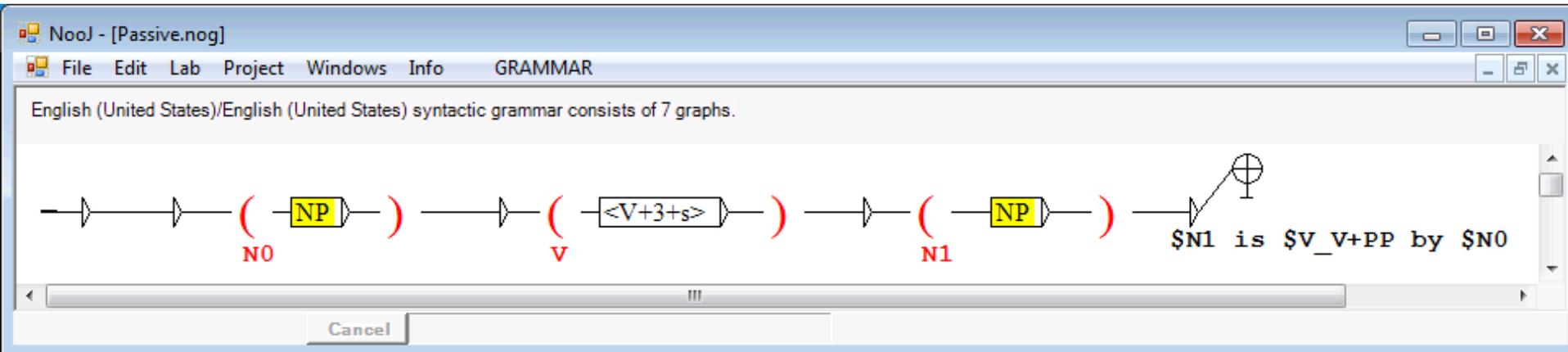
**Top Screenshot: [Passive.nog]**  
The syntactic graph shows a sequence of nodes: a start node, a node for NP (labeled N0), a node for V (labeled V), a node for NP (labeled N1), and a final node. The natural language output is "\$N1 is \$V\_V+PP by \$N0".

**Middle Screenshot: [Negation.nog]**  
The syntactic graph shows a sequence of nodes: a start node, a node for NP (labeled N0), a node for V (labeled V), a node for NP (labeled N1), and a final node. The natural language output is "\$N0 does not \$V\_ \$N1". A "Cancel" button is visible at the bottom.

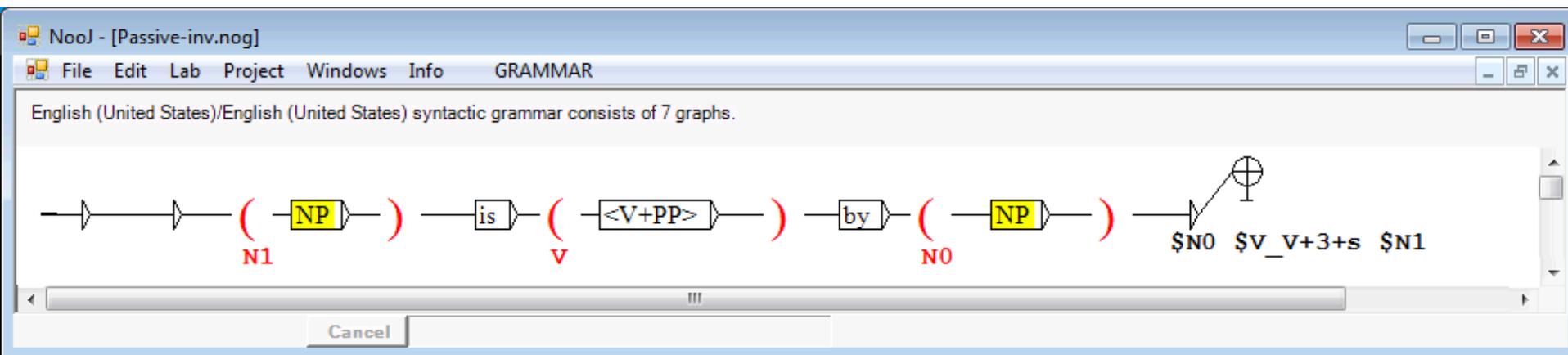
**Bottom Screenshot: [Pron-0.nog]**  
The syntactic graph shows a sequence of nodes: a start node, a node for NP (labeled N0), a node for V (labeled V), a node for NP (labeled N1), and a final node. The natural language output is "\$V \$N1". The V node is expanded to show two possible transformations: "<\$N0\$Gender=masc>He" and "<\$N0\$Gender=fem>She". A "Cancel" button is visible at the bottom.

# Transformations

## Or two?



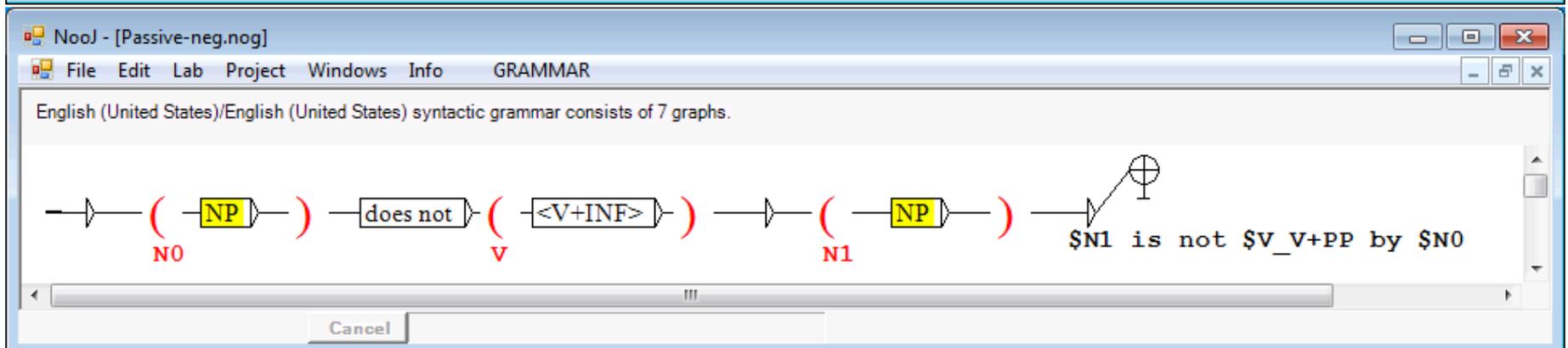
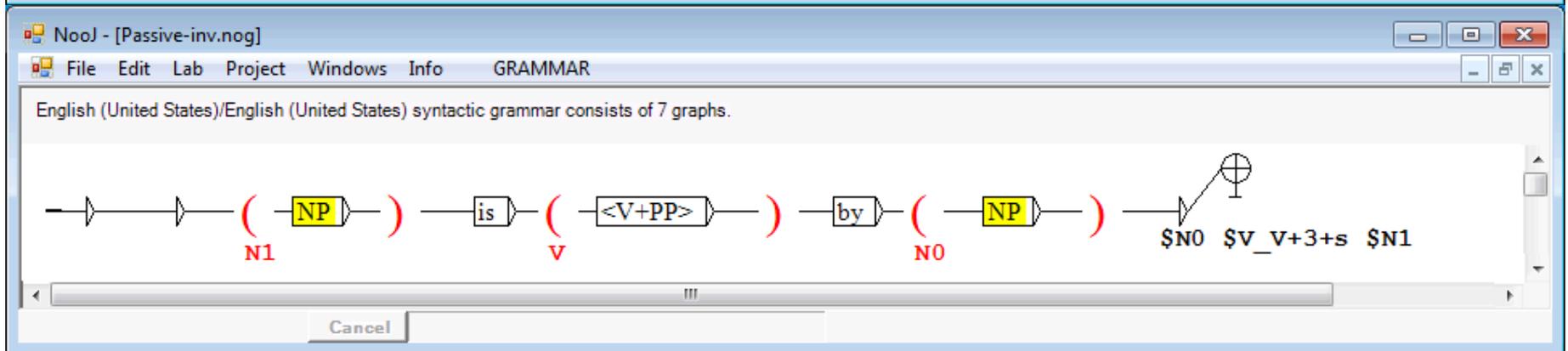
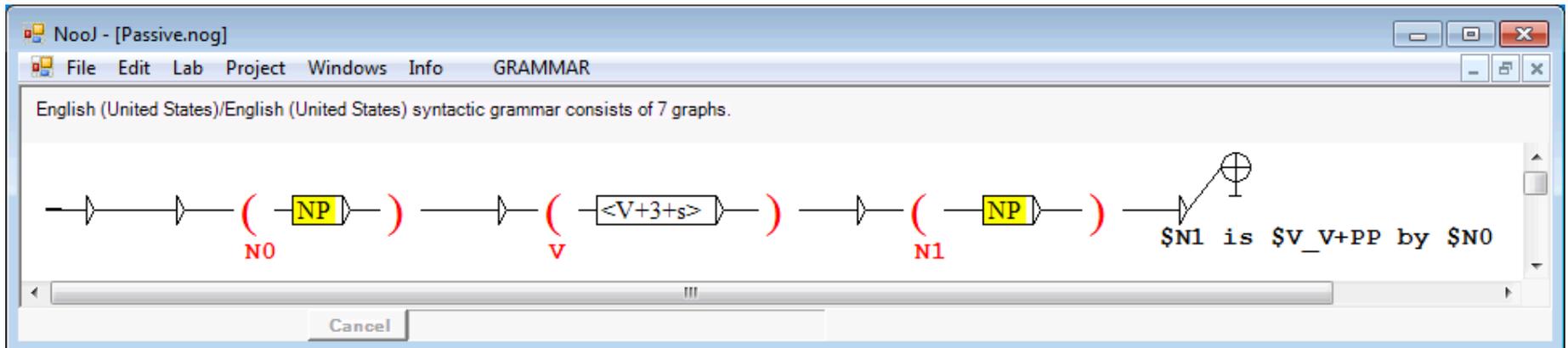
Active to Passive



Passive to Active

# Transformations

Actually: many more!



