

# 15. Unrestricted Grammars

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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.:

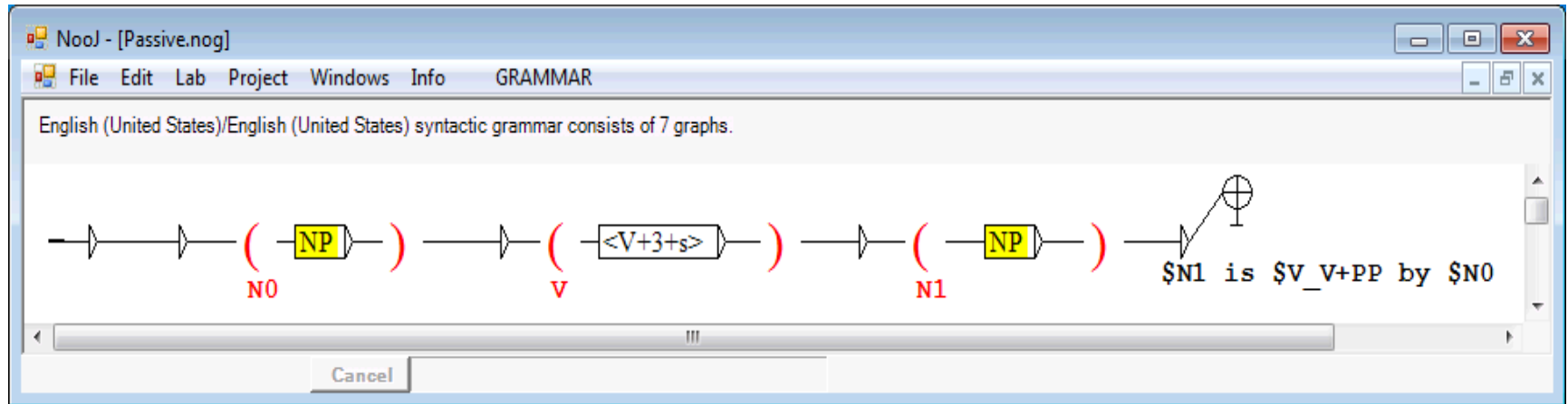
(S1 Joe arrived). (S2 Eva left)/S1 and S2  
*Joe arrived. Eva left. → Joe arrived and Eva left*

- 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)

SAN																																				
N0					Vcop							Class	Quant	Nclass Pred					Adjectivo	P_Adj		Reestr N <sub>0</sub>		(W+E)		Nome										
Nhum	Nap de Nhum	Nap		QueF	ser	estar	andar	ficar	permanecer	viver	encontrar-se	sentir-se	mostrar-se	revelar-se	tornar-se	UM Nclas	Um +Modif	Adv Quant		Superlativo	ser de	origem	NclassP				N Adj	Adj N	Nhum Vop A Prep Nap	(de + em) (E+Def) Nap	em Dposs Nap	em Vinf	para com Nhum	CCI	(Seu + Meu) Adj!	
		Nap	Npc																				nacionalidade	naturalidade	etnia											raça
+	-	-	-	-	+	-	-	-	-	-	-	-	-	-	+	+	+	-	-	+	+	+	+	-	-	abissínio	+	-	-	-	-	-	-	-	Abissínia	
+	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	+	+	-	-	-	+	+	-	+	-	-	acadiano	+	-	-	-	-	-	-	-	Acádia
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+	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	+	+	+	-	-	+	+	+	+	-	-	islandês	+	-	-	-	-	-	-	-	Islândia

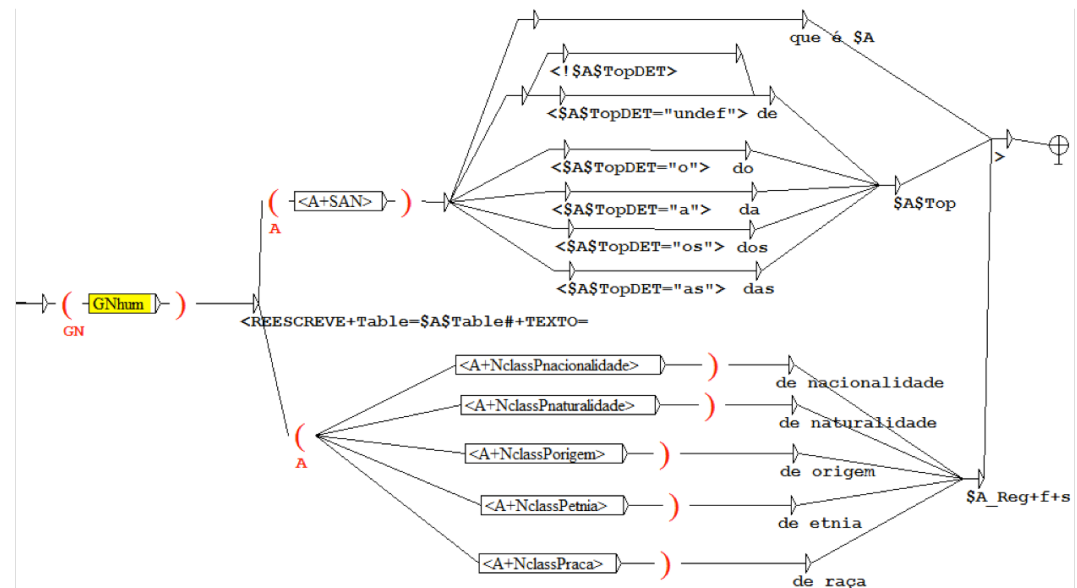
açoriano,A+FLX=ALTO

**+Table=SAN+Nhum+Vcopser+UMNclas+UmModi**  
**f+NclassPserde+NclassPorigem+NclassPnatural**  
**idade+NAdj+DRV=nometop:Açores**

...

iraquiano,A+FLX=ALTO+AN+lang+EN=Iraqi

**+Table=SAN+Nhum+Vcopser+Vcoptornarse+UM**  
**Nclas+UmModif+NclassPserde+NclassPorigem+**  
**NclassPnacionalidade+NclassPnaturalidade+NA**  
**dj+DRV=nometop:Iraque**



# 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)

protestou

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

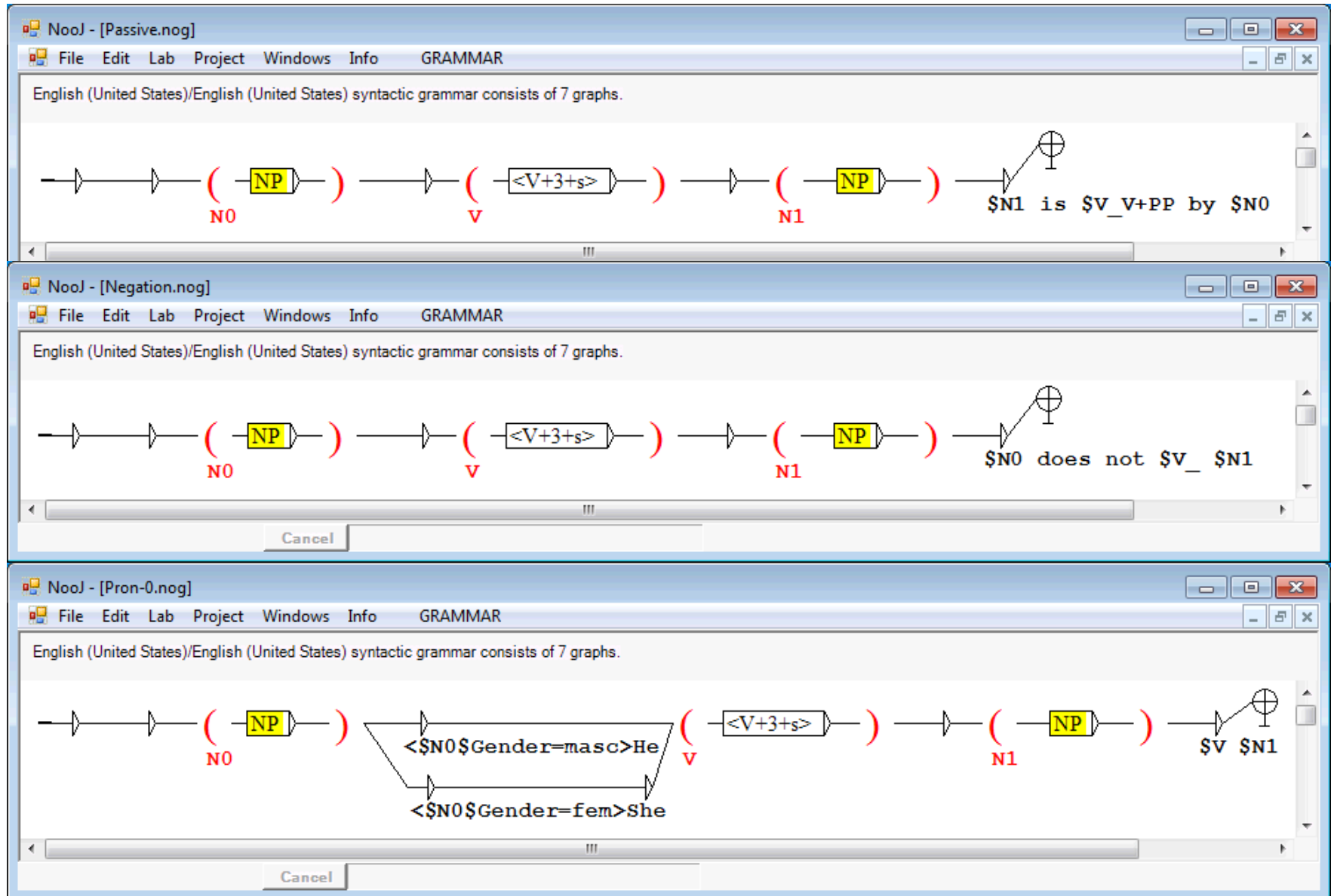
[Nom-V] John gave the card to Mary = The card is John's gift to Mary

...



