Activity Report 2016

Project-Team SEMAGRAMME

Semantic Analysis of Natural Language

Table of contents

<div align="center">

Project-Team SEMAGRAMME

</div>

Creation of the Team: 2011 January 01, updated into Project-Team: 2013 July 01

Keywords:

<u>**Computer Science and Digital Science:**</u>
       5.8. - Natural language processing
       7.4. - Logic in Computer Science
       8.4. - Natural language processing

<u>**Other Research Topics and Application Domains:**</u>
       9.5.8. - Linguistics

1. Members

Research Scientists
    Philippe de Groote [Team leader, Inria, Senior Researcher]
    Bruno Guillaume [Inria, Researcher]
    Sylvain Pogodalla [Inria, Researcher]

Faculty Members
    Maxime Amblard [Univ. Lorraine, Associate Professor, HDR]
    Guy Perrier [Univ. Lorraine, Professor emeritus, HDR]

Engineer
    Nicolas Lefebvre [Inria]

PhD Students
    Clément Beysson [Univ. Lorraine]
    Jirka Maršík [Inria]
    Aleksandre Maskharashvili [Inria, granted by ANR POLYMNIE project]

Administrative Assistants
    Antoinette Courrier [CNRS]
    Sylvie Musilli [Univ. Lorraine]
    Céline Simon [Inria]

Others
    Alexandre Bertrand [Univ. Lorraine, Intern, May 2016]
    Pierre Ludmann [ENS Cachan, Intern, from March 2016 to July 2016]
    Alice Millour [Inria, Intern, from July 2016 to August 2016]
    Stéphane Tiv [Univ. Lorraine, Intern, from February 2016 to June 2016]
    Anh Duc Vu [Univ. Lorraine, Intern, from February 2016 to June 2016]

2. Overall Objectives

2.1. Scientific context

Computational linguistics is a discipline at the intersection of computer science and linguistics. On the theoretical side, it aims to provide computational models of the human language faculty. On the applied side, it is concerned with natural language processing and its practical applications.

From a structural point of view, linguistics is traditionally organized into the following sub-fields:

- Phonology, the study of language abstract sound systems.

- Morphology, the study of word structure.

- Syntax, the study of language structure, i.e., the way words combine into grammatical phrases and sentences.

- Semantics, the study of meaning at the levels of words, phrases, and sentences.

- Pragmatics, the study of the ways in which the meaning of an utterance is affected by its context.

Computational linguistics is concerned by all these fields. Consequently, various computational models, whose application domains range from phonology to pragmatics, have been developed. Among these, logic-based models play an important part, especially at the "higher" levels.

At the level of syntax, generative grammars [31] may be seen as basic inference systems, while categorial grammars [43] are based on substructural logics specified by Gentzen sequent calculi. Finally, model-theoretic grammars [56] amount to sets of logical constraints to be satisfied.

At the level of semantics, the most common approaches derive from Montague grammars [46], [47], [48], which are based on the simply typed λ-calculus and Church's simple theory of types [32]. In addition, various logics (modal, hybrid, intensional, higher-order...) are used to express logical semantic representations.

At the level of pragmatics, the situation is less clear. The word *pragmatics* has been introduced by Morris [50] to designate the branch of philosophy of language that studies, besides linguistic signs, their relation to their users and the possible contexts of use. The definition of pragmatics was not quite precise, and for a long time several authors have considered (and some authors are still considering) pragmatics as the wastebasket of syntax and semantics [27]. Nevertheless, as far as discourse processing is concerned (which includes pragmatic problems such as pronominal anaphora resolution), logic-based approaches have also been successful. In particular, Kamp's Discourse Representation Theory [41] gave rise to sophisticated 'dynamic' logics [40]. The situation, however, is less satisfactory than it is at the semantic level. On the one hand, we are facing a kind of logical "tower of Babel". The various pragmatic logic-based models that have been developed, while sharing underlying mathematical concepts, differ in several respects and are too often based on *ad hoc* features. As a consequence, they are difficult to compare and appear more as competitors than as collaborative theories that could be integrated. On the other hand, several phenomena related to discourse dynamics (e.g., context updating, presupposition projection and accommodation, contextual reference resolution...) are still lacking deep logical explanations. We strongly believe, however, that this situation can be improved by applying to pragmatics the same approach Montague applied to semantics, using the standard tools of mathematical logic.

Accordingly:

> *The overall objective of the Sémagramme project is to design and develop new unifying logic-based models, methods, and tools for the semantic analysis of natural language utterances and discourses. This includes the logical modeling of pragmatic phenomena related to discourse dynamics. Typically, these models and methods will be based on standard logical concepts (stemming from formal language theory, mathematical logic, and type theory), which should make them easy to integrate.*

The project is organized along three research directions (i.e., *Syntax-semantics interface*, *Discourse dynamics*, and *Common basic resources*), which interact as explained below.

2.2. Syntax-semantics interface

The Sémagramme project intends to focus on the semantics of natural languages (in a wider sense than usual, including some pragmatics). Nevertheless, the semantic construction process is syntactically guided, that is, the constructions of logical representations of meaning are based on the analysis of the syntactic structures. We do not want, however, to commit ourselves to such or such specific theory of syntax. Consequently, our approach should be based on an abstract generic model of the syntax-semantic interface.

Here, an important idea of Montague comes into play, namely, the "homomorphism requirement": semantics must appear as a homomorphic image of syntax. While this idea is almost a truism in the context of mathematical logic, it remains challenged in the context of natural languages. Nevertheless, Montague's idea has been quite fruitful, especially in the field of categorial grammars, where van Benthem showed how syntax and semantics could be connected using the Curry-Howard isomorphism [61]. This correspondence is the keystone of the syntax-semantics interface of modern type-logical grammars [49]. It also motivated the definition of our own Abstract Categorial Grammars [3].

Technically, an Abstract Categorial Grammar simply consists of a (linear) homomorphism between two higher-order signatures. Extensive studies have shown that this simple model allows several grammatical formalisms to be expressed, providing them with a syntax-semantics interface for free [4], [59], [60], [54], [42], [55].

We intend to carry on with the development of the Abstract Categorial Grammar framework. At the foundational level, we will define and study possible type theoretic extensions of the formalism, in order to increase its expressive power and its flexibility. At the implementation level, we will continue the development of an Abstract Categorial Grammar support system.

As said above, to consider the syntax-semantics interface as the starting point of our investigations allows us not to be committed to some specific syntactic theory. The Montagovian syntax-semantics interface, however, cannot be considered to be universal. In particular, it does not seem to be that well adapted to dependency and model-theoretic grammars. Consequently, in order to be as generic as possible, we intend to explore alternative models of the syntax-semantics interface. In particular, we will explore relational models where several distinct semantic representations can correspond to the same syntactic structure.

2.3. Discourse dynamics

It is well known that the interpretation of a discourse is a dynamic process. Take a sentence occurring in a discourse. On the one hand, it must be interpreted according to its context. On the other hand, its interpretation affects this context, and must therefore result in an updating of the current context. For this reason, discourse interpretation is traditionally considered to belong to pragmatics. The cut between pragmatics and semantics, however, is not that clear.

As we mentioned above, we intend to apply to some aspects of pragmatics (mainly, discourse dynamics) the same methodological tools Montague applied to semantics. The challenge here is to obtain a completely compositional theory of discourse interpretation, by respecting Montague's homomorphism requirement. We think that this is possible by using techniques coming from programming language theory, in particular, continuation semantics [58], [28], [29], [57] and the related theories of functional control operators [35], [36].