# Transformations

## How many simple transformations are there?

[Pron-0] John ate an apple = He ate an apple → [Passive1] = An apple was eaten by him

[Pron-2] John gave an apple to Marie = John gave her an apple → [Passive2] = She was given an apple by John

[Passive] John ate an apple = an apple was eaten by John → [Passive3]

[Negation] John ate an apple = John did not eat an apple → [Passive4] = An apple was not eaten by John

[Cleft-0] John ate an apple = it is John who ate an apple → [Passive5]

[Cleft-1] John ate an apple = it is an apple that John ate → [Passive6] = It is an apple that was eaten by John

[Question-0] John ate an apple = Who ate an apple? → [Passive7] = By Whom an apple was eaten?

[Question-1] John ate an apple = What did John eat? → [Passive8] = What was eaten by John?

[Question-V] John ate an apple = What did John do? → [Passive9] = What was done by John?

[Nom-0] John loves apples = John is an apple lover → [Passive10]

[Nom-V] John gave the card to Mary = The card is John's gift to Mary → [Passive11]

...

Every single transformed sentence may itself be transformed with a [Passive] transformation...

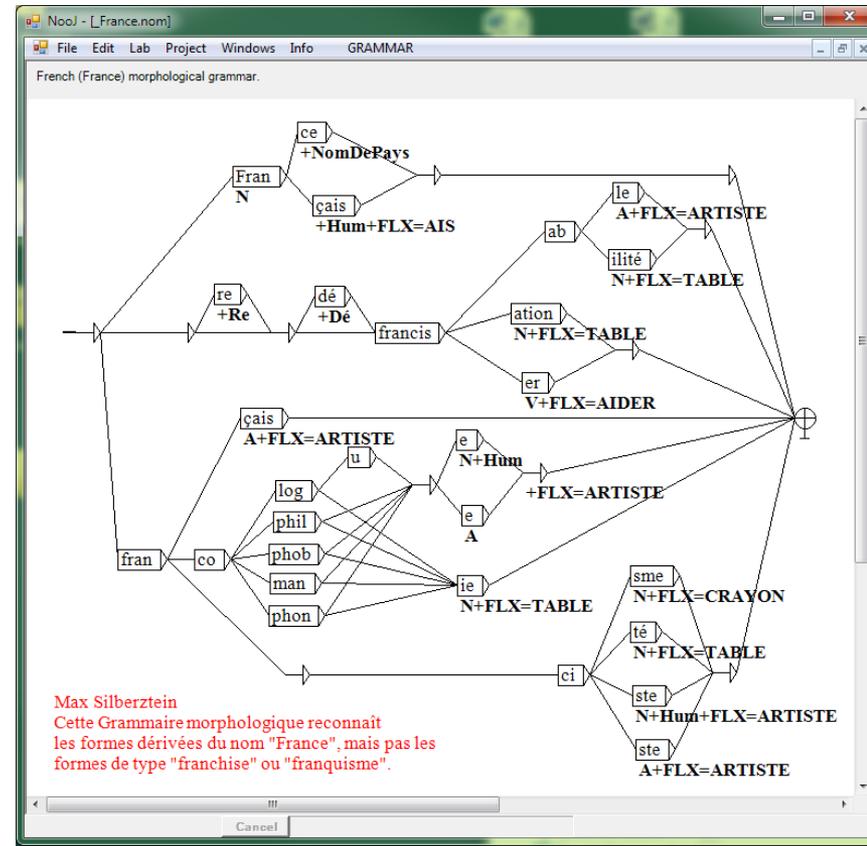
If there are 1,000 elementary transformations, then there are  $1,000 \times 1,000$  combinations of 2 transformations,  $1,000^3$  combinations of 3 transformations, and  $1,000^7$  combinations like:

*It is not like Joe wanted to stop being her lover*

[Cleft-0][Pron-1][Preterit][Negation][Aspect][Modal][Nominalization]

# NooJ solution to transformations: Combine Parsing and Generation

- All NooJ linguistic resources are neutral, i.e., they can be used to parse texts, or to generate texts.
- For example, morphological grammar **France** recognizes all the forms derived and inflected from *France*:
- This grammar can also be used to produce all the forms described in the grammar via NooJ menu item:  
GRAMMAR > Generate Language



# NooJ solution to transformations: Combine Parsing and Generation

- This grammar can also be used to produce all the forms described in the grammar via NooJ menu item:

GRAMMAR > Generate Language

The screenshot displays the NooJ software interface. The main window, titled "\_France.nom", shows a morphological grammar for French. The grammar is represented as a network of nodes and edges. Nodes include "fran", "ce", "çais", "re", "dé", "francis", "ab", "le", "ilité", "ation", "e", "u", "log", "phil", "phob", "man", "phon", "ie". Edges represent morphological transformations, such as "N", "A+FLX=ARTISTE", "N+FLX=TABLE", "A", "N+FL".

An "Explore graph Main in grammar..." dialog box is open, showing options to "Explore Embedded Graphs" and "Stop after:" (5 seconds, 100 sequences). An "Explore all paths" button is visible.

An "Untitled [Modified]" window shows the output of the "Generate Language" operation, listing 38 entries in a dictionary format:

```
# 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
```

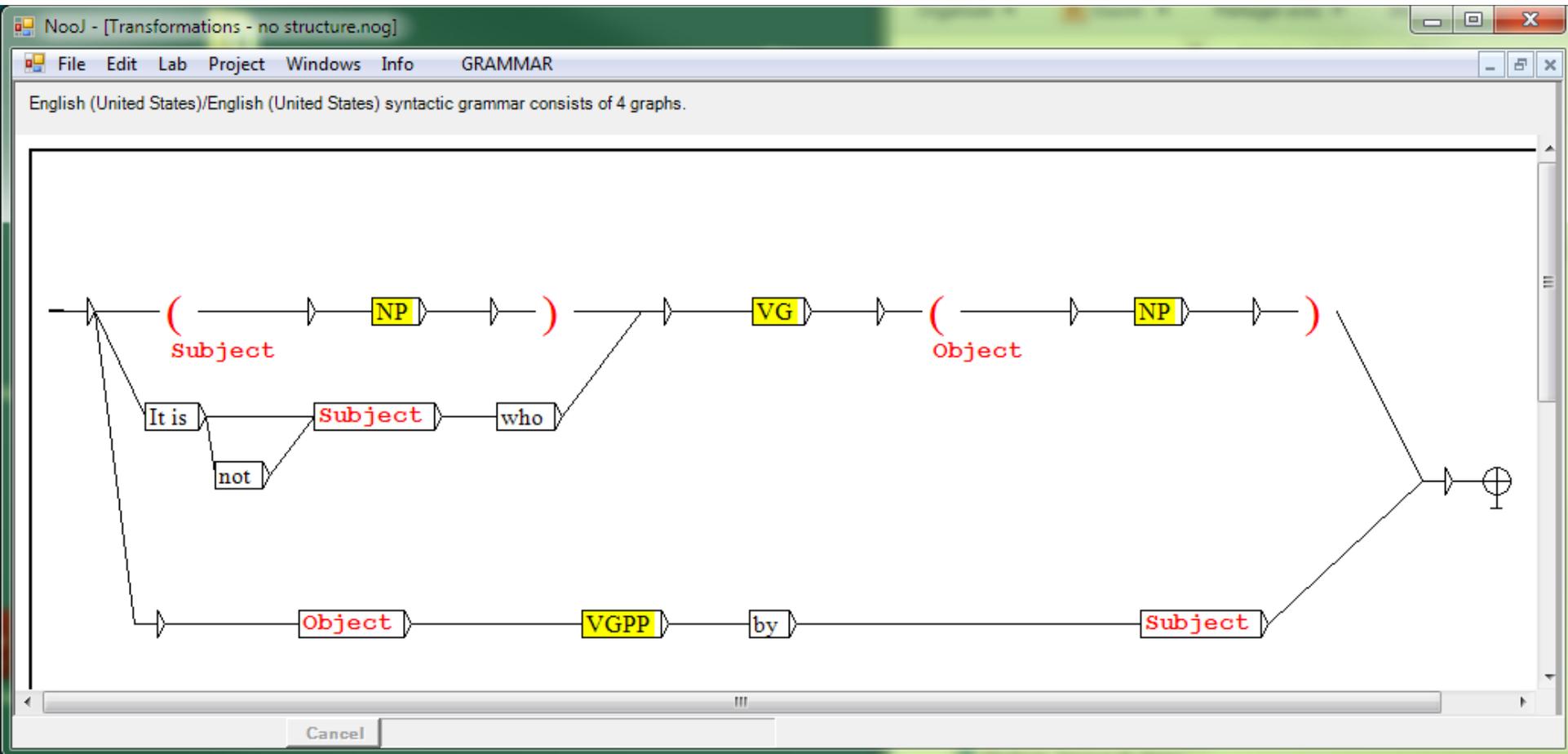
Max Silberztein  
Cette Grammaire morphologique reconnaît  
les formes dérivées du nom "France", mais pas les  
formes de type "franchise" ou "franquisme".