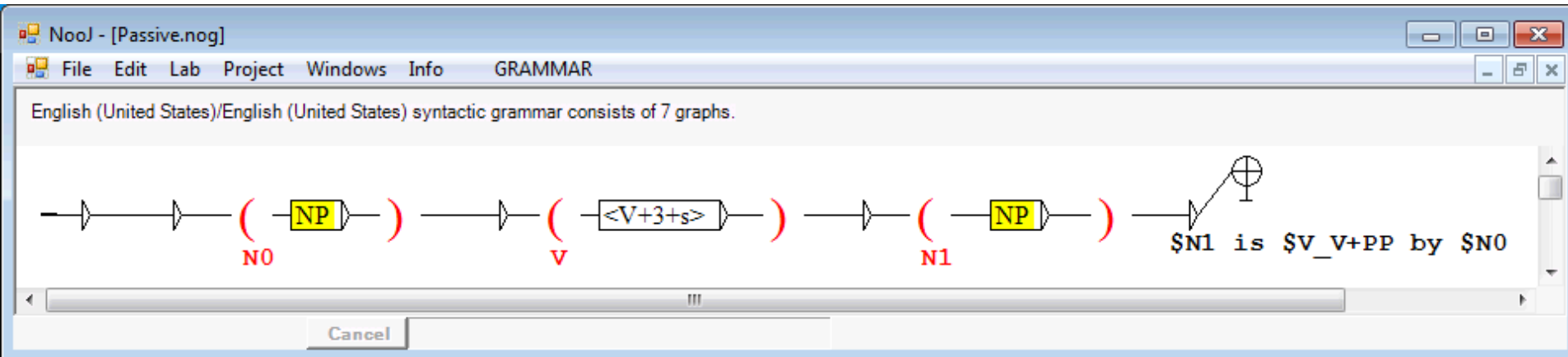
# Transformations

## On grammar per transformation?

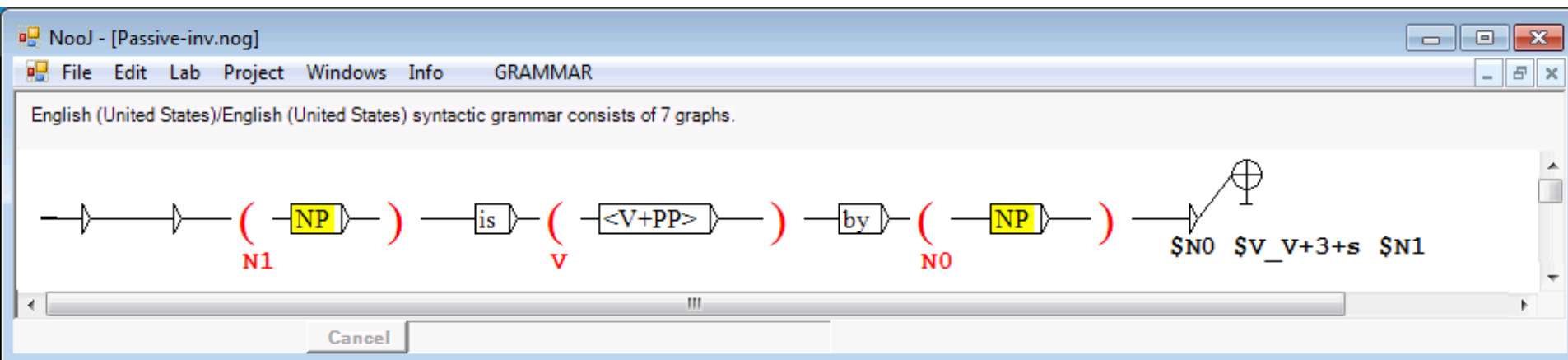


# Transformations

## Or two?



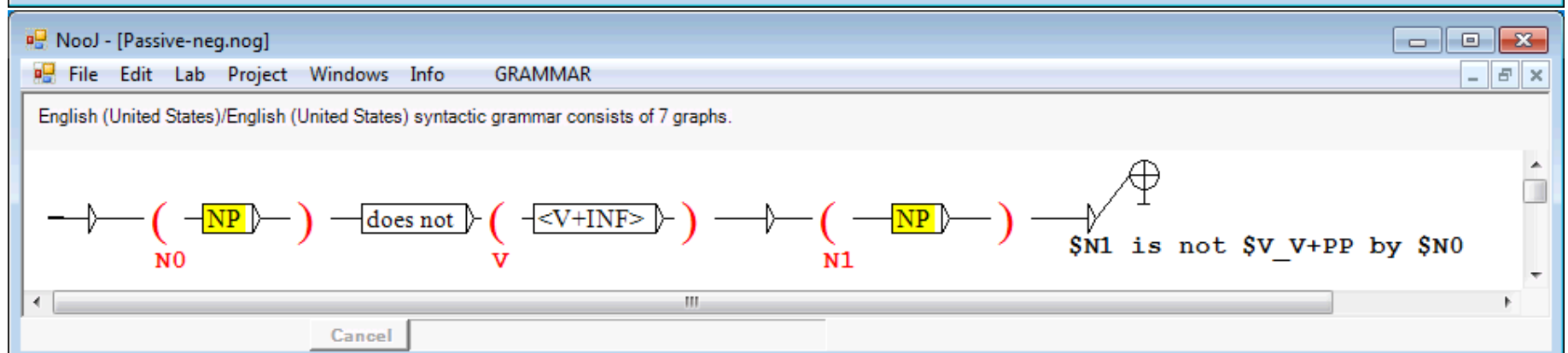
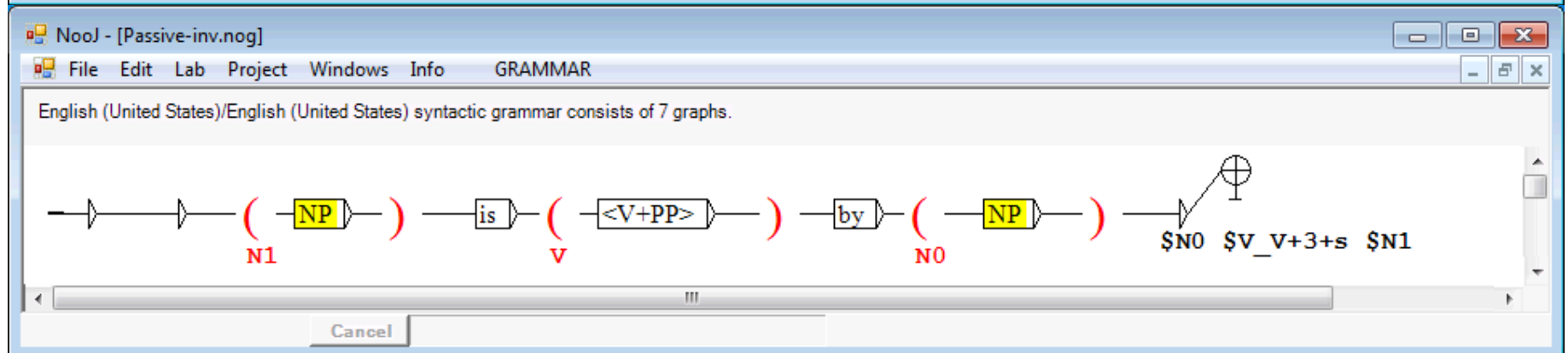
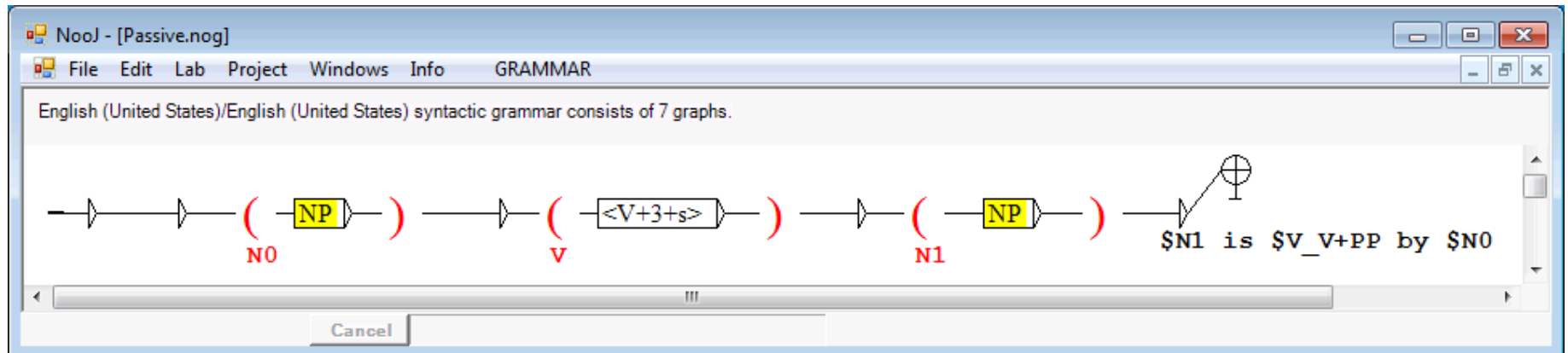
Active to Passive