We have indeed successfully applied such techniques in order to model the way quantifiers in natural languages may dynamically extend their scope [5]. We intend to tackle, in a similar way, other dynamic phenomena (typically, anaphora and referential expressions, presupposition, modal subordination...).

What characterize these different dynamic phenomena is that their interpretations need information to be retrieved from a current context. This raises the question of the modeling of the context itself. At a foundational level, we have to answer questions such as the following. What is the nature of the information to be stored in the context? What are the processes that allow implicit information to be inferred from the context? What are the primitives that allow a context to be updated? How does the structure of the discourse and the discourse relations affect the structure of the context? These questions also raise implementation issues. What are the appropriate datatypes? How can we keep the complexity of the inference algorithms sufficiently low?

2.4. Common basic resources

Even if our research primarily focuses on semantics and pragmatics, we nevertheless need syntax. More precisely, we need syntactic trees to start with. We consequently need grammars, lexicons and parsing

algorithms to produce such trees. During the last years, we have developed the notion of interaction grammar [2] as a model of natural language syntax. This includes the development of a grammar for French [53], together with morpho-syntactic lexicons. We intend to continue this line of research and development. In particular, we want to increase the coverage of our French grammar, and provide our parser with more robust algorithms.

Further primary resources are needed in order to put at work a computational semantic analysis of utterances and discourses. As we want our approach to be as compositional as possible, we must develop lexicons annotated with semantic information. This opens the quite wide research area of lexical semantics.

Finally, when dealing with logical representations of utterance interpretations, the need for inference facilities is ubiquitous. Inference is needed in the course of the interpretation process, but also to exploit the result of the interpretation. Indeed, an advantage of using formal logic for semantic representations is the possibility of using logical inference to derive new information. From a computational point of view, however, logical inference may be highly complex. Consequently, we need to investigate which logical fragments can be used efficiently for natural language oriented inference.

3. Research Program

3.1. Overview

The Sémagramme project relies on deep mathematical foundations. We intend to develop models based on well-established mathematics. We seek two main advantages from this approach. On the one hand, by relying on mature theories, we have at our disposal sets of mathematical tools that we can use to study our models. On the other hand, developing various models on a common mathematical background will make them easier to integrate, and will ease the search for unifying principles.

The main mathematical domains on which we rely are formal language theory, symbolic logic, and type theory.

3.2. Formal language theory

Formal language theory studies the purely syntactic and combinatorial aspects of languages, seen as sets of strings (or possibly trees or graphs). Formal language theory has been especially fruitful for the development of parsing algorithms for context-free languages. We use it, in a similar way, to develop parsing algorithms for formalisms that go beyond context-freeness. Language theory also appears to be very useful in formally studying the expressive power and the complexity of the models we develop.

3.3. Symbolic logic

Symbolic logic (and, more particularly, proof-theory) is concerned with the study of the expressive and deductive power of formal systems. In a rule-based approach to computational linguistics, the use of symbolic logic is ubiquitous. As we previously said, at the level of syntax, several kinds of grammars (generative, categorial...) may be seen as basic deductive systems. At the level of semantics, the meaning of an utterance is captured by computing (intermediate) semantic representations that are expressed as logical forms. Finally, using symbolic logics allows one to formalize notions of inference and entailment that are needed at the level of pragmatics.

3.4. Type theory and typed λ-calculus

Among the various possible logics that may be used, Church's simply typed λ-calculus and simple theory of types (a.k.a. higher-order logic) play a central part. On the one hand, Montague semantics is based on the simply typed λ-calculus, and so is our syntax-semantics interface model. On the other hand, as shown by Gallin [39], the target logic used by Montague for expressing meanings (i.e., his intensional logic) is essentially a variant of higher-order logic featuring three atomic types (the third atomic type standing for the set of possible worlds).

4. Application Domains

4.1. Deep semantic analysis

Our applicative domains concern natural language processing applications that rely on a deep semantic analysis. For instance, one may cite the following ones:

- textual entailment and inference,
- dialogue systems,
- semantic-oriented query systems,
- content analysis of unstructured documents,
- text transformation and automatic summarization,
- (semi) automatic knowledge acquisition.

It seems clear, nowadays, that the need for semantics is ubiquitous. Nevertheless, according to the present state of the art, there are only a few applications for which a deep semantic analysis results in a real improvement over non semantic-based techniques. This is due to the fact that most current application chains are such that their weakest links are not located at the semantic level.

4.2. Text Transformation

Text transformation is an application domain featuring two important sub-fields of computational linguistics:

- parsing, from surface form to abstract representation,
- generation, from abstract representation to surface form.

Text simplification or automatic summarization belong to that domain.

We aim at using the framework of Abstract Categorial Grammars we develop to this end. It is indeed a reversible framework that allows both parsing and generation. Its underlying mathematical structure of λ-calculus makes it fit with our type-theoretic approach to discourse dynamics modeling. The ANR project Polymnie (see section 7.2.1.1) is especially dedicated to this aim.

5. New Software and Platforms

5.1. ACGtk

Abstract Categorial Grammar Development Toolkit
KEYWORDS: Natural language processing - NLP - Syntactic analysis - Semantics
FUNCTIONAL DESCRIPTION

ACGtk provides softwares for developing and using Abstract Categorial Grammars (ACG).

- Contact: Sylvain Pogodalla
- URL: http://www.loria.fr/equipes/calligramme/acg/

5.2. Grew

Graph Rewriting
FUNCTIONAL DESCRIPTION

Grew is a Graph Rewriting tool dedicated to applications in NLP. Grew takes into account confluent and non-confluent graph rewriting and it includes several mechanisms that help to use graph rewriting in the context of NLP applications (built-in notion of feature structures, parametrization of rules with lexical information).

In 2016, Grew was used in different applications. The Graph Rewriting System presented in [1] was improved and is used in the preprocessing of data in the ZombiLingo project (see 6.3.1). It was also extensively used in the Universal Dependencies project for improving the French sub-corpus.

- Contact: Bruno Guillaume
- URL: http://grew.loria.fr

5.3. ZombiLingo

FUNCTIONAL DESCRIPTION

ZombiLingo is a GWAP (Game With A Purpose) where gamers have to give linguistic information about the syntax of natural language sentence.

During 2016, the main evolutions of the application were:

- New game modes: for instance the duel mode where two players can compare their results on a set on sentence.
- Integration of data preprocessing, data postprocessing to the back-office.
- Integration of evaluation methods [15] in the back-office.

The current version is used for the French language and it is planned to use it with other languages (English and low-resourced languages).

- Authors: Nicolas Lefebvre, Karën Fort, Bruno Guillaume and Valentin Stern
- Contact: Bruno Guillaume
- Application URL: http://zombilingo.org/
- Code URL: https://github.com/zombilingo

5.4. SLAMtk

A management chain of the transcriptions of interviews for the SLAM project which products of a full anonymized randomized version of the resources. Some extensions have been implemented based on Distagger (disfluences) and MElt (POS and lemma). The tool was reimplemented in order to propose generic treatments for the different corpora.

- Contact: Maxime Amblard
- URL: http://slam.loria.fr

6. New Results

6.1. Syntax-semantics interface

Participants: Philippe de Groote, Sylvain Pogodalla.