# NooJ solution to transformations:

## Combine Parsing and Generation

- This grammar can also be used to produce all the forms described in the grammar via NooJ menu item:

GRAMMAR > Generate Language



# NooJ solution to transformations:

## Combine Parsing and Generation

### GRAMMAR > Generate Language

The screenshot displays the NooJ software interface. The main window is titled "Transformations - no structure.nog" and shows a graph with nodes "It is", "Subject", "who", "Object", and "VGPP". A dialog box "Explore graph Main in grammar..." is open, with "Explore Embedded Graphs" checked and "Explore all paths" button visible. The right pane, titled "Untitled [Modified]", shows a list of 58 entries generated from the grammar, including sentences like "\$Object is <V+PP> by \$Subject,NOINFO" and "<DET> <N> <V+3+s> <DET> <N>,NOINFO".

English (United States)/English (United States) syntactic grammar consists of 4 graphs.

Explore graph Main in grammar...

Explore Embedded Graphs

Stop after:

5 seconds

100 sequences

Explore all paths

It is

Subject

who

not

Object

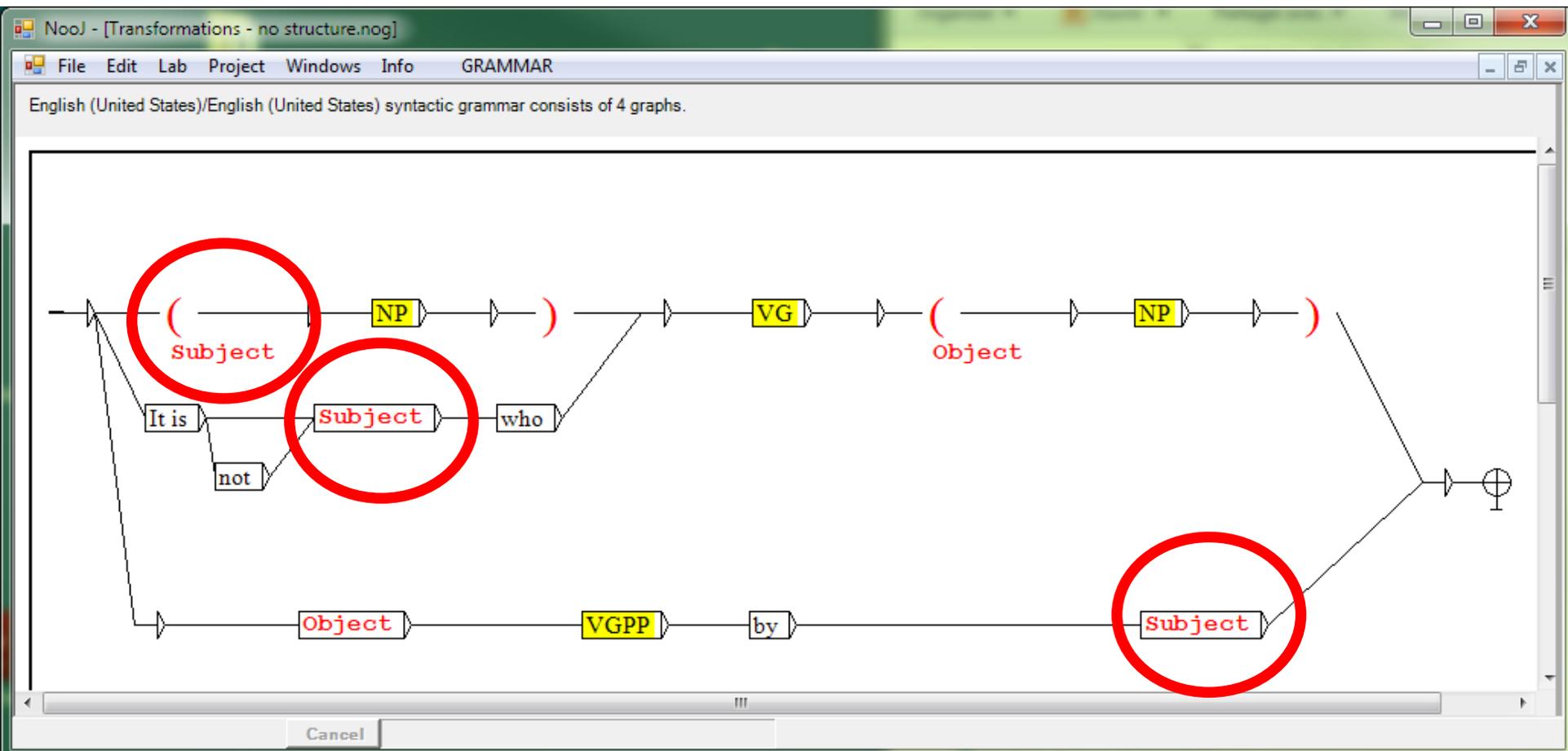
VGPP

Dictionary contains 58 entries

```
#
$Object is <V+PP> by $Subject,NOINFO
$Object is not <V+PP> by $Subject,NOINFO
It is not $Subject who <V+3+s> <DET> <N>,NOINFO
It is not $Subject who <V+3+s> <N+PR>,NOINFO
It is not $Subject who has <V+PP> <DET> <N>,NOINFO
It is not $Subject who has <V+PP> <N+PR>,NOINFO
It is not $Subject who has not <V+PP> <DET> <N>,NOINFO
It is not $Subject who has not <V+PP> <N+PR>,NOINFO
It is not $Subject who is <V+G> <DET> <N>,NOINFO
It is not $Subject who is <V+G> <N+PR>,NOINFO
It is not $Subject who is not <V+G> <DET> <N>,NOINFO
It is not $Subject who is not <V+G> <N+PR>,NOINFO
It is not $Subject who does <V+INF> <DET> <N>,NOINFO
It is not $Subject who does <V+INF> <N+PR>,NOINFO
It is not $Subject who does not <V+INF> <DET> <N>,NOINFO
It is not $Subject who does not <V+INF> <N+PR>,NOINFO
It is $Subject who <V+3+s> <DET> <N>,NOINFO
It is $Subject who <V+3+s> <N+PR>,NOINFO
It is $Subject who has <V+PP> <DET> <N>,NOINFO
It is $Subject who has <V+PP> <N+PR>,NOINFO
It is $Subject who has not <V+PP> <DET> <N>,NOINFO
It is $Subject who has not <V+PP> <N+PR>,NOINFO
It is $Subject who is <V+G> <DET> <N>,NOINFO
It is $Subject who is <V+G> <N+PR>,NOINFO
It is $Subject who is not <V+G> <DET> <N>,NOINFO
It is $Subject who is not <V+G> <N+PR>,NOINFO
It is $Subject who does <V+INF> <DET> <N>,NOINFO
It is $Subject who does <V+INF> <N+PR>,NOINFO
It is $Subject who does not <V+INF> <DET> <N>,NOINFO
It is $Subject who does not <V+INF> <N+PR>,NOINFO
<DET> <N> <V+3+s> <DET> <N>,NOINFO
<DET> <N> <V+3+s> <N+PR>,NOINFO
<DET> <N> has <V+PP> <DET> <N>,NOINFO
<DET> <N> has <V+PP> <N+PR>,NOINFO
<DET> <N> has not <V+PP> <DET> <N>,NOINFO
<DET> <N> has not <V+PP> <N+PR>,NOINFO
```

# NooJ solution to transformations: Combine Parsing and Generation

A variable stores an ALU; all its references are linked



# NooJ solution to transformations: Combine Parsing and Generation

All variables references are linked

- Variables are set during the parsing step
- When parsing the text John loves Mary:
  - variable **\$Subject** is set to “John”
  - variable **\$Verb** is set to “loves”
  - variable **\$Object** is set to “Mary”
- When exploring the graph to produce all the sequences recognized by the grammar, NooJ replaces the variables with their value

# NooJ solution to transformations: Combine Parsing and Generation

The screenshot shows the NooJ software interface. The main window is titled "Transformations - no structure.nog" and displays the text "English (United States)/English (United States) svntactic grammar consists of 4 graphs." A dialog box titled "Transformation for grammar: Transformatio..." is open, showing the input phrase "John loves Mary" and the selected transformation "+Passive-Neg". The dialog also has a "Produce Paraphrases" button. Below the dialog, a red box labeled "Object" and a yellow box labeled "VGPP" are connected by arrows, indicating the flow of data from the transformation process to the generation process. The output window, titled "Untitled [Modified]", displays a list of 26 generated paraphrases, each followed by "NOANALYSIS".