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:

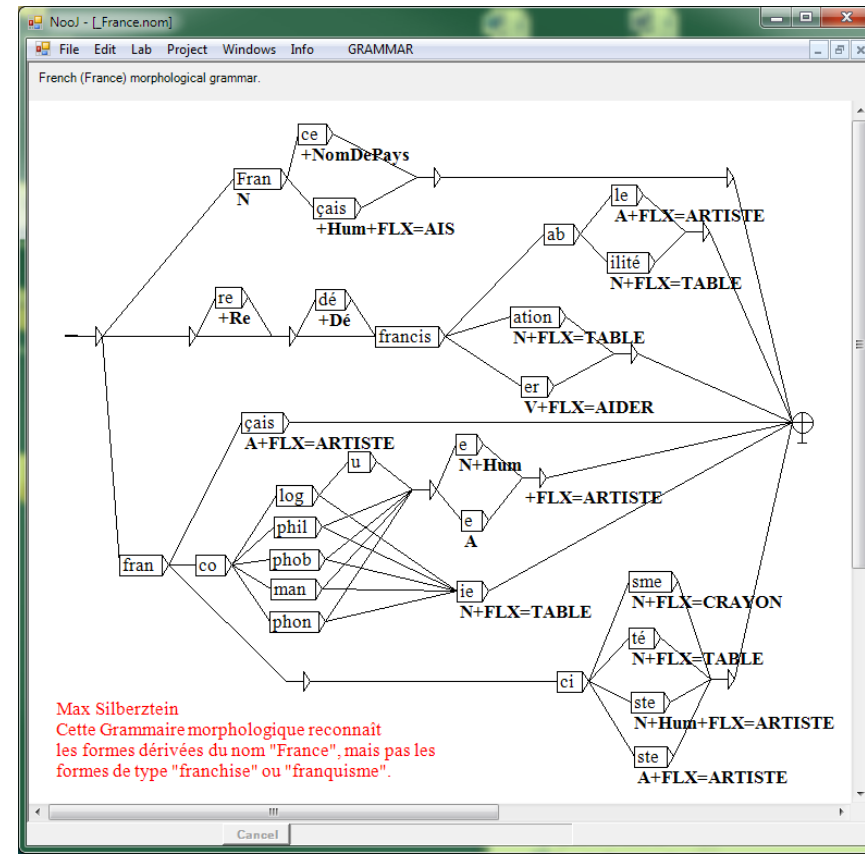
*It is not like Joe wanted to stop being her lover*

[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 "NooJ", shows a project named "\_France.nom" with the description "French (France) morphological grammar." The central area contains a complex graph representing the grammar, with nodes labeled with French words and their grammatical features (e.g., "Fran N", "çais A+FLX=ARTISTE", "re", "dé", "francis", "ation N+FLX=TABLE", "le A+FLX=ARTISTE", "ilité N+FLX=TABLE", "co", "log", "phil", "phob", "man", "phon", "ie N+FL").

Two dialog boxes are open. The "Explore graph Main in grammar..." dialog box has the "Explore Embedded Graphs" checkbox checked and the "Explore all paths" button. The "Untitled [Modified]" dialog box displays a list of 38 entries generated from the grammar, including:

```
# 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=ARTISTE
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
refrancisabilité, N+FLX=TABLE
```

At the bottom left, a red text box contains the following text:

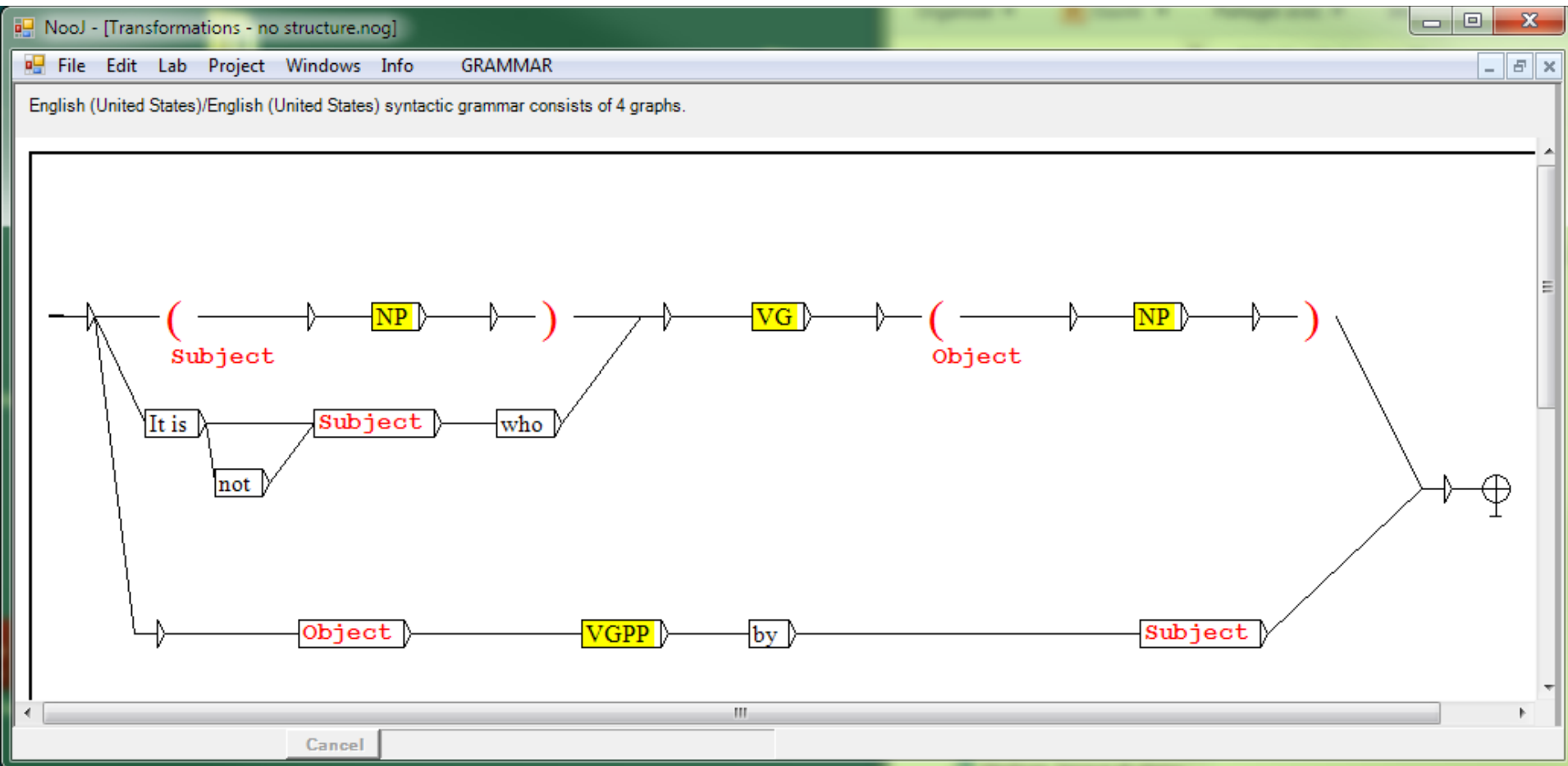
Max Silberstein  
Cette Grammaire morphologique reconnaît  
les formes dérivées du nom "France", mais pas les  
formes de type "franchise" ou "franquisme".

# 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



# Nool solution to transformations:

## Combine Parsing and Generation

### GRAMMAR > Generate Language

The screenshot displays the Nool application interface. The main window is titled "Transformations - no structure.nog" and shows a graph representing a grammar transformation. The graph has nodes labeled "It is", "Subject", "who", "Object", and "VGPP". The "Subject" node is highlighted in red, and the "Object" node is highlighted in yellow. A dialog box titled "Explore graph Main in grammar..." is open, showing options to "Explore Embedded Graphs" (checked) and "Stop after:" (5 seconds or 100 sequences). The "Explore all paths" button is visible.