6.1.1. *Lambek categorial grammar as abstract categorial grammars*

Abstract Categorial Grammars (ACG, for short) differ from classical categorial grammars in an essential way: the ACG type system is based on a commutative logic (namely, the implicative fragment of multiplicative linear logic). For this reason, it has been argued that the way of encoding wh-extraction in an ACG corresponds to an uncontrolled form of extraction, which results in syntactic overgeneration. In particular, an ACG could not accomodate left and right peripheral extractions like a Lambek categorial grammar (LG, for short) does. In order to challenge this claim, we have shown how LG may be encoded as ACG [14].

6.1.2. *Lexical Semantics*

The interpretation of natural language utterances relies on two complementary elements of natural language modeling. On the one hand, the description of the combinatorics of natural language expresses how elementary units, or *lexical units* (typically the word), combine in order to build more complex elements, such as sentences or discourses. On the other hand, the description of these elementary units specifies how they contribute to the meaning of the whole by their *lexical meaning*. This specification should also take into account how the different parts of the lexical meanings combine during the *composition* process and how they relate to their underlying meaning concepts. For instance, the verbs *buy* and *sell* should refer to a common conceptual representation. However, their syntactic arguments (e.g., the subject) play a different (semantic) role with respect to the *transaction* concept that they share.

The modeling of these concepts and how they relate to each other gave rise to Frames Semantics as a representation format of conceptual and lexical knowledge [37], [30], [25], [45]. Frames consists of directed graphs where nodes correspond to entities (individuals, events, ...) and edges correspond to (functional or non-functional) relations between these entities. Providing a fine-grained representation of the internal concept structure allows both for a *decomposition* of the lexical meaning and for a precise description of the sub-structural interactions in the semantic composition process [44].

Following up on our previous work based on Hybrid Logic (HL) [26], [24] on linking Frames and truth-logical semantics, with a specific focus on explicit quantification over entities or events that are lexically triggered, we extended our model to the interaction between bounded events and *for*-adverbials. This interaction turns bounded events (*John biked to the office*) to iterated events (*John biked to the office for three months*), when the bounded events themselves result from coercing a progression (*John biked*) by addition of a prepositional phrase (*to the office*). We also proposed a modeling taking into account the respective scopes of the quantifiers induced by *for*-adverbials (over events) and quantification introduced by indefinites (over entities) [17]. Finally, we used the flexibility of the approach to model semantic coercion as induced by verbs such as *read* that can syntactically have an entity as argument (*John began a book*) while it semantically relates to an event (e.g., *reading*, *writing*, etc.) [21].

6.2. Discourse dynamics

Participants: Philippe de Groote, Sylvain Pogodalla, Maxime Amblard, Jirka Maršík, Aleksandre Maskharashvili.

6.2.1. *Effects and Handlers in Natural Language*

In formal semantics, logical meanings are assigned to natural language utterances. This process is guided by the principle of compositionality: the meaning of an expression is a function of the meanings of its parts. These functions are often formalized using the λ-calculus. However, there are areas of language which challenge the notion of compositionality, e.g. anaphoric pronouns or presupposition triggers. These force one to either abandon compositionality or adjust the structure of meanings. In the first case, meanings are derived by processes that no longer correspond to pure mathematical functions but rather to context-sensitive procedures, much like the functions of a programming language that manipulate their context with side effects. In the second case, when the structure of meanings is adjusted, the new meanings tend to be instances of the same mathematical structure, the monad. Monads themselves being widely used in functional programming to encode side effects, the common theme that emerges in both approaches is the introduction of side effects. Furthermore, different problems in semantics lead to different theories which are challenging to unite. We claim that by looking at these theories as theories of side effects, we can reuse results from programming language research to combine them.

Our work extends the λ-calculus with a monad of computations. The monad implements effects and handlers, a recent technique in the study of programming language side effects. We have proven some of the fundamental properties of our extended calculus: subject reduction, confluence and termination. We have then demonstrated how to use our calculus to implement treatments of several linguistic phenomena: deixis, quantification, conventional implicature, anaphora and presupposition.

6.2.2. Discourse Modeling with Abstract Categorial Grammars

We have studied several TAG-based grammatical formalisms for discourse analysis (D-LTAG [38], G-TAG [34], and D-STAG [33]), and we have proposed an ACG encodings of them. G-TAG is a formalism introduced for generating natural language texts out of conceptual (semantic) representation inputs. D-STAG is a synchronous formalism for modeling the syntax-semantics interface for discourse. It was introduced for discourse analysis (parsing). The ACG encodings of G-TAG and D-STAG shed light on the problem of clause-medial connectives that TAG-based formalisms do not account for. To deal with a discourse that contains clause-medial connectives, D-LTAG, G-TAG, and D-STAG, all make use of an extra grammatical step. In contrast, the ACG encodings of G-TAG and D-STAG offer a purely grammatical approach to discourse connectives occupying clause-medial positions. The method we propose is a generic one and can serve as a solution for encoding clause-medial connectives with the formalisms based on TAGs. The ACG encodings of G-TAG and D-STAG that we propose are second-order. Importantly, the class of second-order ACGs consists of intrinsically reversible grammars. Grammars of this class use the same polynomial algorithm to build parse structures both for strings and for logical formulas. Thus, second-order ACGs can be used both for parsing and generation. Therefore, the problems of parsing and generation with the ACG encodings of G-TAG and D-STAG are of polynomial complexity.

6.3. Common basic resources

Participants: Bruno Guillaume, Guy Perrier, Nicolas Lefebvre.

6.3.1. Crowdsourcing Complex Language Resources

This work [15] presents the results we obtained on a complex annotation task (that of dependency syntax) using a specifically designed Game with a Purpose, ZombiLingo. [1] The design of the game has to deal with the fact that the task is complex and does not directly rely on human intuition. We show that with suitable mechanisms (decomposition of the task, training of the players and regular control of the annotation quality during the game), it is possible to obtain annotations whose quality is significantly higher than that obtainable with a parser, provided that enough players participate. The source code of the game and the resulting annotated corpora (for French) are freely available.

6.3.2. Universal Dependencies

We participated to development of new versions of the French part of the Universal Dependencies project (http://universaldependencies.org/).

The version 1.3 [52] was released in May. In this version, the lemmatization and the morphological annotation were added automatically when possible and with manual verification for ambiguous occurrences.

The version 1.4 [51] was released in November. This version contains a large number of annotation corrections. The Grew software was used to explore, to check consistency and to correct systematically the data. For instance, all copula annotations where checked manually.

7. Partnerships and Cooperations

7.1. Regional Initiatives

7.1.1. Projets Région

7.1.1.1. SLAM
Participants: Maxime Amblard [coordinator], Philippe de Groote, Sylvain Pogodalla.

---

[1] See: http://zombilingo.org/.

Schizophrenia is well-known among mental illnesses for the strength of the thought disorders it involves, and for their widespread and spectacular manifestations: from deviant social behavior to delusion, not to speak about affective and sensitive distortions. It aims at exploring a specific manifestation, namely disorders in conversational speech. This is an interdisciplinary research, both empirical and theoretical from several domains, namely psychology, philosophy, linguistic and computer science.

The first transcriptions of pathological interviews are analyses. The management chain was implemented for disfluences and POS. Moreover, we have focused on implementing the treatment of lexicography issues and proposed an interface for SDRT-annotations. This year, we have developed a new interaction with the Centre Médical d'Aix-en-Provence in order to collect new interviews. The protocol started at the very end of the year. Moreover we have started the reimplementation of the tool SLAMtk.