Enter a phrase to parse:  
John loves Mary

Transformations

Name a transformation  
+Passive-Neg

Perform All Transformations

display lexemes

Produce Paraphrases

Object → VGPP

Dictionary contains 26 entries

- It is John who does not love Mary,NOANALYSIS
- It is John who has loved Mary,NOANALYSIS
- It is John who has not loved Mary,NOANALYSIS
- It is John who is loving Mary,NOANALYSIS
- It is John who is not loving Mary,NOANALYSIS
- It is John who loved Mary,NOANALYSIS
- It is John who loves Mary,NOANALYSIS
- It is not John who does love Mary,NOANALYSIS
- It is not John who does not love Mary,NOANALYSIS
- It is not John who has loved Mary,NOANALYSIS
- It is not John who has not loved Mary,NOANALYSIS
- It is not John who is loving Mary,NOANALYSIS
- It is not John who is not loving Mary,NOANALYSIS
- It is not John who loved Mary,NOANALYSIS
- It is not John who loves Mary,NOANALYSIS
- John does love Mary,NOANALYSIS
- John does not love Mary,NOANALYSIS
- John has loved Mary,NOANALYSIS
- John has not loved Mary,NOANALYSIS
- John is loving Mary,NOANALYSIS
- John is not loving Mary,NOANALYSIS
- John loved Mary,NOANALYSIS
- John loves Mary,NOANALYSIS
- Mary is loved by John,NOANALYSIS
- Mary is not loved by John,NOANALYSIS

# NooJ solution to transformations: Combine Parsing and Generation

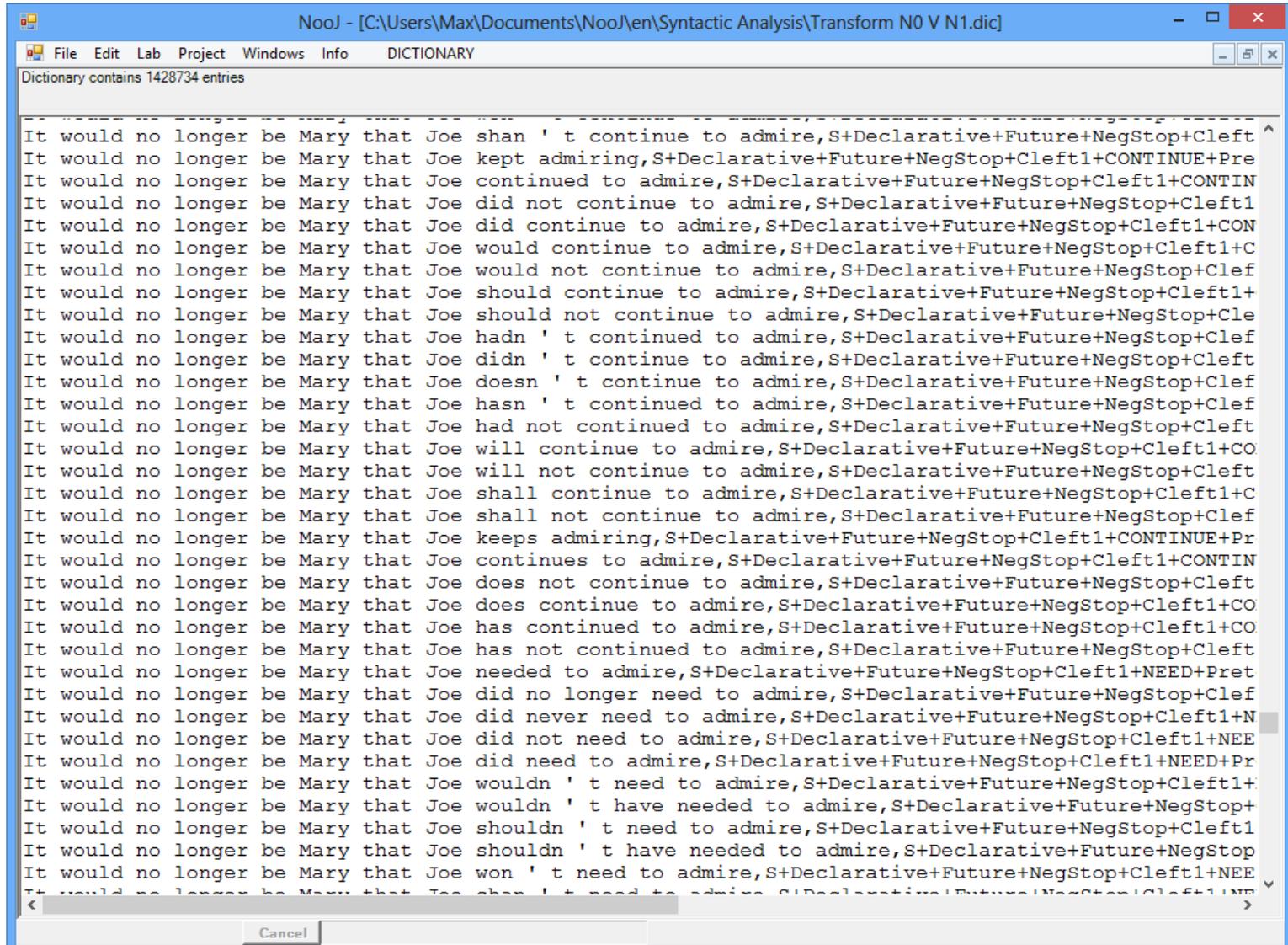
All variables references are linked

- Variables are set during the parsing step
- When parsing the text John loves Mary:
  - variable `$Subject` is set to “John”
  - variable `$Verb` is set to “loves”
  - variable `$Object` is set to “Mary”
- When exploring the graph to produce all the sequences recognized by the grammar, NooJ replaces the variables with their value
- The grammar may produce properties in its outputs, e.g., the name of the transformations: [Passive], [Pron1], [Aspect]...



# NooJ solution to transformations: Combine Parsing and Generation

Produce all the transformed sentences from *Joe loves Lea*



# Nool solution to transformations: In Italian

Produce all the transformed sentences from *Maria osserva om ragazzo*

The screenshot shows the Nool software interface. The main window is titled "Nool" and has a menu bar with "File", "Edit", "Lab", "Project", "Windows", "Info", and "DICTIONARY".

On the left, there is a "Transformation for grammar: Soggetto Verb..." window. It contains the following elements:

- Input field: "Enter a phrase to parse:" with the text "Maria osserva il ragazzo".
- Section: "Transformations" with two radio buttons:
  - Name a transformation: with an input field containing "+Passivo-Neg".
  - Perform All Transformations
- Checkbox:  display lexemes
- Button: "Produce Paraphrases"