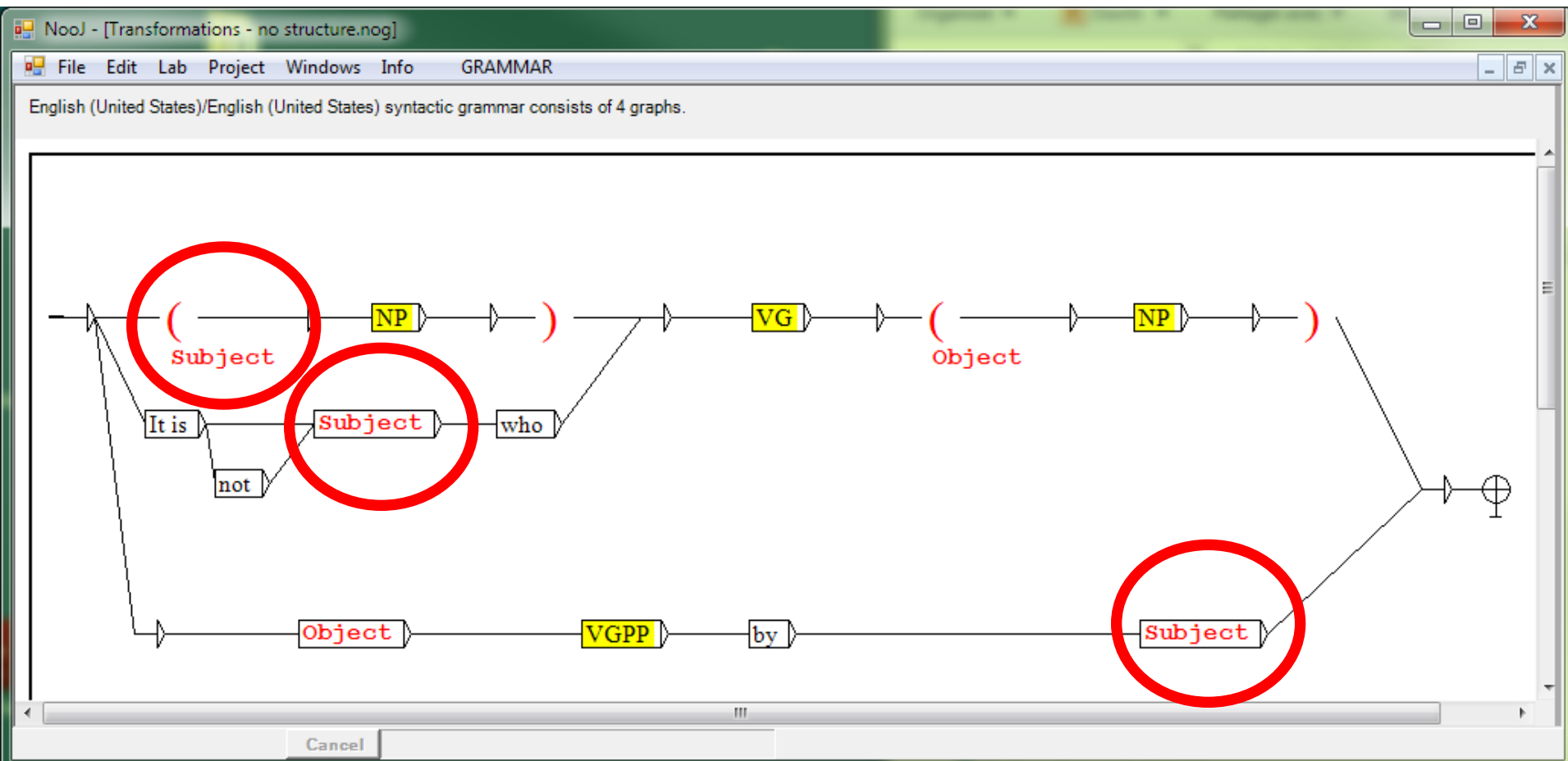
The right pane, titled "Untitled [Modified]", shows a list of generated sentences, each preceded by a hash symbol (#). The sentences are generated from the grammar rules defined in the graph. The list includes:

- \$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

# Nool solution to transformations:

## Combine Parsing and Generation

The screenshot displays the Nool software interface, which is used for linguistic transformations. The main window, titled "Nool", has a menu bar with "File", "Edit", "Lab", "Project", "Windows", "Info", and "DICTIONARY". Below the menu bar, there is a tab labeled "Transformations - no structure.nog". The main text area shows the message: "English (United States)/English (United States) syntactic grammar consists of 4 graphs."

A dialog box titled "Transformation for grammar: Transformation..." is open. It contains the following elements:

- A text input field with the phrase "John loves Mary".
- A section labeled "Transformations" with two radio buttons: "Name a transformation" (unselected) and "Perform All Transformations" (selected).
- A text input field below the radio buttons containing "+Passive-Neg".
- A checkbox labeled "display lexemes" which is currently unchecked.
- A button labeled "Produce Paraphrases".

Below the dialog box, there is a flow diagram showing the transformation process. It starts with a box labeled "Object" (in red) which points to a box labeled "VGPP" (in yellow). The "VGPP" box then points to a window titled "Untitled [Modified]".

The "Untitled [Modified]" window displays a list of 26 entries, which are paraphrases of the original phrase "John loves Mary". The entries are as follows:

- 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

At the bottom of the Nool window, there is a "Cancel" button.

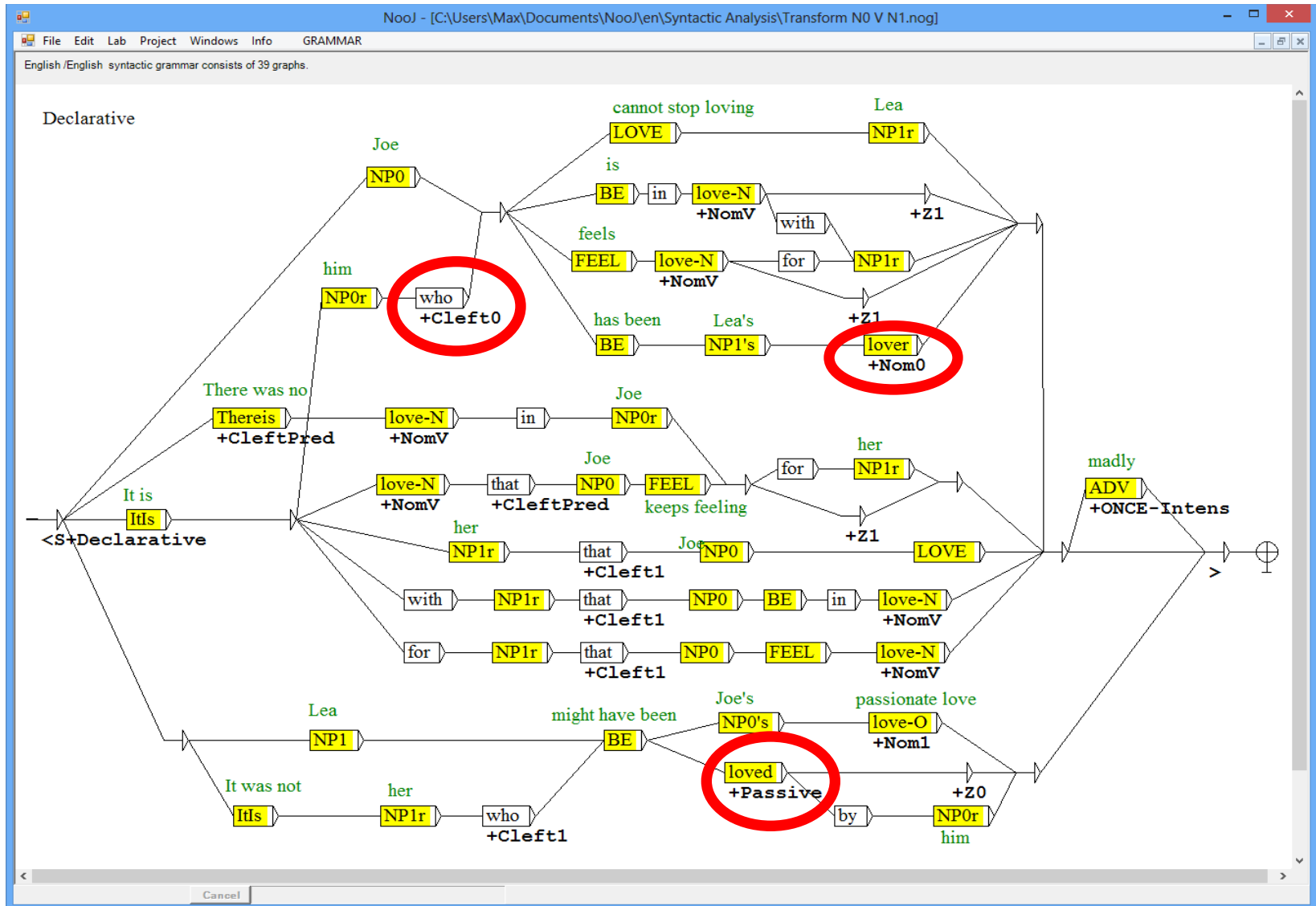
# NooJ solution to transformations:

## 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]...

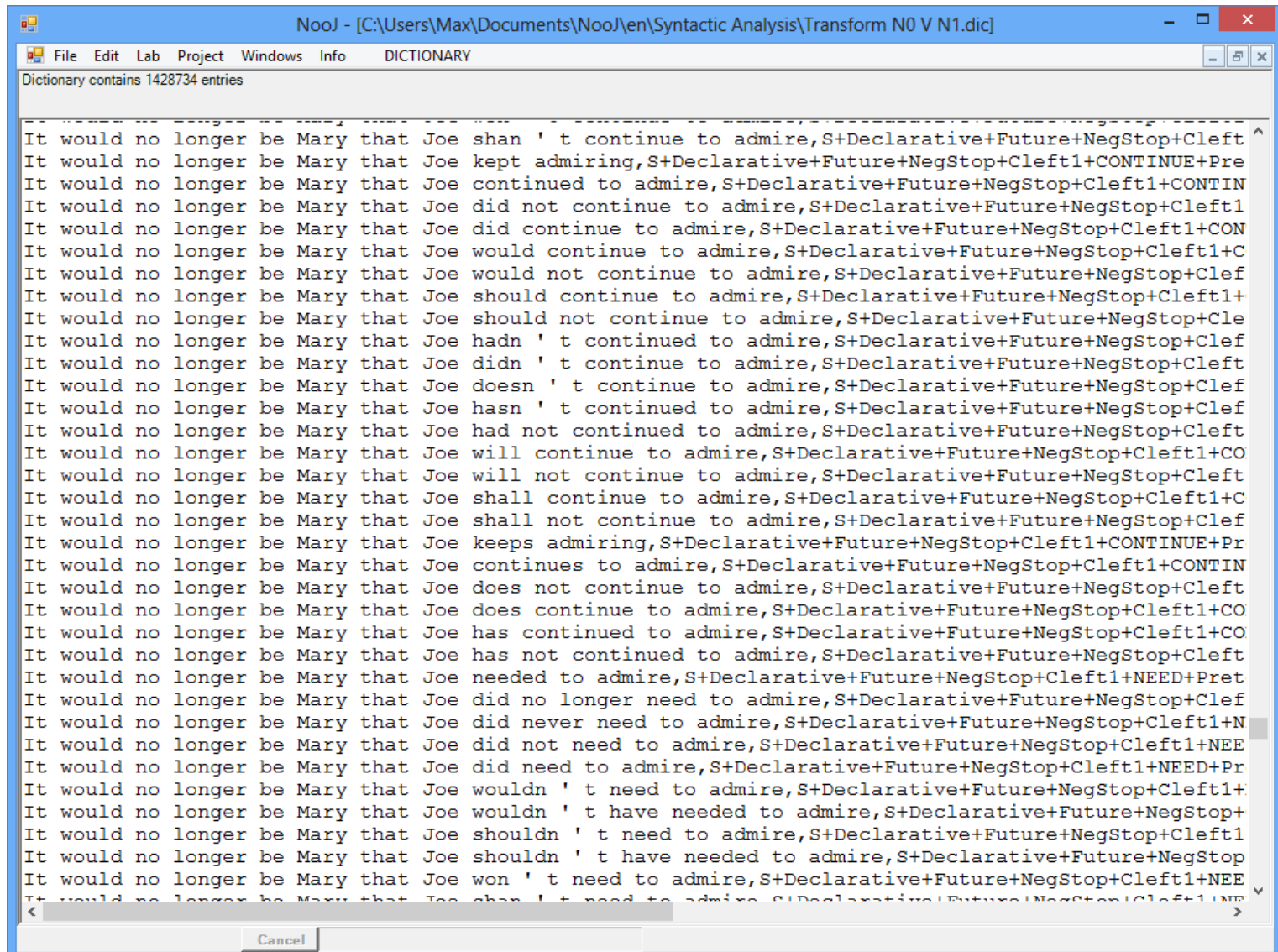
## Name the transformations in the outputs



# NooJ solution to transformations:

## Combine Parsing and Generation

Produce all the transformed sentences from *Joe loves Lea*



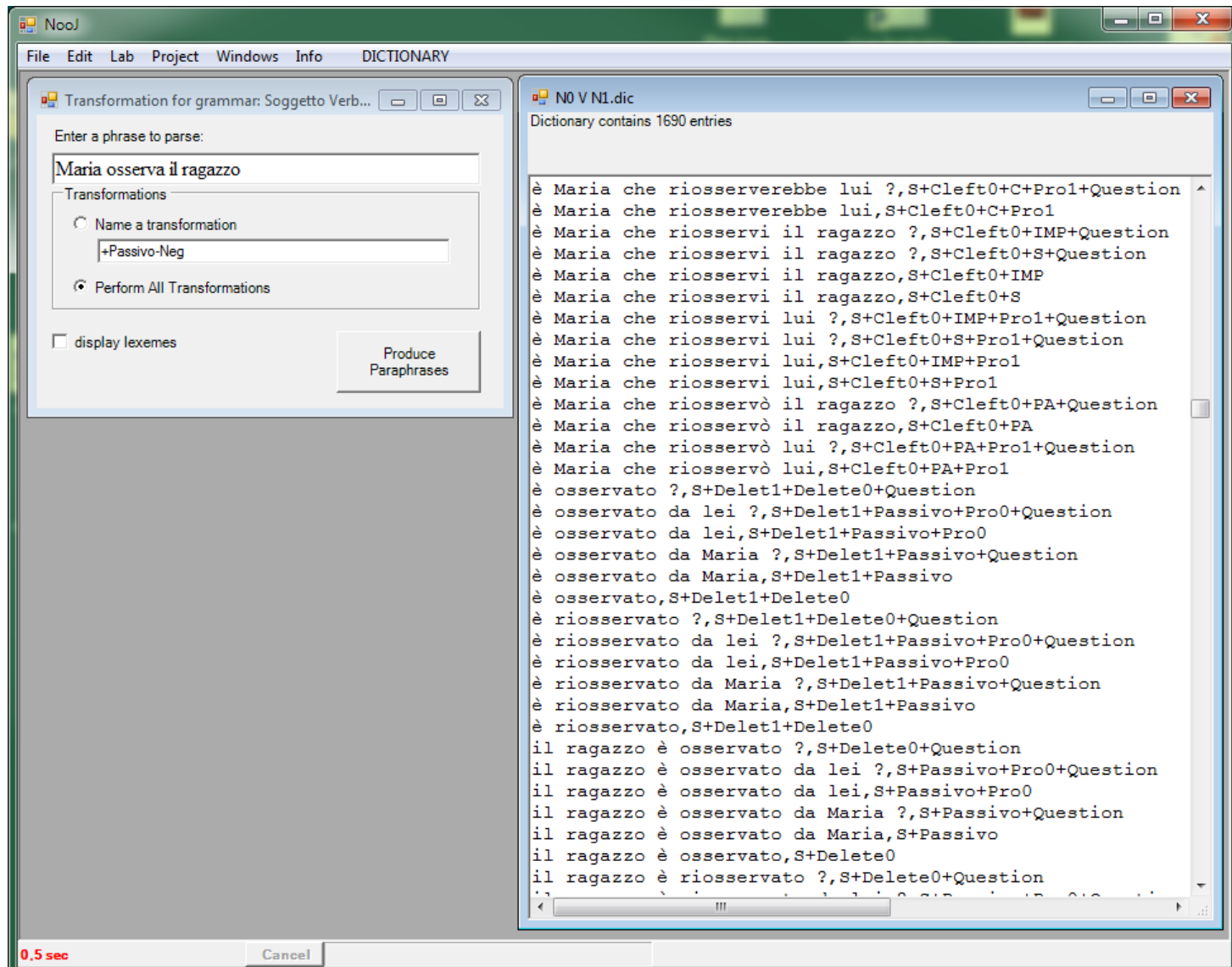
The screenshot shows the NooJ application window with the title bar "NooJ - [C:\Users\Max\Documents\NooJ\en\Syntactic Analysis\Transform N0 V N1.dic]". The menu bar includes File, Edit, Lab, Project, Windows, Info, and a DICTONARY button. Below the menu bar, a status bar indicates "Dictionary contains 1428734 entries". The main text area displays a list of transformed sentences, each starting with "It would no longer be Mary that Joe" followed by a verb phrase and a syntactic analysis string. The sentences are: "It would no longer be Mary that Joe shan ' t continue to admire, S+Declarative+Future+NegStop+Cleft", "It would no longer be Mary that Joe kept admiring, S+Declarative+Future+NegStop+Cleft1+CONTINUE+Pre", "It would no longer be Mary that Joe continued to admire, S+Declarative+Future+NegStop+Cleft1+CONTIN", "It would no longer be Mary that Joe did not continue to admire, S+Declarative+Future+NegStop+Cleft1", "It would no longer be Mary that Joe did continue to admire, S+Declarative+Future+NegStop+Cleft1+CON", "It would no longer be Mary that Joe would continue to admire, S+Declarative+Future+NegStop+Cleft1+C", "It would no longer be Mary that Joe would not continue to admire, S+Declarative+Future+NegStop+Clef", "It would no longer be Mary that Joe should continue to admire, S+Declarative+Future+NegStop+Cleft1+", "It would no longer be Mary that Joe should not continue to admire, S+Declarative+Future+NegStop+Cle", "It would no longer be Mary that Joe hadn ' t continued to admire, S+Declarative+Future+NegStop+Clef", "It would no longer be Mary that Joe didn ' t continue to admire, S+Declarative+Future+NegStop+Cleft", "It would no longer be Mary that Joe doesn ' t continue to admire, S+Declarative+Future+NegStop+Clef", "It would no longer be Mary that Joe hasn ' t continued to admire, S+Declarative+Future+NegStop+Clef", "It would no longer be Mary that Joe had not continued to admire, S+Declarative+Future+NegStop+Cleft", "It would no longer be Mary that Joe will continue to admire, S+Declarative+Future+NegStop+Cleft1+CO", "It would no longer be Mary that Joe will not continue to admire, S+Declarative+Future+NegStop+Cleft", "It would no longer be Mary that Joe shall continue to admire, S+Declarative+Future+NegStop+Cleft1+C", "It would no longer be Mary that Joe shall not continue to admire, S+Declarative+Future+NegStop+Clef", "It would no longer be Mary that Joe keeps admiring, S+Declarative+Future+NegStop+Cleft1+CONTINUE+Pr", "It would no longer be Mary that Joe continues to admire, S+Declarative+Future+NegStop+Cleft1+CONTIN", "It would no longer be Mary that Joe does not continue to admire, S+Declarative+Future+NegStop+Cleft", "It would no longer be Mary that Joe does continue to admire, S+Declarative+Future+NegStop+Cleft1+CO", "It would no longer be Mary that Joe has continued to admire, S+Declarative+Future+NegStop+Cleft1+CO", "It would no longer be Mary that Joe has not continued to admire, S+Declarative+Future+NegStop+Cleft", "It would no longer be Mary that Joe needed to admire, S+Declarative+Future+NegStop+Cleft1+NEED+Pret", "It would no longer be Mary that Joe did no longer need to admire, S+Declarative+Future+NegStop+Clef", "It would no longer be Mary that Joe did never need to admire, S+Declarative+Future+NegStop+Cleft1+N", "It would no longer be Mary that Joe did not need to admire, S+Declarative+Future+NegStop+Cleft1+NEE", "It would no longer be Mary that Joe did need to admire, S+Declarative+Future+NegStop+Cleft1+NEED+Pr", "It would no longer be Mary that Joe wouldn ' t need to admire, S+Declarative+Future+NegStop+Cleft1+", "It would no longer be Mary that Joe wouldn ' t have needed to admire, S+Declarative+Future+NegStop+", "It would no longer be Mary that Joe shouldn ' t need to admire, S+Declarative+Future+NegStop+Cleft1", "It would no longer be Mary that Joe shouldn ' t have needed to admire, S+Declarative+Future+NegStop", "It would no longer be Mary that Joe won ' t need to admire, S+Declarative+Future+NegStop+Cleft1+NEE", "It would no longer be Mary that Joe shan ' t need to admire, S+Declarative+Future+NegStop+Cleft1+NE".