The SLAM project was supported by the MSH–Lorraine, USR 3261, the region Grand-Est and the University of Lorraine. We organise the fourth workshop (In)Coherence of Discourse which gather linguists, psychologists and computer scientists in march 2017 : http://discours.loria.fr.

7.1.2. CPER

7.1.2.1. ITL-DI-Oeil
Participant: Maxime Amblard.

Interrelation troubles du langage, discours et processus oculomoteurs

This project is part of another research project about eye-tracking of schizophrenics. It is really close to the SLAM project. One of the main issue is how to collect the data. In order to simplify this clue, the two projects share the same corpus. SLAM is concerned by the transcription of the interviews whereas ITL-DI-Oeil analyses the eye-tracking records.

7.2. National Initiatives

7.2.1. ANR

7.2.1.1. Polymnie: Parsing and synthesis with abstract categorial grammars. From lexicon to discourse
Participants: Maxime Amblard, Philippe de Groote, Aleksandre Maskharashvili, Sylvain Pogodalla [coordinator].

POLYMNIE[2] is a research project funded by the French national research agency (ANR) from September 2012 to February 2016. It relies on the grammatical framework of Abstract Categorial Grammars (ACG). A feature of this formalism is to provide the same mathematical perspective both on the surface forms and on the more abstract forms the latter correspond to. As a consequence:

- ACG allows for the encoding of a large variety of grammatical formalisms such as context-free grammars, Tree Adjoining grammars (TAG), etc.
- ACG defines two languages: an abstract language for the abstract forms, and an object language for the surface forms.

Importantly, the notions of object language and abstract language are relative to each other. If we can naturally see surface forms as strings for instance and abstract forms as the associated syntactic trees, we can also consider to associate this abstract form to a first order logical formula as surface (object) form. This property is central in our project as it offers a unified approach to text analysis and text generation, in particular considering the underlying algorithms and their complexity.

---

[2]http://semagramme.loria.fr/doku.php?id=projects:polymnie

ACG definition uses type-theory and lambda-calculus. From this point of view, they smoothly integrate formal semantics models issuing from Montague's proposal. Theories that extend to the discourse level such as Discourse Representation Theory (DRT) and Dynamic Predicate Logic (DPL) were not initially formulated using lambda-calculus. But such formulations have been proposed. In particular, a formulation based on continuation semantics allows them to be expressed quite naturally in the ACG architecture. Dynamic effects of discourse, in particular those related to anaphora resolution or rhetorical relation inference, have then to be expressed by lexical semantics or computed from the syntactic rules as studied in the Inria Collaborative Research Project (ARC) CAuLD [3].

It has been shown that the discourse structure of texts plays a key role in their understanding. This is the case for both human readers and automatic processing systems. For instance, it can enhance text transformation systems such as the ones performing automatic summarization.

POLYMNIE focuses on studying and implementing the modeling of sentences and discourses in a compositional paradigm that takes into account their dynamics and their structures, both in parsing and in generation. To that end, we rely on the ACG framework. The kind of processing we are interested in relates to the automatic construction of summaries or to text simplification. This has to be considered in the limits of the modeling of the linguistic processes (as opposed to inferential processes for instance) these tasks involve.

Partners:

- Sémagramme people,

- Alpage (Paris 7 university & Inria Paris-Rocquencourt): Laurence Danlos (local coordinator), C. Braud, C. Roze, Éric Villemonte de la Clergerie,

- MELODI (IRIT, CNRS): Stergos Afantenos, Nicholas Asher (local coordinator), Juliette Conrath, Philippe Muller,

- Signes (LaBRI, CNRS): Jérôme Kirman, Richard Moot, Christian Retoré (local coordinator), Sylvain Salvati, Noémie-Fleur Sandillon-Rezer.

The project has been presented during the *journés du numérique de l'ANR* [23]. A demonstration of the ACGtk software has been given during the TALN conference 2016 [22].

7.2.2. DGLFLF (Délégation générale à la langue française et aux langues de France)

7.2.2.1. ZombiLingo
Participants: Bruno Guillaume [coordinator], Nicolas Lefebvre.

The goal of the ZombiLingo project is to develop an online GWAP (Game With A Purpose) to help the construction of linguistic resources. See 6.3.1 for more information.

8. Dissemination

8.1. Promoting Scientific Activities

8.1.1. Scientific Events Organisation

8.1.1.1. General Chair, Scientific Chair
> MAXIME AMBLARD: LACL 2016 *Logical Aspects of Computational Linguistics 2016.*

8.1.1.2. Member of the Organizing Committees
> PHILIPPE DE GROOTE: LACL 2016 *Logical Aspects of Computational Linguistics 2016.*
> SYLVAIN POGODALLA: LACL 2016 *Logical Aspects of Computational Linguistics 2016.*

---

[3]https://members.loria.fr/SPogodalla/files/cauld

8.1.2. Scientific Events Selection

8.1.2.1. Chair of Conference Program Committees

SYLVAIN POGODALLA: co-chair of FG 2016 *21st Conference on Formal Grammar*[19]; co-chair of LACL 2016 (*Logical Aspects of Computational Linguistics 2016*) [18]

MAXIME AMBLARD: co-chair of LACL 2016 (*Logical Aspects of Computational Linguistics 2016*) [18]

8.1.2.2. Member of the Conference Program Committees

PHILIPPE DE GROOTE: FG 2016, *21st Conference on Formal Grammar*; NLCS'16, *Fourth Workshop on Natural Language and Computer Science*; LACL 2016 *Logical Aspects of Computational Linguistics 2016*.

MAXIME AMBLARD: LACL 2016 *Logical Aspects of Computational Linguistics 2016*; TALN 2016 *Traitement Automatique des Langues 2016*; RECITAL 2016 *Rencontre des Étudiants Chercheurs en Informatique pour le Traitement Automatique des Langues*.

GUY PERRIER: HrTAL2016 *10th International Conference on Natural Language Processing*.

8.1.2.3. Reviewer

PHILIPPE DE GROOTE: FG 2016, *21st Conference on Formal Grammar*; NLCS'16, *Fourth Workshop on Natural Language and Computer Science*; LACL 2016 *Logical Aspects of Computational Linguistics 2016*.

SYLVAIN POGODALLA: NISM 2016 *New Ideas in Semantics and Modelisation*; Cognitive Structures: Linguistic, Philosophical and Psychological Perspectives; FG 2016 *21st Conference on Formal Grammar*; LACL 2016 *Logical Aspects of Computational Linguistics 2016*.

MAXIME AMBLARD: LACL 2016 *Logical Aspects of Computational Linguistics 2016*; TALN 2016 *Traitement Automatique des Langues 2016*; RECITAL 2016 *Rencontre des Étudiants Chercheurs en Informatique pour le Traitement Automatique des Langues*.

GUY PERRIER: HrTAL2016 *10th International Conference on Natural Language Processing*; LACL 2016 *Logical Aspects of Computational Linguistics 2016*.

8.1.3. Journal

8.1.3.1. Member of the Editorial Boards

PHILIPPE DE GROOTE: area editor of the *FoLLI-LNCS series*; associate editor of *Higher-Order and Symbolic Computation*; member of the editorial board of *Cahiers du Centre de Logique*.

SYLVAIN POGODALLA: Member of the editorial board of the journal *Traitement Automatique des Langues*, in charge of the *Résumés de thèses* section.