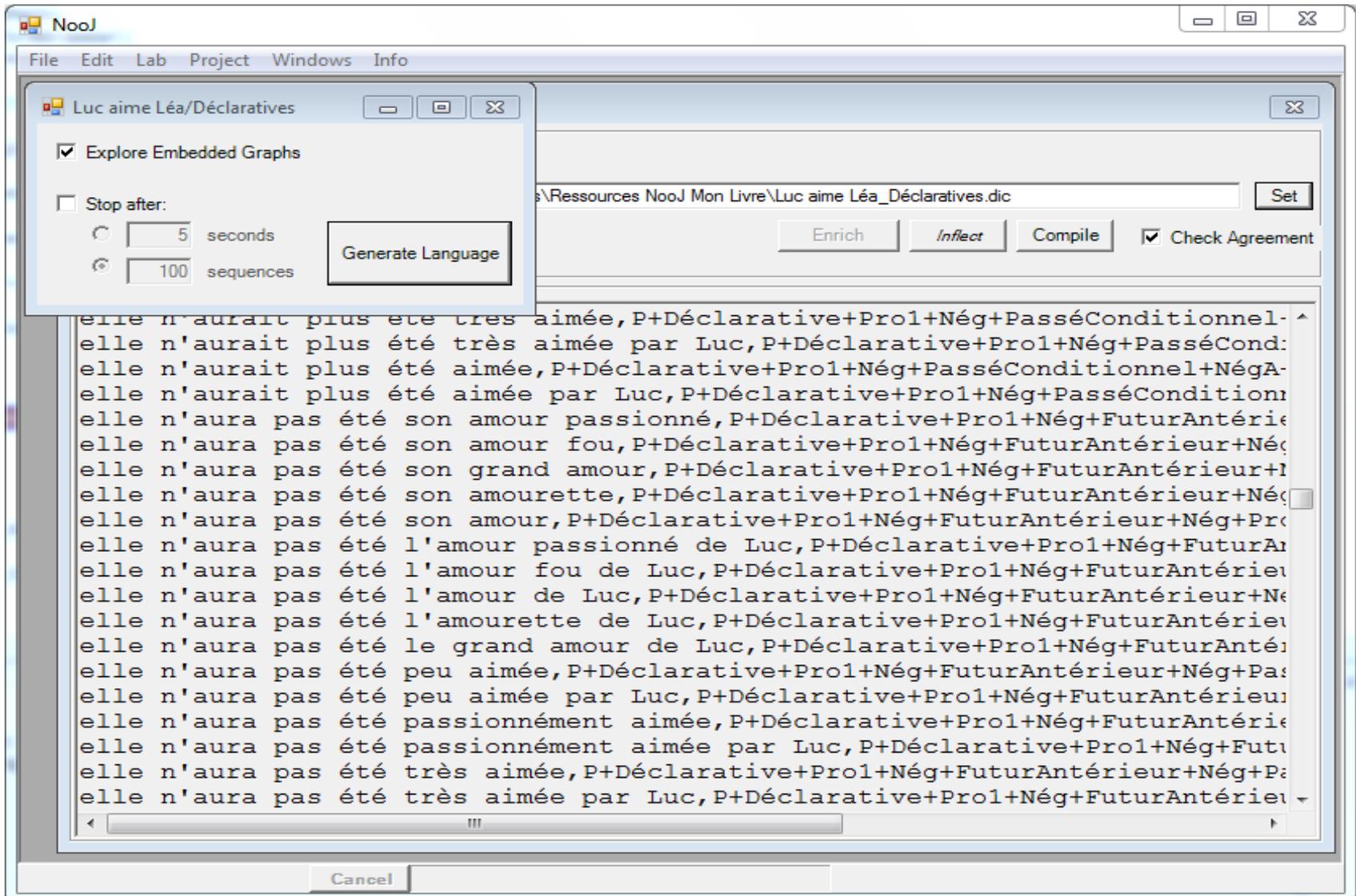
On the right, there is a "NO V N1.dic" window. It displays a list of transformed sentences and their corresponding grammatical structures. The dictionary contains 1690 entries. The visible text is as follows:

```
è Maria che riosserverebbe lui ?,S+Cleft0+C+Pro1+Question
è Maria che riosserverebbe lui,S+Cleft0+C+Pro1
è Maria che riosservi il ragazzo ?,S+Cleft0+IMP+Question
è Maria che riosservi il ragazzo ?,S+Cleft0+S+Question
è Maria che riosservi il ragazzo,S+Cleft0+IMP
è Maria che riosservi il ragazzo,S+Cleft0+S
è Maria che riosservi lui ?,S+Cleft0+IMP+Pro1+Question
è Maria che riosservi lui ?,S+Cleft0+S+Pro1+Question
è Maria che riosservi lui,S+Cleft0+IMP+Pro1
è Maria che riosservi lui,S+Cleft0+S+Pro1
è Maria che riosservò il ragazzo ?,S+Cleft0+PA+Question
è Maria che riosservò il ragazzo,S+Cleft0+PA
è Maria che riosservò lui ?,S+Cleft0+PA+Pro1+Question
è Maria che riosservò lui,S+Cleft0+PA+Pro1
è osservato ?,S+Delet1+Delete0+Question
è osservato da lei ?,S+Delet1+Passivo+Pro0+Question
è osservato da lei,S+Delet1+Passivo+Pro0
è osservato da Maria ?,S+Delet1+Passivo+Question
è osservato da Maria,S+Delet1+Passivo
è osservato,S+Delet1+Delete0
è riosservato ?,S+Delet1+Delete0+Question
è riosservato da lei ?,S+Delet1+Passivo+Pro0+Question
è riosservato da lei,S+Delet1+Passivo+Pro0
è riosservato da Maria ?,S+Delet1+Passivo+Question
è riosservato da Maria,S+Delet1+Passivo
è riosservato,S+Delet1+Delete0
il ragazzo è osservato ?,S+Delete0+Question
il ragazzo è osservato da lei ?,S+Passivo+Pro0+Question
il ragazzo è osservato da lei,S+Passivo+Pro0
il ragazzo è osservato da Maria ?,S+Passivo+Question
il ragazzo è osservato da Maria,S+Passivo
il ragazzo è osservato,S+Delete0
il ragazzo è riosservato ?,S+Delete0+Question
```

At the bottom left, a timer shows "0,5 sec". A "Cancel" button is visible at the bottom center.

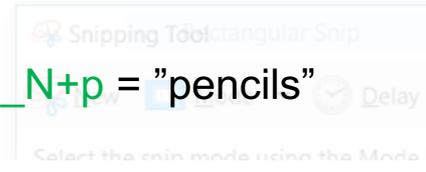
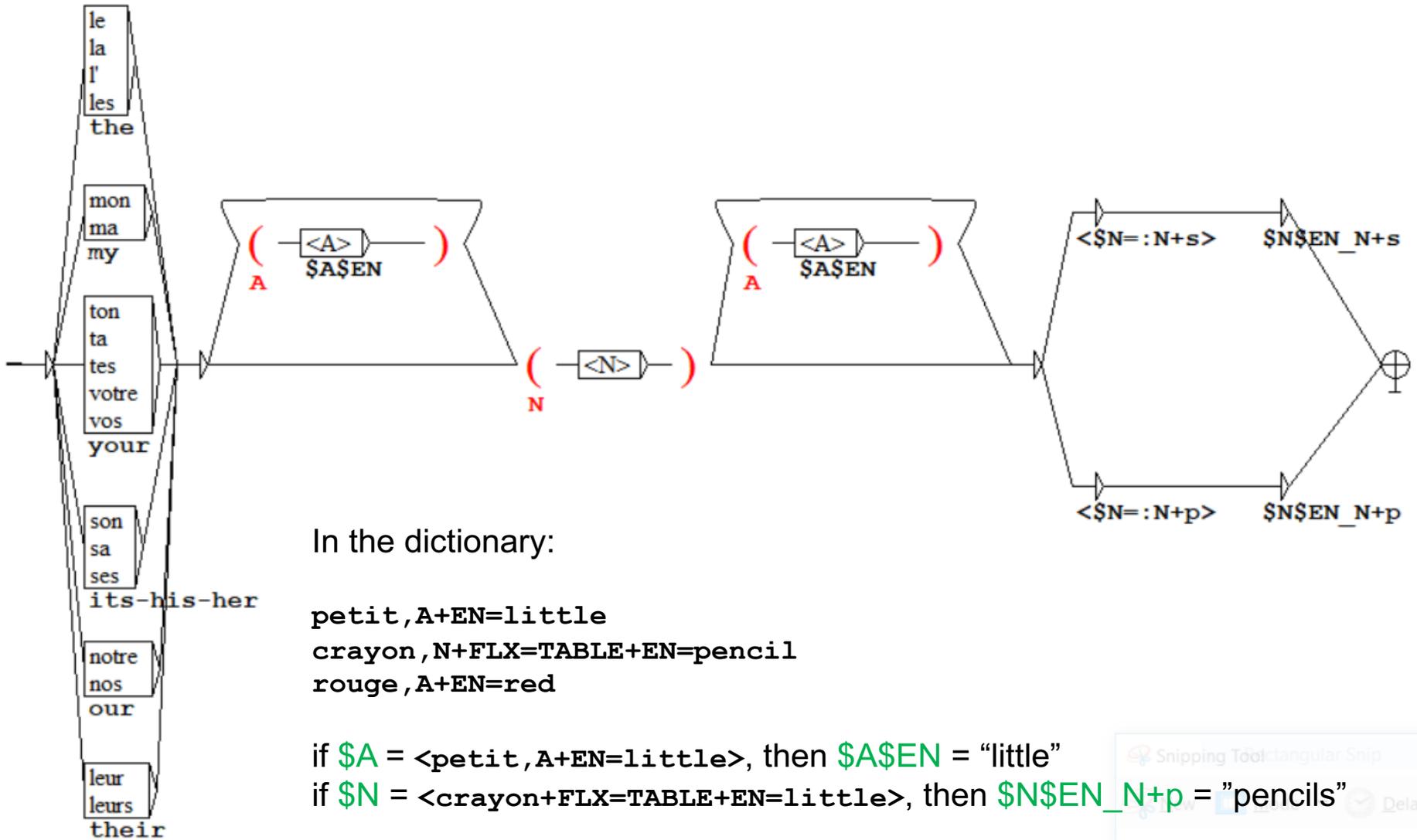
# NooJ solution to transformations: In French