At the bottom of the window, there is a "Cancel" button.

# Nool solution to transformations:

## In Italian

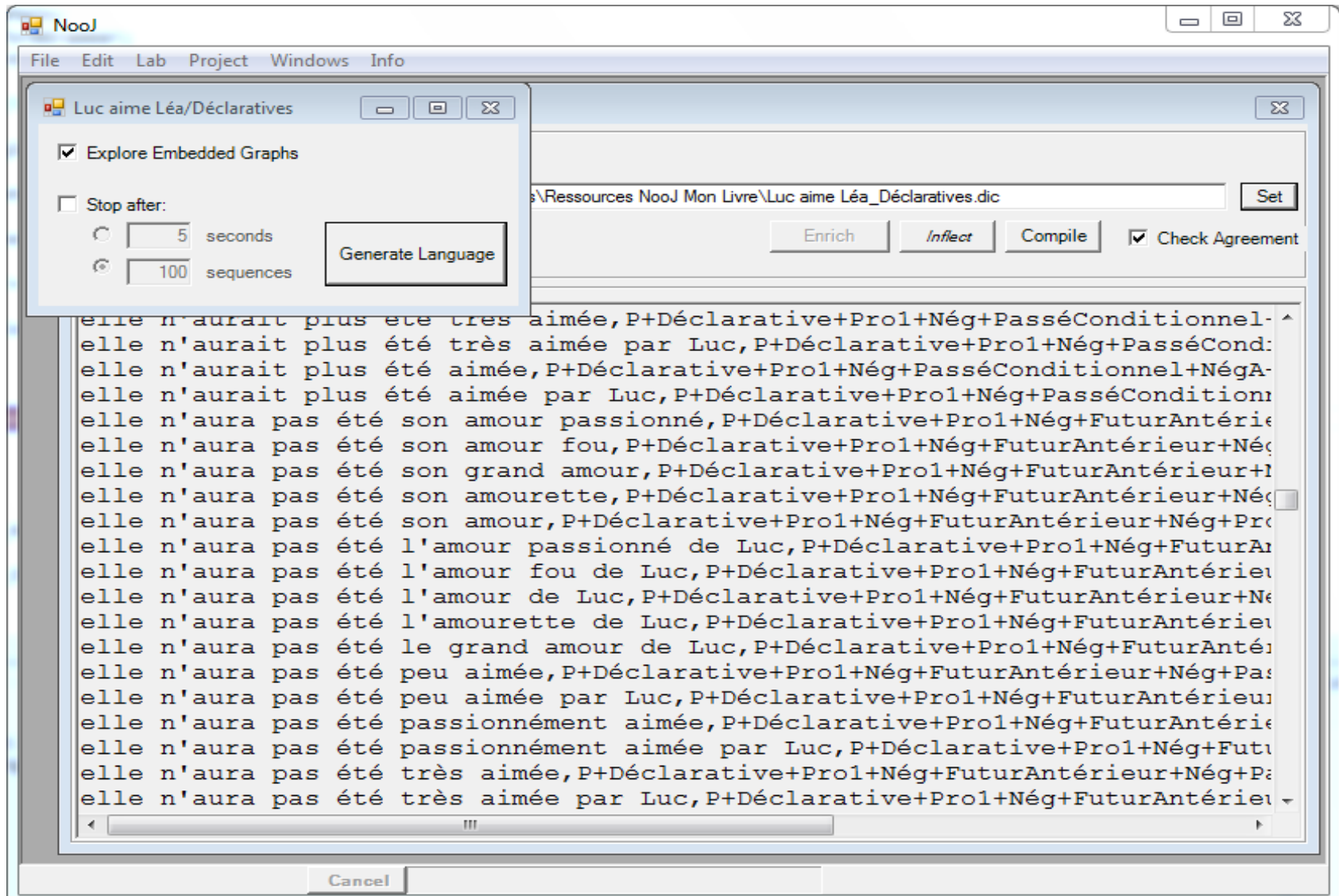
Produce all the transformed sentences from *Maria osserva om ragazzo*





# NooJ solution to transformations: In French

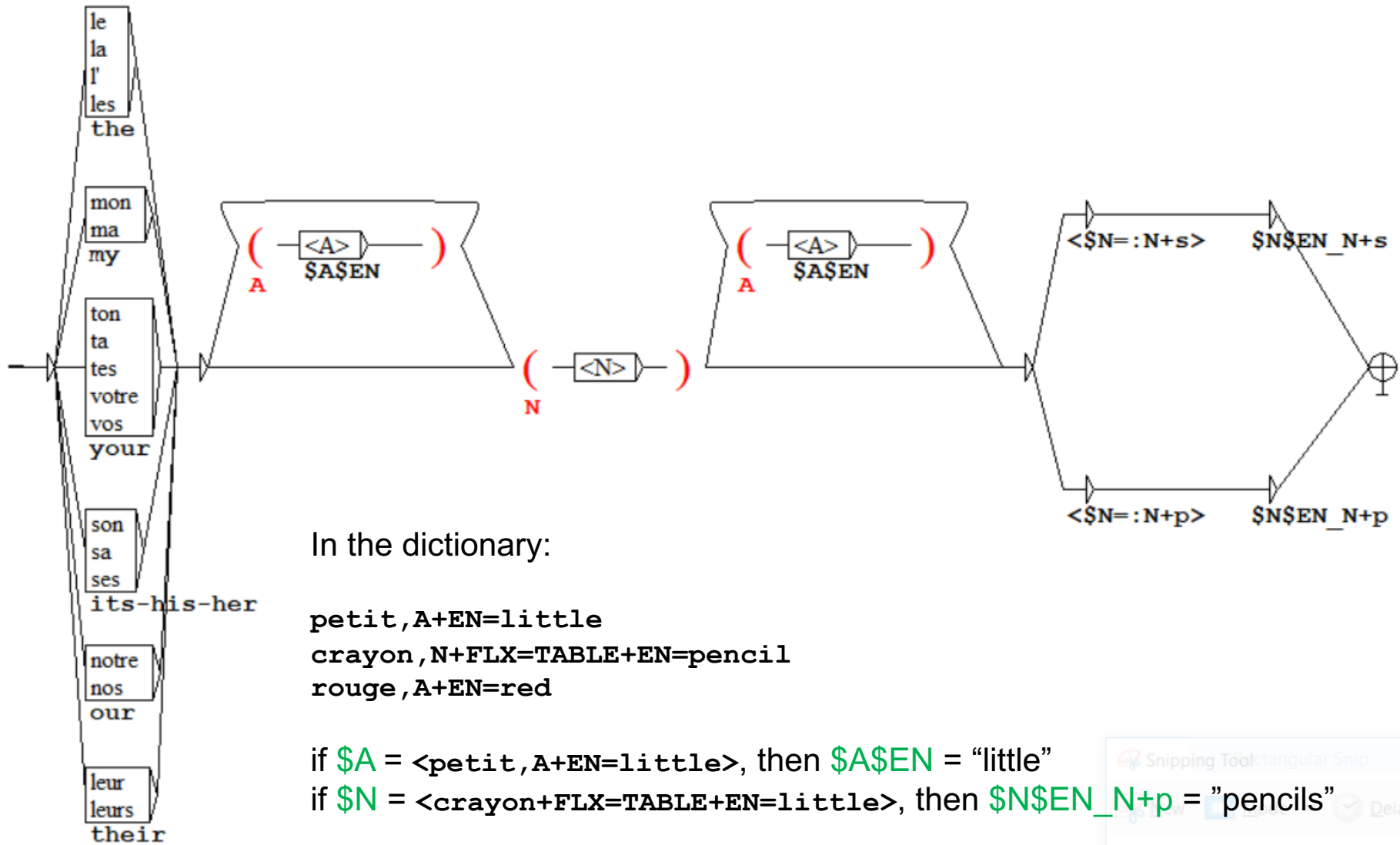
Produce all the transformed sentences from *Luc aime Léa*