MAXIME AMBLARD: Member of the editorial board of the journal *Traitement Automatique des Langues*, in charge of the final editing process

8.1.3.2. Reviewer - Reviewing Activities

PHILIPPE DE GROOTE: *Journal of Logic, Language and Information*; *Journal of Applied Logic*.

SYLVAIN POGODALLA: *Journal of Language Modelling*; *Traitement Automatique des Langues*.

MAXIME AMBLARD: *Traitement Automatique des Langues*.

8.1.4. Invited Talks

MAXIME AMBLARD: *Sémantique : modélisation formelle et interprétation de données empiriques*, ATILF, Nancy; *L'informaticien face au traitement du langage : que peut-on faire et que croit-on que nous faisons ?*, at the occasion of *Images du savoir pratique : les figures de l'informaticien et du médecin dans les récits de fiction populaire contemporains*, IRIST, Strasbourg.

8.1.5. Leadership within the Scientific Community

PHILIPPE DE GROOTE: vice president of SIGMOL, *Association for Mathematics of Language, a Special Interest Group of the Association for Computational Linguistics*; member of the LACL steering committee.

BRUNO GUILLAUME: nominated as a Management Committee Substitute of the COST Action CA16105 "European Network for Combining Language Learning with Crowdsourcing Techniques" (http://www.cost.eu/COST_Actions/ca/CA16105)

SYLVAIN POGODALLA: member of the LACL steering committee; member of the Formal Grammar standing committee.

8.1.6. Scientific Expertise

PHILIPPE DE GROOTE: expert for the FNRS, *Fond National de la Recherche Scientifique*, Belgium; expert for the *National Science Center*, Poland.

SYLVAIN POGODALLA: expert for the Research Executive Agency (REA) of the EU.

MAXIME AMBLARD: member of the PhD award of ATALA

8.1.7. Research Administration

PHILIPPE DE GROOTE: member of the *bureau du comité des projets d'Inria-Nancy*.

BRUNO GUILLAUME:

- Head of the Loria department NLPKD (Natural Language Processing and Kownledge Discovery)
- Animator of the CPER 2015-2020 project *Langues, Connaissances et Humanités Numériques'* (Languages, Knowledge and Digital Humanities) in which ten laboratories of the *Université de Lorraine* are implied.
- Elected member of the *Pôle scientifique AM2I* of the Université de Lorraine.
- Member of the Comipers (Inria committee for PhD and Post-doctoral selection).

MAXIME AMBLARD:

- member of *conseil scientifique de l'Université de Lorraine*.
- member of *conseil de laboratoire du Loria*
- member of *conseil de gestion de la Maison des sciences de l'homme, MSH-Lorraine*
- head of the master (M2) in Natural Language Processing.
- in charge of the proposal of a new master in NLP.

8.2. Teaching - Supervision - Juries

8.2.1. Teaching

Licence: Maxime Amblard, Formalismes de représentation et raisonnement, 25h, L3, Université de Lorraine, France

Licence: Maxime Amblard, C2i, 20h, L1, Université de Lorraine, France

Licence: Jirka Maršík, Ingénierie linguistique, 25h, L3, Université de Lorraine, France

Master: Maxime Amblard, Formalisms : from Syntax to Discourse, 50h, M2, Univ. Lorraine, France

Master: Maxime Amblard, Remise à niveau TAL, 6h, M2, Université de Lorraine, France

Master: Maxime Amblard, Programming for NLP, 44h, M1, Université de Lorraine, France

Master: Philippe de Groote, Formal logic, 35h, M2, Université de Lorraine, France.

Master: Philippe de Groote, Computational structures and logics for natural language modelling, 18h, M2, Université Paris Diderot, France.

Master : Bruno Guillaume, NLP Toolchain and Linguistic Resources, 15h, M2, Université de Lorraine, France.

Master: Jirka Maršík, IA fondamentale : représentation des connaissances et fouille de données, 11h30, M1, Université de Lorraine, France

Master: Jirka Maršík, Communication scientifique, 15h30, M1, Université de Lorraine, France

Master: Jirka Maršík, Cognitive Aspect of Computational Linguistic, 15h, M2, Université de Lorraine, France

Master: Jirka Maršík, Aspects cognitives de la linguistique computationnelle, 16h30, M2, Université de Lorraine, France

Master: Jirka Maršík, Remise à niveau TAL, 10h, M2, Université de Lorraine, France

Master : Sylvain Pogodalla, Formal Languages, 24h, M2, Université de Lorraine, France.

8.2.2. Supervision

HdR: Maxime Amblard, Sémantique et discours, de la modélisation à l'interprétation, Université de Lorraine, November 28th, 2016, Philippe de Groote.

PhD: Jirka Maršík, Effects and Handlers in Natural Language, Université de Lorraine, December 9th, 2016, Philippe de Groote and Maxime Amblard.

PhD: Aleksandre Maskharashvili, Discourse Modeling with Abstract Categorial Grammars, Université de Lorraine, December 1st, 2016, Philippe de Groote and Sylvain Pogodalla.

PhD in progress: Clément Beysson, Quantificateurs généralisés dynamiques pour l'analyse discursive, since september 2015, Philippe de Groote and Bruno Guillaume.

8.2.3. Juries

PHILIPPE DE GROOTE was member of the jury of the HdR of Maxime Amblard, *Sémantique et discours, de la modélisation à l'interprétation* [6], November 28th, 2016, Université de Lorraine.

PHILIPPE DE GROOTE was member of the jury of the PhD thesis of Aleksandre Maskharashvili, *Discourse Modeling with Abstract Categorial Grammars* [8], December 1st, 2016, Université de Lorraine.

PHILIPPE DE GROOTE was member of the jury of the PhD thesis of Jirka Maršík, *Effects and Handlers in Natural Language* [7], Université de Lorraine, December 9th, 2016, Université de Lorraine.

SYLVAIN POGODALLA was member of the jury of the PhD thesis of Aleksandre Maskharashvili, *Discourse Modeling with Abstract Categorial Grammars* [8], December 1st, 2016, Université de Lorraine.

MAXIME AMBLARD was member of the jury of the PhD thesis of Jirka Maršík, *Effects and Handlers in Natural Language* [7], Université de Lorraine, December 9th, 2016, Université de Lorraine.

GUY PERRIER was member of the jury of the PhD thesis of Bikash Gyawali *Surface Realisation from Knowledge Bases*, January 20, 2016, Université de Lorraine.

8.3. Popularization

- Maxime Amblard is scientific vice head of the editorial board of interstice)i(, a french magazine popularizing computer sciences. He is the head of the rubric *informatique —ou presque— dans les films*.

- Maxime Amblard was scientific expert for the exhibition *Homo Numericus*.

- Bruno Guillaume was invited twice to present and lead an open discussion about Citizen Science: *Séminaire ESPÉ DANE : la pépinière 4.0*, in January, and *Séminaire ESPÉ DANE : la pépinière 4.1*, in October.