Produce all the transformed sentences from *Luc aime Léa*



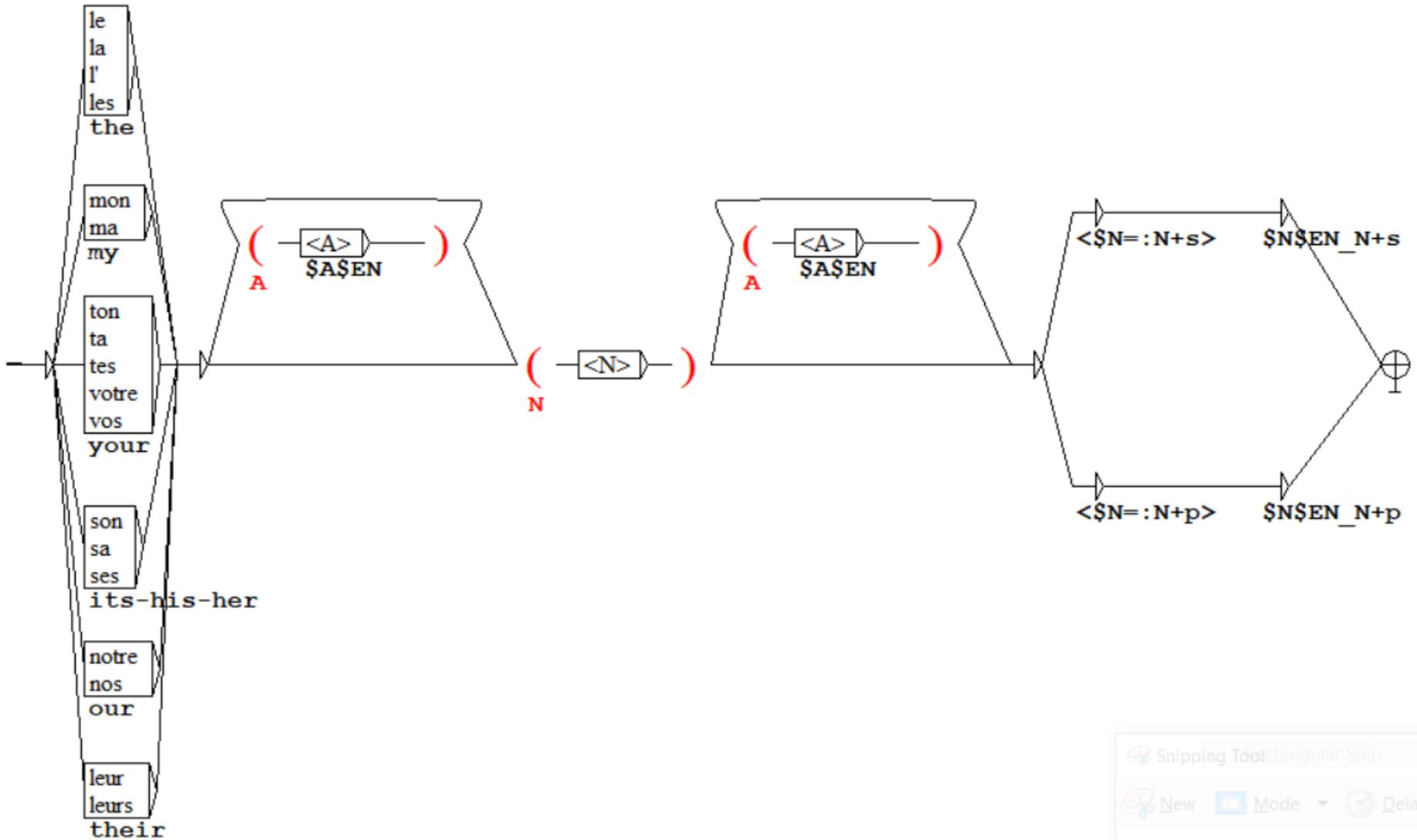
# Unrestricted Grammars in NooJ

## Machine Translation

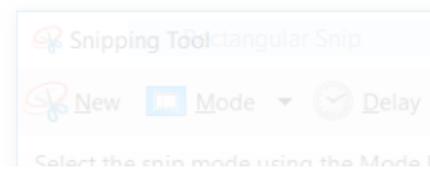


# Unrestricted Grammars in NooJ

## Machine Translation



*le petit crayon rouge* → *the little red pen*



# Unrestricted Grammars in NooJ

## Machine Translation

The screenshot shows the NooJ software interface. The main window displays the text "fr2en NP.not" with a search for "1 / 8 TUs". A concordance window is open, showing the following text:

La petite table  
L'attraction  
Le joli crayon rouge  
  
Mes attractions  
Nos petites tables  
leurs jolis crayons rouges.  
  
Sa table...

The concordance window, titled "Concordance for Text fr2en NP.not", shows the following results:

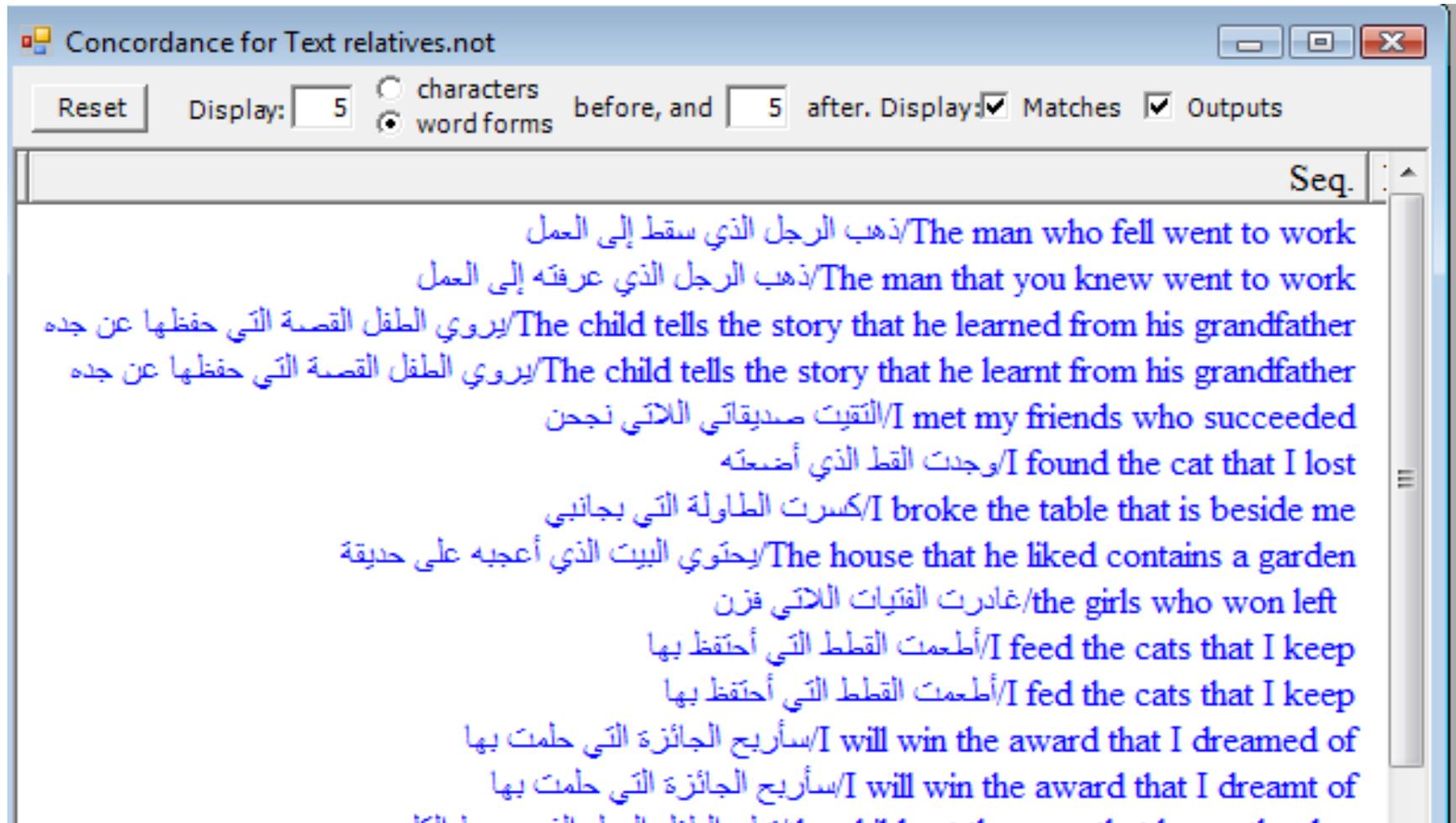
Text	Before	Seq.	After
		La petite table/the little table	
		L'attraction/the show	
		Le joli crayon rouge/the pretty red pencil	
		Nos petites tables/our little tables	
		leurs jolis crayons rouges/their pretty red pencils	
		Sa table/its-his-her table	

At the bottom of the concordance window, it says "Query 6/6".