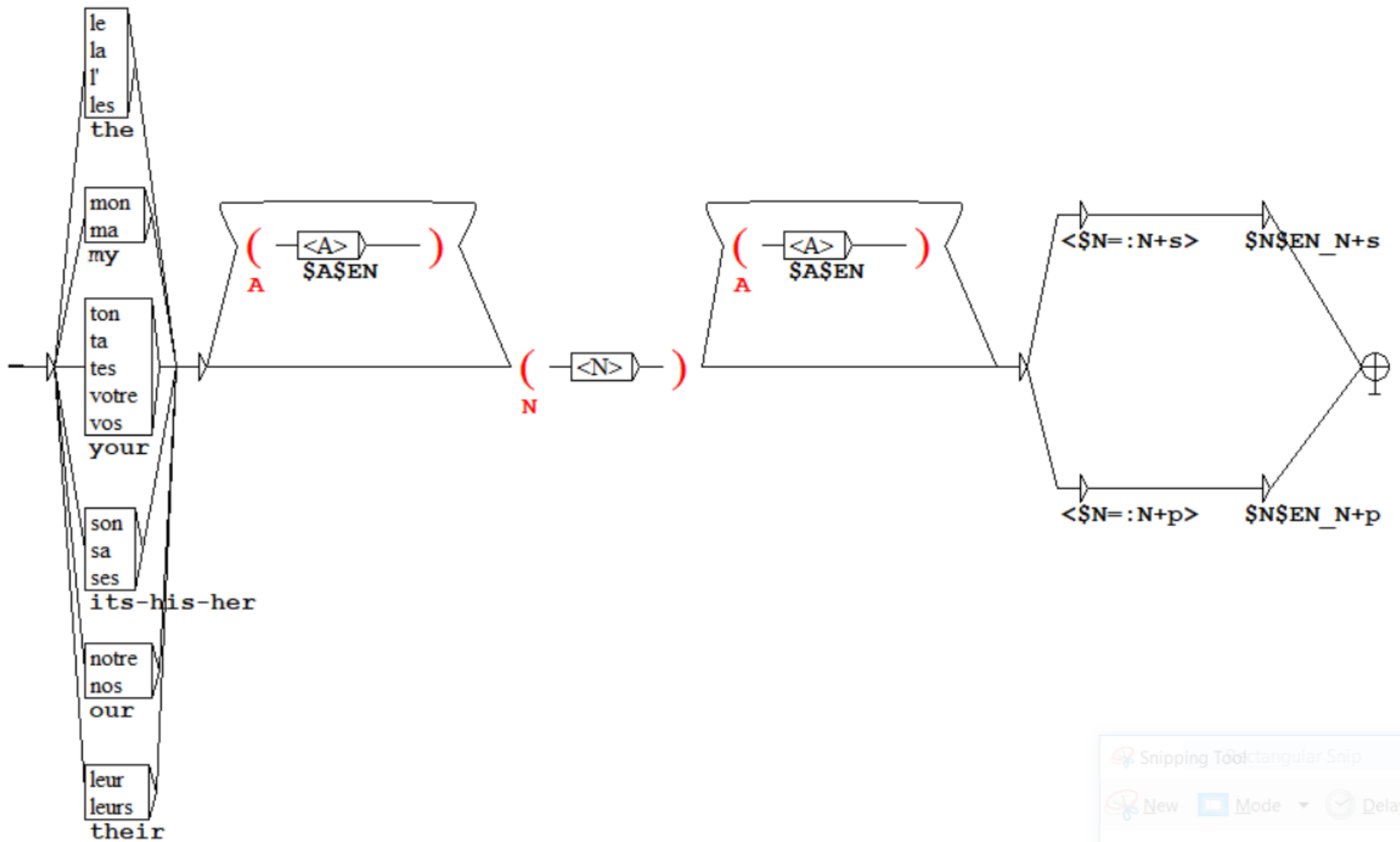
# Unrestricted Grammars in NooJ

## Machine Translation

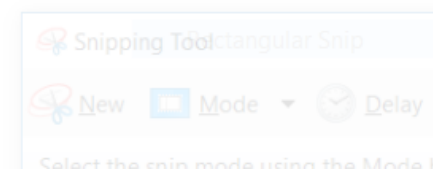


# Unrestricted Grammars in NooJ

## Machine Translation



*le petit crayon rouge → the little red pen*



# Unrestricted Grammars in NooJ

## Machine Translation

The screenshot displays the NooJ software interface. The main window shows a text file named 'fr2en NP.not' with the following content:

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

Below the text, there is a section for 'Show Text Annotation Structure' with a list of options: Characters, Tokens, Digrams, Annotations, and Ambiguities. A checkbox for 'Show Text Annotation Structure' is present.

A 'Concordance for Text fr2en NP.not' window is open, showing a table of matches. The table has four columns: Text, Before, Seq., and After. The matches are listed in red text:

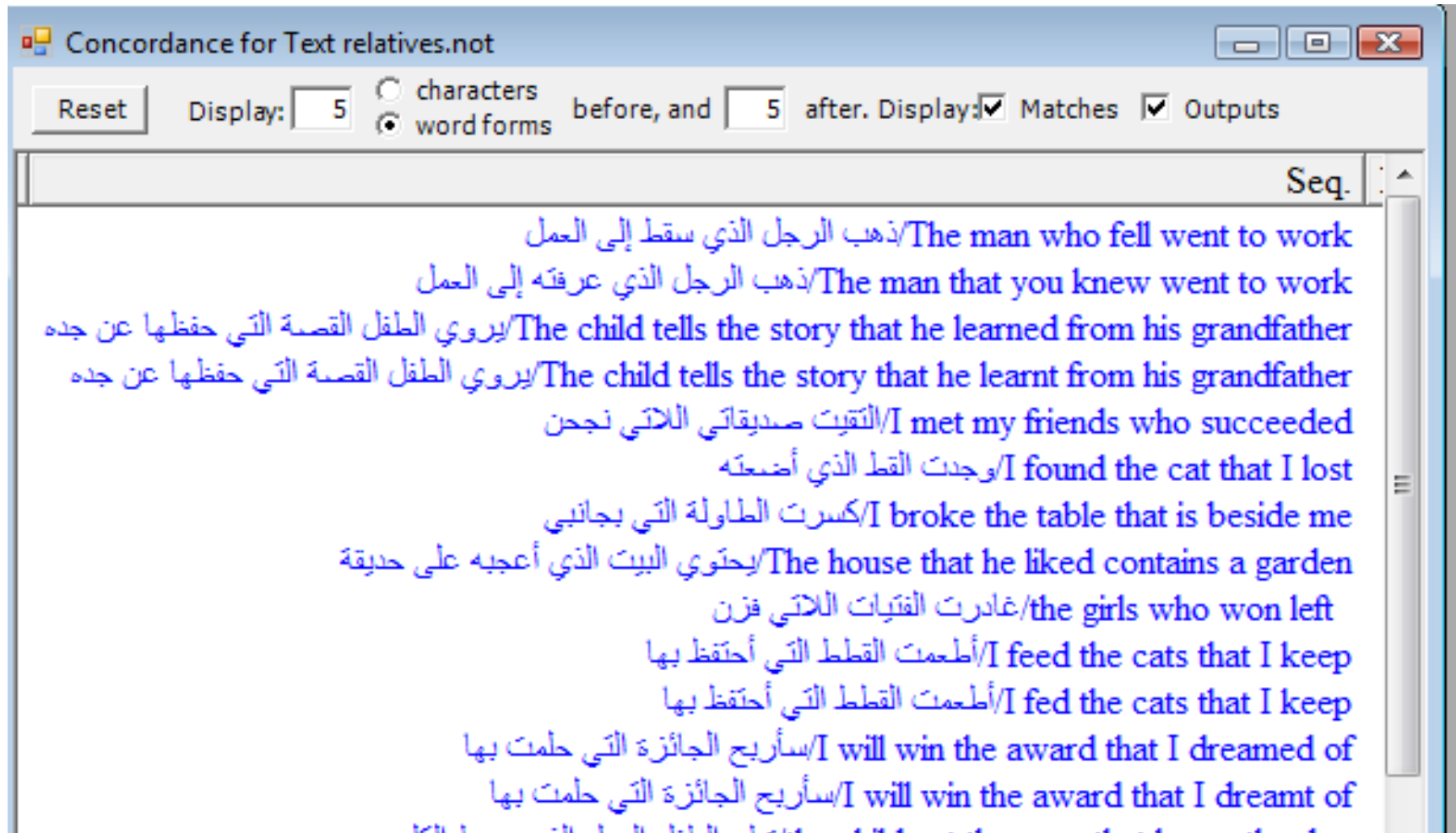
Text	Before	Seq.	After
La petite table		1	the little table
L'attraction		2	the show
Le joli crayon rouge		3	the pretty red pencil
Nos petites tables		4	our little tables
leurs jolis crayons rouges		5	their pretty red pencils
Sa table		6	its-his-her table

The concordance window also includes a 'Query' section at the bottom right showing '6/6' matches.

The bottom of the NooJ window shows a 'Cancel' button and the text 'PROJECT MODE' in red.