- Bruno Guillaume was invited in July to a panel discussion about Citizen Science, *Les rendez-vous de Science&You.*

9. Bibliography

Major publications by the team in recent years

[1] G. BONFANTE, B. GUILLAUME, M. MOREY, G. PERRIER. *Modular Graph Rewriting to Compute Semantics*, in "9th International Conference on Computational Semantics - IWCS 2011", Oxford, Royaume-Uni, J. BOS, S. PULMAN (editors), January 2011, pp. 65–74, http://hal.inria.fr/inria-00579244/en/

[2] B. GUILLAUME, G. PERRIER. *Interaction Grammars*, in "Research on Language & Computation", 2009, vol. 7, pp. 171–208

[3] P. DE GROOTE. *Towards abstract categorial grammars*, in "Association for Computational Linguistics, 39th Annual Meeting and 10th Conference of the European Chapter", Toulouse, France, none, July 2001, pp. 148-155, Colloque avec actes et comité de lecture. internationale, http://hal.inria.fr/inria-00100529/en

[4] P. DE GROOTE, S. POGODALLA. *On the expressive power of abstract categorial grammars: Representing context-free formalisms*, in "Journal of Logic, Language and Information", 2004, vol. 13, n° 4, pp. 421–438

[5] P. DE GROOTE. *Towards a Montagovian Account of Dynamics*, in "16th Semantics and Linguistic Theory conference - SALT2006", Tokyo, Japan, M. GIBSON, J. HOWELL (editors), 2006, http://elanguage.net/journals/index.php/salt/article/view/16.1

Publications of the year

Doctoral Dissertations and Habilitation Theses

[6] M. AMBLARD. *Semantics and Discourse: from modelling to interpretation*, Université de Lorraine (Nancy), November 2016, Habilitation à diriger des recherches, https://hal.inria.fr/tel-01415967

[7] J. MARŠÍK. *Effects and Handlers in Natural Language*, Université de Lorraine, December 2016, https://hal.inria.fr/tel-01417467

[8] A. MASKHARASHVILI. *Discourse Modeling with Abstract Categorial Grammars*, University of Lorraine ; Inria Nancy - Grand Est (Villers-lès-Nancy, France), December 2016, https://hal.inria.fr/tel-01412765

Articles in International Peer-Reviewed Journals

[9] M. AMBLARD. *Pour un TAL responsable*, in "Traitement Automatique des Langues", 2016, vol. 57, n° 2, pp. 21 - 45, https://hal.inria.fr/hal-01414145

[10] M. AMBLARD, A. BOUMAZA. *Human Robots, Are You Real Then?*, in "Iride", 2016, vol. XXIX, n° 2, pp. 287-298 [*DOI :* 10.1414/84251], https://hal.inria.fr/hal-01391754

[11] S. QIAN, P. DE GROOTE, M. AMBLARD. *Modal Subordination in Type Theoretic Dynamic Logic*, in "Linguistic Issues in Language Technology", August 2016, vol. 14, 54 p. , https://hal.inria.fr/hal-01370557

Invited Conferences

[12] M. AMBLARD. *L'informaticien face au traitement du langage : que peut-on faire et que croit-on que nous faisons ?*, in "Séminaire 2015/2016 « Images du savoir pratique : les figures de l'informaticien et du médecin dans les récits de fiction populaire contemporains", Strasbourg, France, February 2016, https://hal.inria.fr/hal-01280932

International Conferences with Proceedings

[13] L. DANLOS, A. MASKHARASHVILI, S. POGODALLA. *Interfacing Sentential and Discourse TAG-based Grammars*, in "The 12th International Workshop on Tree Adjoining Grammars and Related Formalisms (TAG+12)", Düsseldorf, Germany, Proceedings of the 12th International Workshop on Tree Adjoining Grammars and Related Formalisms (TAG+12), June 2016, https://hal.inria.fr/hal-01328697

[14] P. DE GROOTE. *Lambek Categorial Grammars as Abstract Categorial Grammars*, in "LENLS 13", Tokyo, Japan, Logic and Engineering of Natural Language Semantics 13, October 2016, https://hal.inria.fr/hal-01412795

[15] B. GUILLAUME, K. FORT, N. LEFÈBVRE. *Crowdsourcing Complex Language Resources: Playing to Annotate Dependency Syntax*, in "International Conference on Computational Linguistics (COLING)", Osaka, Japan, Proceedings of the 26th International Conference on Computational Linguistics (COLING), December 2016, https://hal.inria.fr/hal-01378980

[16] J. MARŠÍK, M. AMBLARD. *Introducing a Calculus of Effects and Handlers for Natural Language Semantics*, in "Formal Grammar 2016", Bozen-Bolzano, Italy, A. FORET, G. MORRILL, R. MUSKENS, R. OSSWALD, S. POGODALLA (editors), Lecture Notes in Computer Science,, Springer Berlin Heidelberg, August 2016, vol. 9804, pp. 257–272 [*DOI :* 10.1007/978-3-662-53042-9], https://hal.inria.fr/hal-01332762

Scientific Books (or Scientific Book chapters)

[17] L. KALLMEYER, R. OSSWALD, S. POGODALLA. *For-Adverbials and Aspectual Interpretation: An LTAG Analysis Using Hybrid Logic and Frame Semantics*, in "Empirical Issues in Syntax and Semantics 11", C. PIÑÓN (editor), Empirical Issues in Syntax and Semantics, 2016, vol. 11, https://hal.inria.fr/hal-01417847

Books or Proceedings Editing

[18] M. AMBLARD, P. DE GROOTE, S. POGODALLA, C. RETORÉ (editors). *Logical Aspects of Computational Linguistics. Celebrating 20 Years of LACL (1996–2016): 9th International Conference, LACL 2016, Nancy, France, December 5-7, 2016, Proceedings*, Lecture Notes in Computer Science, Springer Berlin Heidelberg, Nancy, France, 2016, vol. 10054 [*DOI :* 10.1007/978-3-662-53826-5], https://hal.inria.fr/hal-01403271

[19] A. FORET, G. MORRILL, R. MUSKENS, R. OSSWALD, S. POGODALLA (editors). *Formal Grammar: 20th and 21st International Conferences, FG 2015, Barcelona, Spain, August 2015, Revised Selected Papers. FG 2016, Bozen, Italy, August 2016, Proceedings*, Lecture Notes in Computer Science, Springer Berlin Heidelberg, Italy, 2016, vol. 9804 [*DOI :* 10.1007/978-3-662-53042-9], https://hal.inria.fr/hal-01360105

Scientific Popularization

[20] M. AMBLARD. *Regard sur « À quoi rêvent les algorithmes »*, in "Interstices", January 2016, https://hal.inria.fr/hal-01280938

Other Publications

[21] L. KALLMEYER, R. OSSWALD, S. POGODALLA. *Quantification in Frame Semantics with Binders and Nominals of Hybrid Logic*, December 2016, Submitted, https://hal.inria.fr/hal-01417853

[22] S. POGODALLA. *ACGTK: un outil de développement et de test pour les grammaires catégorielles abstraites*, Actes de la 23ème Conférence sur le Traitement Automatique des Langues Naturelles, 31ème Journées d'Études sur la Parole, 18ème Rencontre des Étudiants Chercheurs en Informatique pour le Traitement Automatique des Langues, July 2016, JEP-TALN-RECITAL 2016, Poster - Démonstration aux 23ème Conférence sur le Traitement Automatique des Langues Naturelles JEP-TALN-RECITAL 2016, Paris, France, https://hal.inria.fr/hal-01328702

[23] S. POGODALLA. *Parsing and Generation with Abstract Categorial Grammars : From Lexicon to Discourse*, November 2016, Les rencontres du numérique de l'ANR, Poster, https://hal.inria.fr/hal-01417895

References in notes

[24] P. BLACKBURN, J. V. BENTHEM, F. WOLTER (editors). *Handbook of Modal Logic*, Studies in Logic and Practical Reasoning, Elsevier, 2007, vol. 3