At the bottom of the main window, there is a "Cancel" button and the text "PROJECT MODE" in red.

# Automatic Machine Translation

Arabic-French MT (Fehri, 2015-2022), Belarusian-Spanish (Veka, Yakubovich, 2016), Greek-Spanish MT (Papadopoulou, Chadjipapa, 2013), English-Italian MT (Maisto, Guarasci, 2016), Portuguese-English MT (Barreiro, 2008), etc.



Concordance for Text relatives.not

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

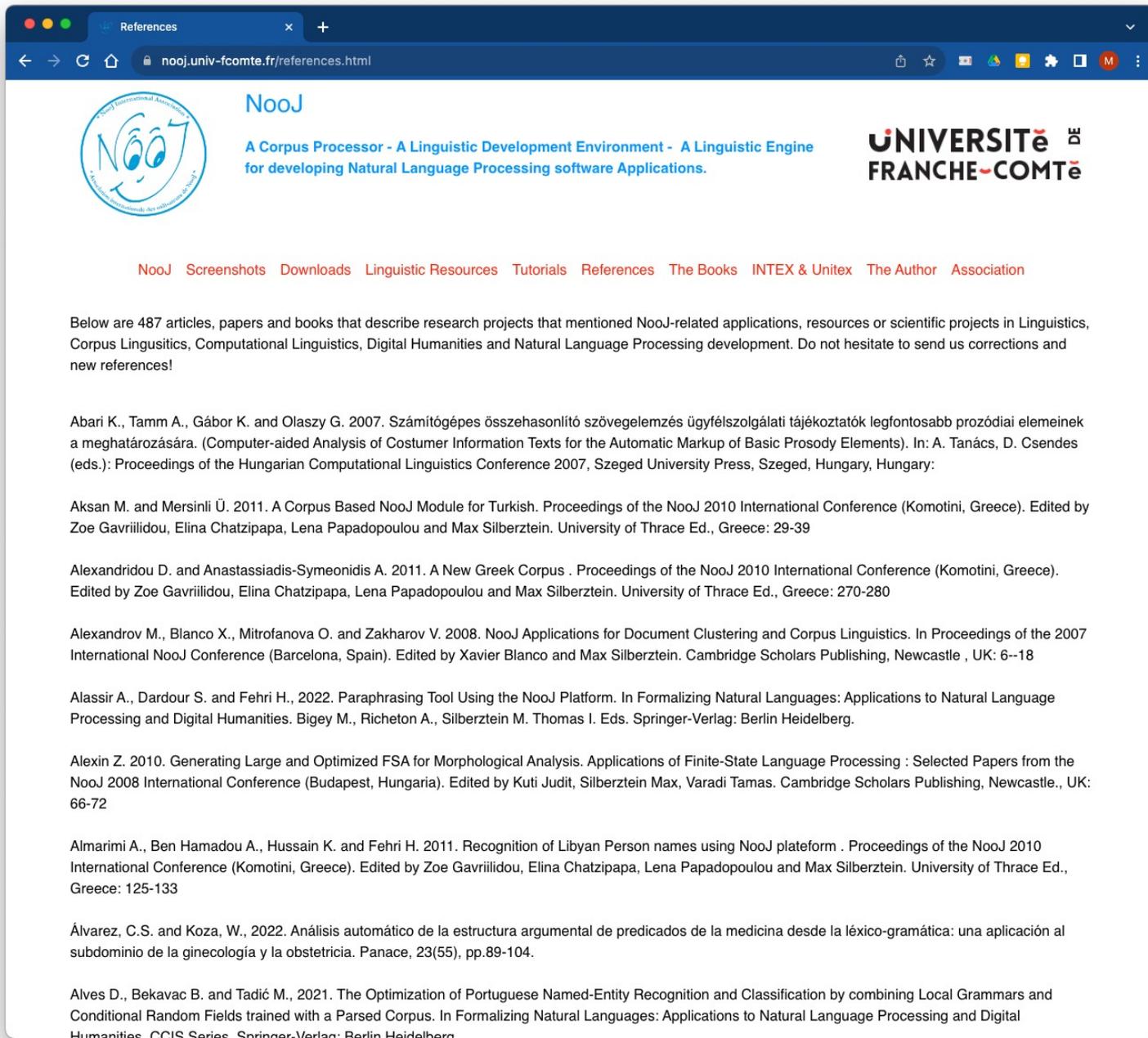
Seq.

ذهب الرجل الذي سقط إلى العمل / The man who fell went to work  
ذهب الرجل الذي عرفته إلى العمل / The man that you knew went to work  
يروى الطفل القصة التي حفظها عن جده / The child tells the story that he learned from his grandfather  
يروى الطفل القصة التي حفظها عن جده / The child tells the story that he learnt from his grandfather  
التقيت صديقاتي اللاتي نجحن / I met my friends who succeeded  
وجدت القط الذي أضعته / I found the cat that I lost  
كسرت الطاولة التي بجانبى / I broke the table that is beside me  
يحتوي البيت الذي أعجبه على حديقة / The house that he liked contains a garden  
غادرت الفتيات اللاتي فزن / the girls who won left  
أطعمت القطط التي أحتفظ بها / I feed the cats that I keep  
أطعمت القطط التي أحتفظ بها / I fed the cats that I keep  
سأربح الجائزة التي حلمت بها / I will win the award that I dreamed of  
سأربح الجائزة التي حلمت بها / I will win the award that I dreamt of

# Many applications of unrestricted grammars

- Transcribe French $\rightleftarrows$ Arabic proper names
- Transcribe Phonemic $\rightleftarrows$ Orthographic notations
- Rewrite a scientific medical text with simpler paraphrases
- Parse a text, and produce its abstract
- Parse a question, *e.g.*, “Who built the Eiffel Tower”, and produce all the potential answers “X built the Eiffel Tower”, “The Eiffel Tower was built by X”, “X has been instrumental in building the Eiffel Tower”, etc. then look for these answer on the Web
- Parse a text, and produce its semantic representation, either in Predicate form GIVE(Joe, apple, Eva), or in XML RDF format
- etc.

# Many applications (cf. references)



References

nooj.univ-fcomte.fr/references.html

 **NooJ**  
A Corpus Processor - A Linguistic Development Environment - A Linguistic Engine  
for developing Natural Language Processing software Applications.

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[NooJ](#) [Screenshots](#) [Downloads](#) [Linguistic Resources](#) [Tutorials](#) [References](#) [The Books](#) [INTEX & Unitex](#) [The Author](#) [Association](#)

Below are 487 articles, papers and books that describe research projects that mentioned NooJ-related applications, resources or scientific projects in Linguistics, Corpus Linguistics, Computational Linguistics, Digital Humanities and Natural Language Processing development. Do not hesitate to send us corrections and new references!

Abari K., Tamm A., Gábor K. and Olaszky G. 2007. Számítógépes összehasonlító szövegelemzés ügyfélszolgálati tájékoztatók legfontosabb prozódiai elemeinek a meghatározására. (Computer-aided Analysis of Costumer Information Texts for the Automatic Markup of Basic Prosody Elements). In: A. Tanács, D. Csendes (eds.): Proceedings of the Hungarian Computational Linguistics Conference 2007, Szeged University Press, Szeged, Hungary, Hungary:

Aksan M. and Mersinli Ü. 2011. A Corpus Based NooJ Module for Turkish. Proceedings of the NooJ 2010 International Conference (Komotini, Greece). Edited by Zoe Gavriilidou, Elina Chatzipapa, Lena Papadopoulou and Max Silberstein. University of Thrace Ed., Greece: 29-39

Alexandridou D. and Anastasiadis-Symeonidis A. 2011. A New Greek Corpus . Proceedings of the NooJ 2010 International Conference (Komotini, Greece). Edited by Zoe Gavriilidou, Elina Chatzipapa, Lena Papadopoulou and Max Silberstein. University of Thrace Ed., Greece: 270-280

Alexandrov M., Blanco X., Mitrofanova O. and Zakharov V. 2008. NooJ Applications for Document Clustering and Corpus Linguistics. In Proceedings of the 2007 International NooJ Conference (Barcelona, Spain). Edited by Xavier Blanco and Max Silberstein. Cambridge Scholars Publishing, Newcastle , UK: 6-18

Alassir A., Dardour S. and Fehri H., 2022. Paraphrasing Tool Using the NooJ Platform. In Formalizing Natural Languages: Applications to Natural Language Processing and Digital Humanities. Bigey M., Richeton A., Silberstein M. Thomas I. Eds. Springer-Verlag: Berlin Heidelberg.