# Automatic Machine Translation

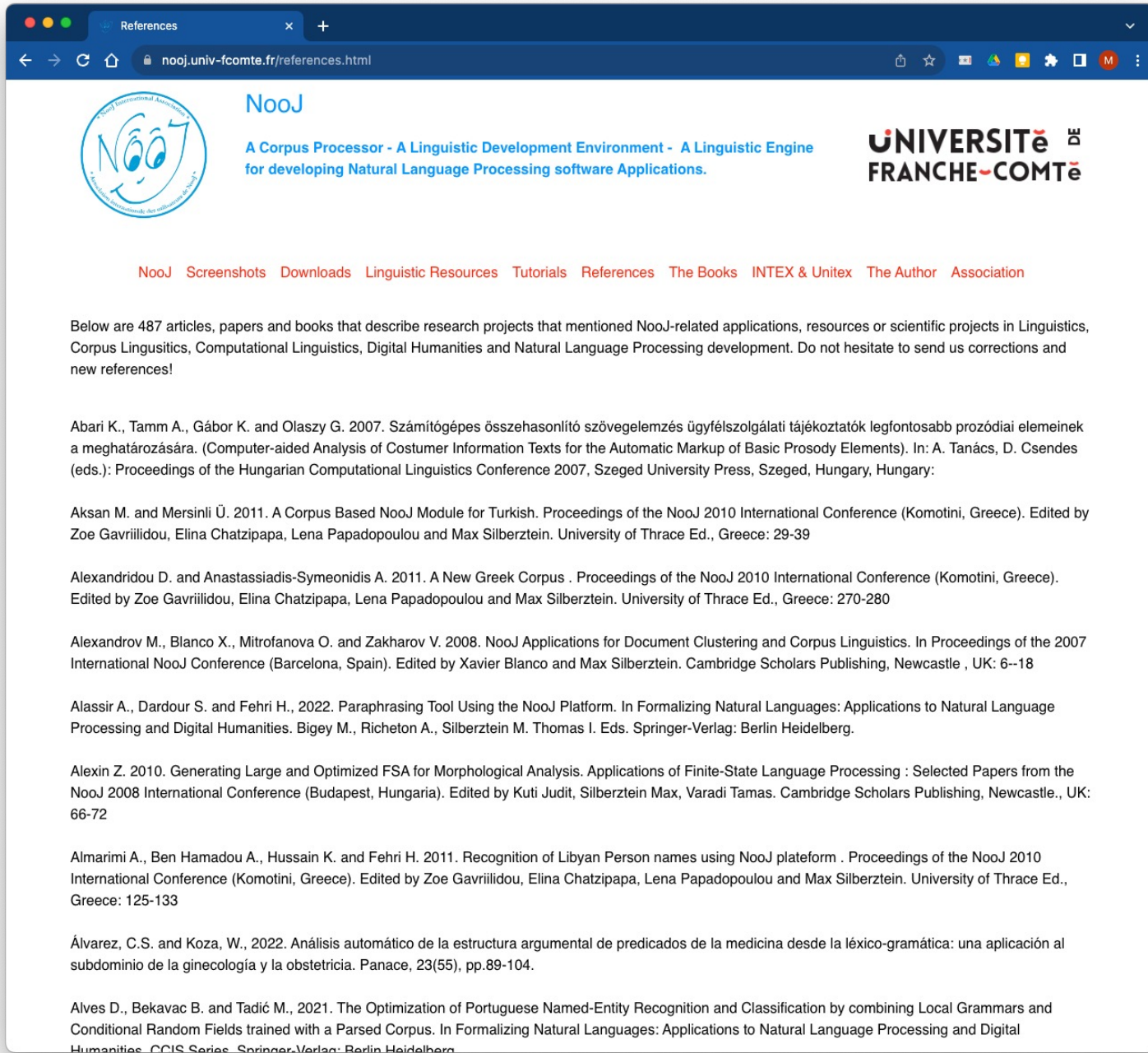
Arabic-French MT (Fehri, 2015-2022), Belarusian-Spanish (Veka, Yakubovich, 2016), Greek-Spanish MT (Papadopoulou, Chadjipapa, 2013), English-Italian MT (Maisto, Guarasci, 2016), Portuguese-English MT (Barreiro, 2008), etc.



# 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)



The screenshot shows a web browser window with the address bar displaying `nooj.univ-fcomte.fr/references.html`. The page features the NooJ logo on the left, which includes a circular emblem with the text "NooJ International Association" and "Association internationale des universitaires de NooJ". To the right of the logo, the text reads "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 FRANCHE-COMTÉ". A horizontal navigation menu contains links: "NooJ", "Screenshots", "Downloads", "Linguistic Resources", "Tutorials", "References", "The Books", "INTEX & Unitex", "The Author", and "Association". The main content area begins with a paragraph stating that 487 articles, papers, and books are listed, describing research projects related to NooJ. It encourages users to send corrections and new references. Below this, several bibliographic entries are provided, including works by Abari K. et al. (2007), Aksan M. and Mersinli Ü. (2011), Alexandridou D. and Anastasiadis-Symeonidis A. (2011), Alexandrov M. et al. (2008), Alassir A. et al. (2022), Alexin Z. (2010), Almarimi A. et al. (2011), Álvarez, C.S. and Koza, W. (2022), and Alves D. et al. (2021).

References

[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.

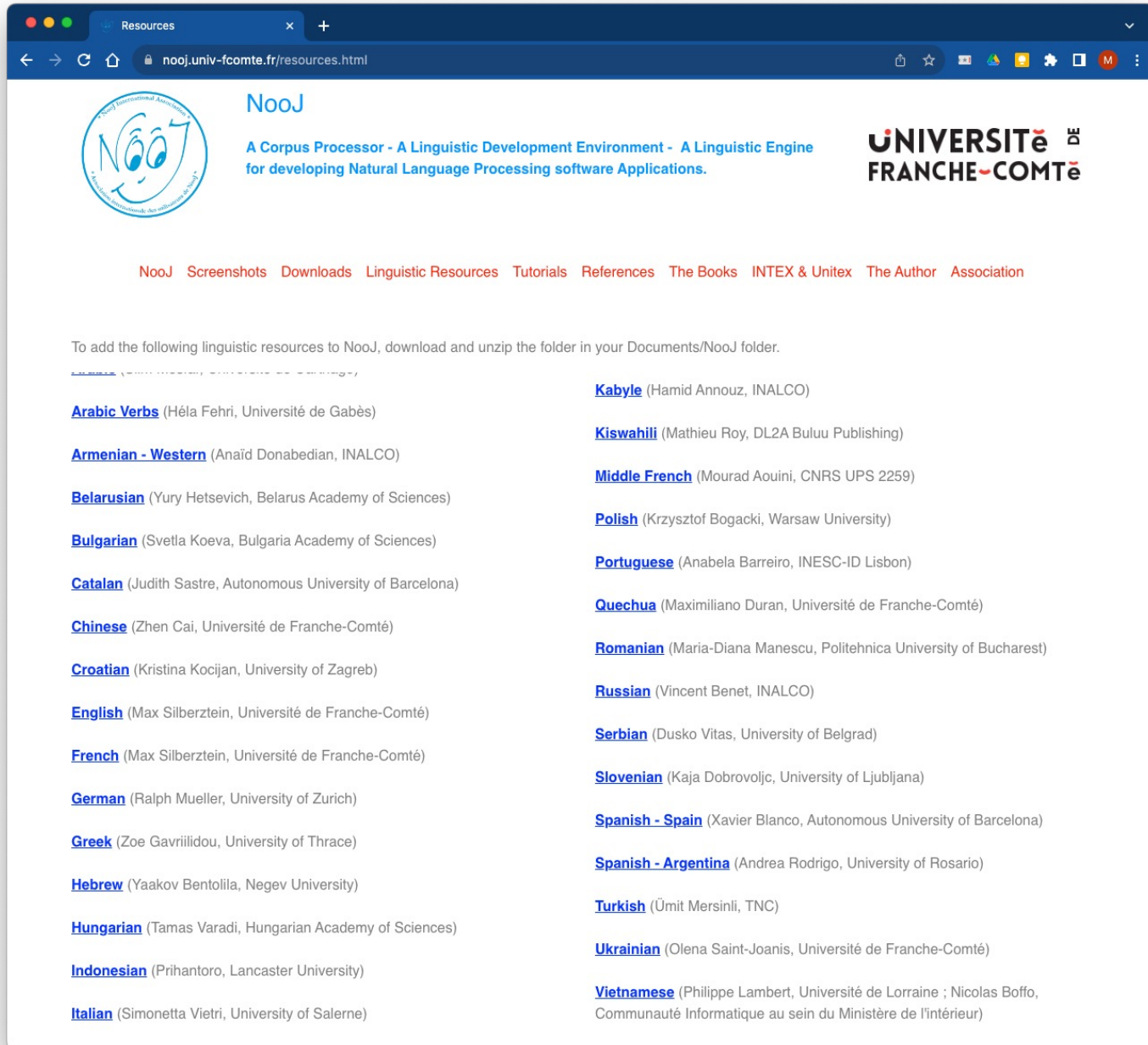
Alexin Z. 2010. Generating Large and Optimized FSA for Morphological Analysis. Applications of Finite-State Language Processing : Selected Papers from the NooJ 2008 International Conference (Budapest, Hungaria). Edited by Kuti Judit, Silberstein Max, Varadi Tamas. Cambridge Scholars Publishing, Newcastle., 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 address bar displaying "nooj.univ-fcomte.fr/resources.html". The page features the NooJ logo on the left, which is a stylized face with the text "NooJ" and "Association International des utilisateurs de NooJ". To the right of the logo, the text reads "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 these 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 area contains a paragraph stating: "To add the following linguistic resources to NooJ, download and unzip the folder in your Documents/NooJ folder." Below this paragraph is a list of 30 language resources, each with a link and the name of the provider. The resources are arranged in two columns.

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

**UNIVERSITÉ DE FRANCHE-COMTÉ**

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

To add the following linguistic resources to NooJ, download and unzip the folder in your Documents/NooJ folder.

[Arabic Verbs](#) (Héla Fehri, Université de Gabès)

[Armenian - Western](#) (Anaïd Donabedian, INALCO)

[Belarusian](#) (Yury Hetsevlch, 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 Silberstein, Université de Franche-Comté)

[French](#) (Max Silberstein, 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.