[25] T. GAMERSCHLAG, D. GERLAND, R. OSSWALD, W. PETERSEN (editors). *Frames and Concept Types*, Studies in Linguistics and Philosophy, Springer International Publishing, 2014, vol. 94, http://dx.doi.org/10.1007/978-3-319-01541-5

[26] C. ARECES, B. TEN CATE. *Hybrid logics*, in "Handbook of Modal Logic", P. BLACKBURN, J. V. BENTHEM, F. WOLTER (editors), Studies in Logic and Practical Reasoning, Elsevier, 2007, vol. 3, chap. 14, pp. 821–868, http://dx.doi.org/10.1016/S1570-2464(07)80017-6

[27] Y. BAR-HILLEL. *Out of the pragmatic wastebasket*, in "Linguistic Inquiry", 1971, vol. 2, n° 3, pp. 401–407

[28] C. BARKER. *Continuations and the Nature of Quantification*, in "Natural Language Semantics", 2002, vol. 10, n° 3, pp. 211–242

[29] C. BARKER. *Continuations in Natural Language*, in "Proceedings of the Fourth ACM SIGPLAN Continuations Workshop (CW'04)", 2004

[30] L. BARSALOU. *Frames, concepts, and conceptual fields*, in "Frames, fields, and contrasts: New essays in semantic and lexical organization", Hillsdale, A. LEHRER, E. F. KITTEY (editors), Lawrence Erlbaum Associates, 1992, pp. 21–74

[31] N. CHOMSKY. *Three models for the description of language*, in "Information Theory, IRE Transactions on", 1956, vol. 2, n° 3, pp. 113–124

[32] A. CHURCH. *A formulation of the simple theory of types*, in "The journal of symbolic logic", 1940, vol. 5, n° 2, pp. 56–68

[33] L. DANLOS. *D-STAG: a discourse analysis formalism based on synchronous TAGs*, in "TAL", 2009, vol. 50, n° 1, pp. 111–143

[34] L. DANLOS. *G-TAG : un formalisme lexicalisé pour la génération de textes inspiré de TAG*, in "Traitement Automatique des Langues", 1998, vol. 39, n⁰ 2, 28 p p.

[35] M. FELLEISEN, D. P. FRIEDMAN, E. KOHLBECKER, B. DUBA. *A syntactic theory of sequential control*, in "Theor. Comput. Sci.", June 1987, vol. 52, pp. 205–237, http://dx.doi.org/10.1016/0304-3975(87)90109-5

[36] M. FELLEISEN, R. HIEB. *The revised report on the syntactic theories of sequential control and state*, in "Theoretical Computer Science", 1992, vol. 103, n⁰ 2, pp. 235 - 271 [*DOI :* 10.1016/0304-3975(92)90014-7], http://www.sciencedirect.com/science/article/pii/0304397592900147

[37] C. J. FILLMORE. *Frame Semantics*, in "Linguistics in the Morning Calm", Seoul, T. L. S. OF KOREA (editor), Hanshin Publishing Co., 1982, pp. 111–137

[38] K. FORBES, E. MILTSAKAKI, R. PRASAD, A. SARKAR, A. K. JOSHI, B. L. WEBBER. *D-LTAG System: Discourse Parsing with a Lexicalized Tree-Adjoining Grammar*, in "Journal of Logic, Language and Information", 2003, vol. 12, n⁰ 3, pp. 261–279

[39] D. GALLIN. *Intensional and higher-order modal logic: with applications to Montague semantics*, North-Holland mathematics studies, North-Holland, 1975, http://books.google.fr/books?id=jkiNo5Rok7cC

[40] J. GROENENDIJK, M. STOKHOF. *Dynamic predicate logic*, in "Linguistics and philosophy", 1991, vol. 14, n⁰ 1, pp. 39–100

[41] H. KAMP, U. REYLE. *From discourse to logic: Introduction to modeltheoretic semantics of natural language, formal logic and discourse representation theory*, Kluwer Academic Dordrecht, The Netherlands, 1993, vol. 42

[42] M. KANAZAWA, S. SALVATI. *Generating Control Languages with Abstract Categorial Grammars*, in "Proceedings of the 12th conference on Formal Grammar", 2007

[43] J. LAMBEK. *The mathematics of sentence structure*, in "The American Mathematical Monthly", 1958, vol. 65, n⁰ 3, pp. 154–170

[44] S. LÖBNER. *Sub-compositionality*, in "The Oxford Handbook of Compositionality", M. WERNING, W. HINZEN, E. MACHERY (editors), Oxford Handbooks in Linguistics, Oxford University Press, 2012, chap. 10, pp. 220-241

[45] S. LÖBNER. *Evidence for frames from human language*, in "Frames and Concept Types", Dordrecht, T. GAMERSCHLAG, D. GERLAND, R. OSSWALD, W. PETERSEN (editors), Studies in Linguistics and Philosophy, Springer, 2014, vol. 94, n⁰ 94, pp. 23–67, http://dx.doi.org/10.1007/978-3-319-01541-5_2

[46] R. MONTAGUE. *English as a formal language*, in "Linguaggi nella societae nella tecnica", 1970, pp. 189–224

[47] R. MONTAGUE. *Universal grammar*, in "Theoria", 1970, vol. 36, n⁰ 3, pp. 373–398

[48] R. MONTAGUE. *The Proper Treatment of Quantification in Ordinary English*, in "Formal Semantics", 1973, pp. 221–242

[49] M. MOORTGAT. *Categorial type logics*, in "Handbook of logic and language", 1997, pp. 93–177

[50] C. MORRIS. *Foundations of the Theory of Signs*, University of Chicago Press, 1938, vol. 1