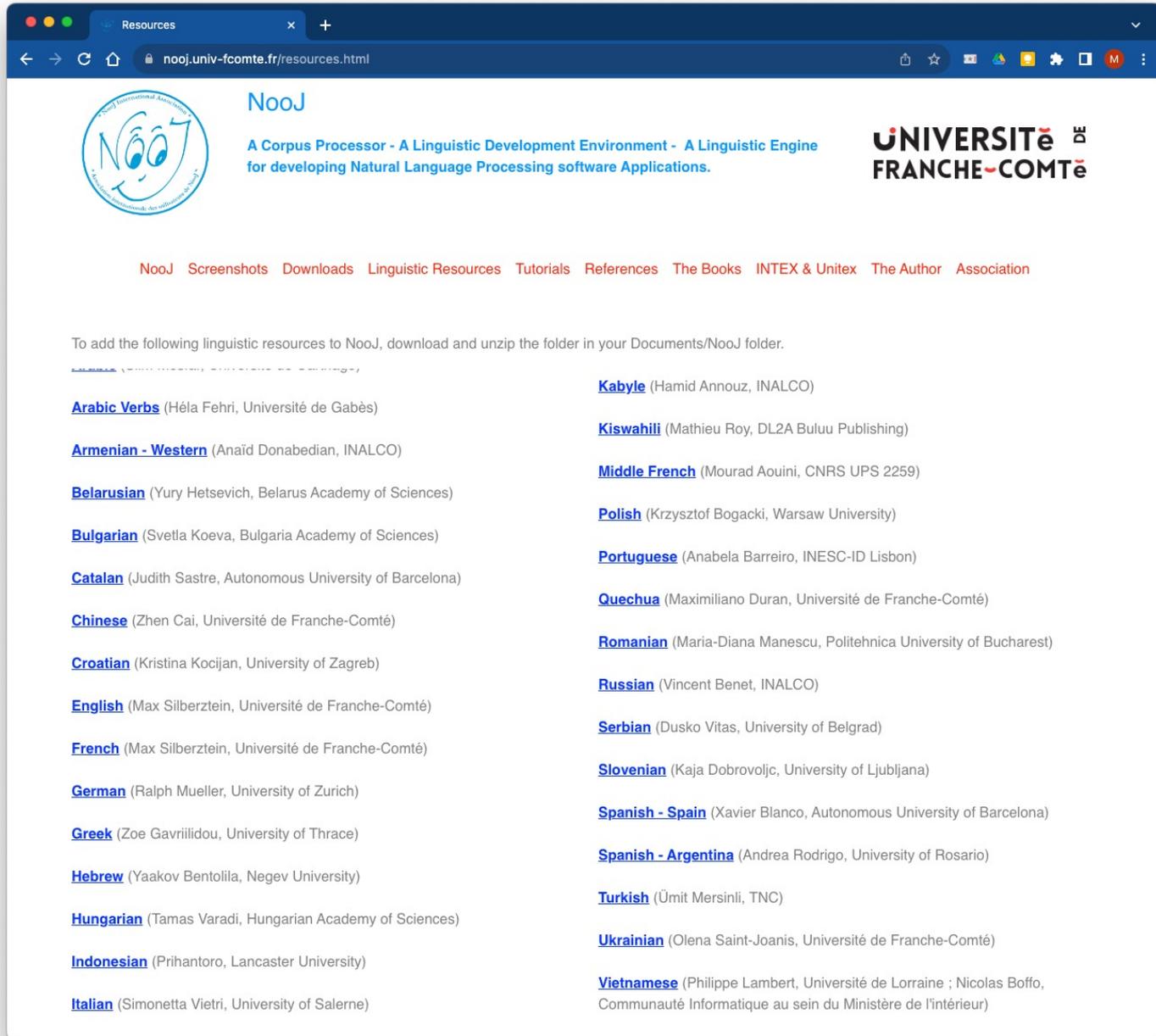
Alexin Z. 2010. Generating Large and Optimized FSA for Morphological Analysis. Applications of Finite-State Language Processing : Selected Papers from the NooJ 2008 International Conference (Budapest, Hungaria). Edited by Kuti Judit, Silberstein Max, Varadi Tamas. Cambridge Scholars Publishing, Newcastle., UK: 66-72

Almarimi A., Ben Hamadou A., Hussain K. and Fehri H. 2011. Recognition of Libyan Person names using NooJ platform . Proceedings of the NooJ 2010 International Conference (Komotini, Greece). Edited by Zoe Gavriilidou, Elina Chatzipapa, Lena Papadopoulou and Max Silberstein. University of Thrace Ed., Greece: 125-133

Álvarez, C.S. and Koza, W., 2022. Análisis automático de la estructura argumental de predicados de la medicina desde la léxico-gramática: una aplicación al subdominio de la ginecología y la obstetricia. Panace, 23(55), pp.89-104.

Alves D., Bekavac B. and Tadić M., 2021. The Optimization of Portuguese Named-Entity Recognition and Classification by combining Local Grammars and Conditional Random Fields trained with a Parsed Corpus. In Formalizing Natural Languages: Applications to Natural Language Processing and Digital Humanities. CCIS Series. Springer-Verlag: Berlin Heidelberg.

# Many language resources (30 modules downloadable)



The screenshot shows a web browser window with the URL `nooj.univ-fcomte.fr/resources.html`. The page features the NooJ logo on the left, which is a stylized face with the text "NooJ Linguistic Association" around it. To the right of the logo is the text "NooJ A Corpus Processor - A Linguistic Development Environment - A Linguistic Engine for developing Natural Language Processing software Applications." Further right is the logo for "UNIVERSITÉ DE FRANCHE-COMTÉ". Below the logos is a navigation menu with links: "NooJ", "Screenshots", "Downloads", "Linguistic Resources", "Tutorials", "References", "The Books", "INTEX & Unitex", "The Author", and "Association".

The main content of the page is a list of linguistic resources. It starts with the instruction: "To add the following linguistic resources to NooJ, download and unzip the folder in your Documents/NooJ folder." Below this is a list of 30 language resources, each with a link and the contributor's name and affiliation:

- [Arabic Verbs](#) (Héla Fehri, Université de Gabès)
- [Armenian - Western](#) (Anaïd Donabedian, INALCO)
- [Belarusian](#) (Yury Hetsevich, Belarus Academy of Sciences)
- [Bulgarian](#) (Svetla Koeva, Bulgaria Academy of Sciences)
- [Catalan](#) (Judith Sastre, Autonomous University of Barcelona)
- [Chinese](#) (Zhen Cai, Université de Franche-Comté)
- [Croatian](#) (Kristina Kocijan, University of Zagreb)
- [English](#) (Max Silberztein, Université de Franche-Comté)
- [French](#) (Max Silberztein, Université de Franche-Comté)
- [German](#) (Ralph Mueller, University of Zurich)
- [Greek](#) (Zoe Gavriilidou, University of Thrace)
- [Hebrew](#) (Yaakov Bentolila, Negev University)
- [Hungarian](#) (Tamas Varadi, Hungarian Academy of Sciences)
- [Indonesian](#) (Prihantoro, Lancaster University)
- [Italian](#) (Simonetta Vietri, University of Salerno)
- [Kabyle](#) (Hamid Annouz, INALCO)
- [Kiswahili](#) (Mathieu Roy, DL2A Buluu Publishing)
- [Middle French](#) (Mourad Aouini, CNRS UPS 2259)
- [Polish](#) (Krzysztof Bogacki, Warsaw University)
- [Portuguese](#) (Anabela Barreiro, INESC-ID Lisbon)
- [Quechua](#) (Maximiliano Duran, Université de Franche-Comté)
- [Romanian](#) (Maria-Diana Manescu, Politehnica University of Bucharest)
- [Russian](#) (Vincent Benet, INALCO)
- [Serbian](#) (Dusko Vitas, University of Belgrad)
- [Slovenian](#) (Kaja Dobrovoljc, University of Ljubljana)
- [Spanish - Spain](#) (Xavier Blanco, Autonomous University of Barcelona)
- [Spanish - Argentina](#) (Andrea Rodrigo, University of Rosario)
- [Turkish](#) (Ümit Mersinli, TNC)
- [Ukrainian](#) (Olena Saint-Joanis, Université de Franche-Comté)
- [Vietnamese](#) (Philippe Lambert, Université de Lorraine ; Nicolas Boffo, Communauté Informatique au sein du Ministère de l'Intérieur)



# CONGRATULATIONS



You know how to construct unrestricted grammars to perform transformations, compute paraphrases, produce semantic analyses and compute translations.