[51] J. NIVRE, Ž. AGIĆ, L. AHRENBERG, M. J. ARANZABE, M. ASAHARA, A. ATUTXA, M. BALLES-
TEROS, J. BAUER, K. BENGOETXEA, Y. BERZAK, R. A. BHAT, E. BICK, C. BÖRSTELL, C. BOSCO,
G. BOUMA, S. BOWMAN, G. CEBIROĞLU ERYIĞIT, G. G. A. CELANO, F. CHALUB, Ç. ÇÖLTEKIN, M.
CONNOR, E. DAVIDSON, M.-C. DE MARNEFFE, A. DIAZ DE ILARRAZA, K. DOBROVOLJC, T. DOZAT, K.
DROGANOVA, P. DWIVEDI, M. ELI, T. ERJAVEC, R. FARKAS, J. FOSTER, C. FREITAS, K. GAJDOŠOVÁ,
D. GALBRAITH, M. GARCIA, M. GÄRDENFORS, S. GARZA, F. GINTER, I. GOENAGA, K. GOJENOLA,
M. GÖKIRMAK, Y. GOLDBERG, X. GÓMEZ GUINOVART, B. GONZÁLES SAAVEDRA, M. GRIONI, N.
GRŪZĪTIS, B. GUILLAUME, J. HAJIČ, L. HÀ MỸ, D. HAUG, B. HLADKÁ, R. ION, E. IRIMIA, A. JO-
HANNSEN, F. JØRGENSEN, H. KAŞIKARA, H. KANAYAMA, J. KANERVA, B. KATZ, J. KENNEY, N. KOT-
SYBA, S. KREK, V. LAIPPALA, L. LAM, P. LÊ HỒNG, A. LENCI, N. LJUBEŠIĆ, O. LYASHEVSKAYA, T.
LYNN, A. MAKAZHANOV, C. MANNING, C. MĂRĂNDUC, D. MAREČEK, H. MARTÍNEZ ALONSO, A.
MARTINS, J. MAŠEK, Y. MATSUMOTO, R. MCDONALD, A. MISSILÄ, V. MITITELU, Y. MIYAO, S. MON-
TEMAGNI, K. S. MORI, S. MORI, B. MOSKALEVSKYI, K. MUISCHNEK, N. MUSTAFINA, K. MÜÜRISEP,
L. NGUYỄN THỊ, H. NGUYỄN THỊ MINH, V. NIKOLAEV, H. NURMI, P. OSENOVA, R. ÖSTLING, L. ØVRE-
LID, V. PAIVA, E. PASCUAL, M. PASSAROTTI, C.-A. PEREZ, S. PETROV, J. PIITULAINEN, B. PLANK, M.
POPEL, L. PRETKALNIŅA, P. PROKOPIDIS, T. PUOLAKAINEN, S. PYYSALO, A. RADEMAKER, L. RA-
MASAMY, L. REAL, L. RITUMA, R. ROSA, S. SALEH, B. SAULĪTE, S. SCHUSTER, W. SEEKER, M. SER-
AJI, L. SHAKUROVA, M. SHEN, N. SILVEIRA, M. SIMI, R. SIMIONESCU, K. SIMKÓ, M. ŠIMKOVÁ, K.
SIMOV, A. SMITH, C. SPADINE, A. SUHR, U. SULUBACAK, Z. SZÁNTÓ, T. TANAKA, R. TSARFATY, F.
TYERS, S. UEMATSU, L. URIA, G. VAN NOORD, V. VARGA, V. VINCZE, L. WALLIN, J. X. WANG, J.
N. WASHINGTON, M. WIRÉN, Z. ŽABOKRTSKÝ, A. ZELDES, D. ZEMAN, H. ZHU. *Universal Dependen-
cies 1.4*, 2016, LINDAT/CLARIN digital library at the Institute of Formal and Applied Linguistics, Charles
University in Prague, http://hdl.handle.net/11234/1-1827

[52] J. NIVRE, Ž. AGIĆ, L. AHRENBERG, M. J. ARANZABE, M. ASAHARA, A. ATUTXA, M. BALLESTEROS,
J. BAUER, K. BENGOETXEA, Y. BERZAK, R. A. BHAT, C. BOSCO, G. BOUMA, S. BOWMAN, G.
CEBIROĞLU ERYIĞIT, G. G. A. CELANO, Ç. ÇÖLTEKIN, M. CONNOR, M.-C. DE MARNEFFE, A. DIAZ
DE ILARRAZA, K. DOBROVOLJC, T. DOZAT, K. DROGANOVA, T. ERJAVEC, R. FARKAS, J. FOSTER, D.
GALBRAITH, S. GARZA, F. GINTER, I. GOENAGA, K. GOJENOLA, M. GOKIRMAK, Y. GOLDBERG, X.
GÓMEZ GUINOVART, B. GONZÁLES SAAVEDRA, N. GRŪZĪTIS, B. GUILLAUME, J. HAJIČ, D. HAUG,
B. HLADKÁ, R. ION, E. IRIMIA, A. JOHANNSEN, H. KAŞIKARA, H. KANAYAMA, J. KANERVA, B.
KATZ, J. KENNEY, S. KREK, V. LAIPPALA, L. LAM, A. LENCI, N. LJUBEŠIĆ, O. LYASHEVSKAYA, T.
LYNN, A. MAKAZHANOV, C. MANNING, C. MĂRĂNDUC, D. MAREČEK, H. MARTÍNEZ ALONSO, J.
MAŠEK, Y. MATSUMOTO, R. MCDONALD, A. MISSILÄ, V. MITITELU, Y. MIYAO, S. MONTEMAGNI,
K. S. MORI, S. MORI, K. MUISCHNEK, N. MUSTAFINA, K. MÜÜRISEP, V. NIKOLAEV, H. NURMI, P.
OSENOVA, L. ØVRELID, E. PASCUAL, M. PASSAROTTI, C.-A. PEREZ, S. PETROV, J. PIITULAINEN, B.
PLANK, M. POPEL, L. PRETKALNIŅA, P. PROKOPIDIS, T. PUOLAKAINEN, S. PYYSALO, L. RAMASAMY,
L. RITUMA, R. ROSA, S. SALEH, B. SAULĪTE, S. SCHUSTER, W. SEEKER, M. SERAJI, L. SHAKUROVA,
M. SHEN, N. SILVEIRA, M. SIMI, R. SIMIONESCU, K. SIMKÓ, K. SIMOV, A. SMITH, C. SPADINE, A.
SUHR, U. SULUBACAK, Z. SZÁNTÓ, T. TANAKA, R. TSARFATY, F. TYERS, S. UEMATSU, L. URIA, G.
VAN NOORD, V. VARGA, V. VINCZE, J. X. WANG, J. N. WASHINGTON, Z. ŽABOKRTSKÝ, D. ZEMAN,
H. ZHU. *Universal Dependencies 1.3*, 2016, LINDAT/CLARIN digital library at the Institute of Formal and
Applied Linguistics, Charles University in Prague, http://hdl.handle.net/11234/1-1699

[53] G. PERRIER. *A French Interaction Grammar*, in "International Conference on Recent Advances in Natural
Language Processing - RANLP 2007", Borovets, Bulgarie, G. ANGELOVA, K. BONTCHEVA, R. MITKOV,

N. NICOLOV, K. SIMOV (editors), INCOMA Ltd, Shoumen, Bulgaria, 2007, pp. 463-467, http://hal.inria.fr/inria-00184108/en/

[54] S. POGODALLA. *Computing Semantic Representation: Towards ACG Abstract Terms as Derivation Trees*, in "Seventh International Workshop on Tree Adjoining Grammar and Related Formalisms - TAG+7", Vancouver, BC, Canada, 2004, pp. 64-71, Colloque avec actes et comité de lecture. Internationale, https://hal.inria.fr/inria-00107768

[55] C. RETORÉ, S. SALVATI. *A Faithful Representation of Non-Associative Lambek Grammars in Abstract Categorial Grammars*, in "Journal of Logic Language and Information", April 2010, vol. 19, n° 2, pp. 185–200, http://hal.inria.fr/inria-00409557/en/

[56] J. ROGERS. *A model-theoretic framework for theories of syntax*, in "Proceedings of the 34th annual meeting on Association for Computational Linguistics", Association for Computational Linguistics, 1996, pp. 10–16

[57] C.-C. SHAN. *Delimited continuations in natural language: quantification and polarity sensitivity*, in "CoRR", 2004, vol. cs.CL/0404006

[58] C. STRACHEY, C. P. WADSWORTH. *Continuations: A Mathematical Semantics for Handling Full Jumps*, in "Higher-Order and Symbolic Computation", 1974, vol. 13, pp. 135–152

[59] P. DE GROOTE. *Tree-Adjoining Grammars as Abstract Categorial Grammars*, in "TAG+6, Proceedings of the sixth International Workshop on Tree Adjoining Grammars and Related Frameworks", Università di Venezia, 2002, pp. 145–150

[60] P. DE GROOTE, S. POGODALLA. *m-linear context-free rewriting systems as abstract categorial grammars*, in "oceedings of Mathematics of Language - MOL-8", 2003

[61] J. VAN BENTHEM. *Essays in logical semantics*, Reidel, 1986, n° 29