PROGR A M

ESSLLI is the Annual Summer School of FoLLI,
The Association for Logic, Language and Information
http://www.folli.org
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3
Chapter 1

Welcome

The Programme Committee and Organization Committee for the 19th European Summer School in Logic, Language and Information warmly welcome you to Ireland, and to Trinity College Dublin, in particular.

Tomaž Erjavec
Programme Committee Chair
Institute Josef Stefan

Carl Vogel
Organization Committee Chair
Trinity College Dublin

Caveats

You will have noticed by now that the Organization Committee is far from perfect. This printed program will certainly have inaccuracies. You may wish to keep track of the live website even during the event as announcements get posted there. The live website will also contain a link to a copy of the static site replicated on the CD, with course readers and its interlinked schedule and course descriptions.
Chapter 2

Organization

Program Committee

Chair: Tomaž Erjavec

Local Co-chair: Tim Fernando

Area Specialists: Nissim Francez and Makoto Kanazawa (Logic and Language)
Michael Fisher and Balder ten Cate (Logic and Computation)
Dan Cristea and Geert-Jan Kruijff (Language and Computation)

Organizing Committee

Local Organizers: Carl Vogel (Chair)
Martin Emms
Tim Fernando
Saturnino Luz
Gillian Long
Alena Moison

An awful lot of other people helped out, among them:

Ann Devitt
Jennifer Foster
Daniel Iseman
Jerom Janssen
Claire Jessel

Amelia Kelly
Ger Lynch
Grainne Lynch
Majdi Mohammed
Dominique Mulvaney

Eva Florencio Nieto
Mary Ronner
Elaine Ui Dhonnchadha
Aengus Walton
Chapter 3

Timetable of All Sessions

3.1 Calendar of Events

Saturday, August 4  Formal Grammar Check-in 9am [Lloyd Institute Foyer]
Saturday, August 4  Formal Grammar 9:30am [Lloyd 1]
Saturday, August 4  Formal Grammar Dinner 8pm [O’Neill’s on Suffolk Street]
Sunday, August 5  Formal Grammar 9:30am [Lloyd 1]
Sunday, August 5  Registration Opens 2pm-6pm [Arts Block]
Sunday, August 5  Welcome Reception 7pm-9pm [The Atrium]
Monday, August 6  Courses begin 9am!
Monday, August 6  Coffee 10:30am [Arts Building near Registration]
Monday, August 6  Lunch 12:30am [The Dining Hall]
Tuesday, August 7  Coffee 10:30am [Arts Building near Registration]
Tuesday, August 7  Evening Lecture: Alexander Koller 7pm [Burke Theatre]
Wednesday, August 8  Coffee 10:30am [Arts Building near Registration]
Thursday, August 9  Coffee 10:30am [Arts Building near Registration]
Thursday, August 9  Beth Prize: 6:30 pm [Burke Theatre]
Thursday, August 9  Evening Lecture: Michael Witbrock 7pm [Burke Theatre]
Friday, August 10  Coffee 10:30am [Arts Building near Registration]
Friday, August 10  8pm Week 1 Lecturer’s Dinner [TBA]

CHAPTER 8. USEFUL INFORMATION

8.2.2 Other Stuff

Notice Boards  It is possible to post notices on the pillars at the registration desk or on the noticeboard in the Lloyd Institute.

Sports  Sign-up for the football match at Herbert Park (Monday, August 13 – 7pm) and croquet (Saturday and Sunday, 3-5pm) in New Square is possible in the registration desk.

Access Hours  The lecture halls will be accessible from 8:30 to 6:30 each weekday. The buildings must be vacated by 7pm on all of the days except those with evening lectures.

Campus itself is open to nonresidents until midnight. Residents have access to campus after midnight by knocking on the front gate of College and displaying the residential key.

Laundry  The college laundry is a self-service facility between the Atrium and Chapel. Other laundries are available with both self-service and full service washes on Pearse Street (Liffey side, in the direction of Dublin Bay), and on George’s Street (a left turn off Dame Street), not far beyond the George’s Street arcade. A dry cleaner is available just behind the Pearse Street Guarda (Police) station, on Townsend Street.

Web Access  Everyone has wireless access. It is necessary to sign for it upon registration. See this URL for details:

http://isservices.tcd.ie/network/wireless_guest_network.php

Registration hours  The registration desk is open August 5, 2-6pm and then during the extent of the conference, from 9 to 4pm.

Insurance  Individual travel insurance is necessary.

Other Transport  The Tourist Information Centre on St. Andrews Street has a desk that sells bus passes. A five day pass costs 17.30 euro; a seven day pass costs 21 euro.

Library Access  The Trinity Library is not open for use by the general public. However, they have been known to allow in staff of other universities who show their home university ID.

Telephone Cards  A convenient telephone shop exists in Temple Bar (between Dame Street and the Liffey).

Photocopying  Photocopy cards can be purchased from the vending machine in the concourse of the Arts Building. Read’s has a professional photocopy facility just off Nassau Street, behind the Killkenny Shop.
CHAPTER 8. USEFUL INFORMATION

8.2 Other Useful Details

8.2.1 Contact Numbers

Accommodation Office: (353 (1)) 896 1177
Campus Security – General: (353 (1)) 896 1317
Campus Security – Emergencies: (353 (1)) 896 1999
A fax machine at which you can receive faxes sent to the “attention of ESSLLI 2007 (C Vogel)”: (353 (1)) 677 2204
Registration desk: (353 (1)) 896 1649
Restaurant Express: (353 (1)) 670 6666

CHAPTER 3. TIMETABLE OF ALL SESSIONS

Saturday, August 11
11am ESSLLI Committees [ORI]
3pm-5pm croquet [New Square]
9pm ESSLLI Party [Harry B’s – Kildare Street]
Sunday, August 12
3pm-5pm croquet [New Square]
Monday, August 13
Coffee 10:30am [Arts Building near Registration]
7pm Lecturers vs. Students Football [Herbert Park]
Tuesday, August 14
Coffee 10:30am [Arts Building near Registration]
Evening Lecture: Ede Zimmermann 7pm [Burke Theatre]
Wednesday, August 15
Coffee 10:30am [Arts Building near Registration]
Handbook of Spatial Logics Launch [M20 & ORI]
Thursday, August 16
Coffee 10:30am [Arts Building near Registration]
Evening Lecture: Ronan Reilly 7pm [Burke Theatre]
Friday, August 17
Coffee 10:30am [Arts Building near Registration]
8pm Week 2 Lecturer’s Dinner [TBA]

3.2 Room Codes

- Lloyd 1 – Lloyd Institute Basement
- Lloyd 4 – Lloyd Institute Basement
- Lloyd 8 – Lloyd Institute Basement
- Lloyd 11 – Lloyd Institute Basement
- Lloyd 1.07 – Lecturers’ Workroom (Lloyd Institute First Floor)
- Burke Theatre – Arts Building Lower Level
- Davis Theatre – Arts Building Registration Level (Very End)
- Swift Theatre – Arts Building Registration Level
- Ui Chadhain – Arts Building Registration Level
- M20 – Museum Building, upstairs & to the right.
- ORI LCR – O’Reilly Institute, Large Conference Room
- House 10 – Accommodation Office (House 10)
- The Atrium – Attached to the Dining Hall
- College Laundry – Beside the Atrium

### 3.3 Notes on the timetable

- F = Foundational
- I = Introductory
- A = Advanced
- AM 1 = 9-10:30
- AM 2 = 10:45-12:15
- PM 1 = 2:00-3:30
- PM 2 = 5:00-6:30
- Student Sessions are 3:30-5:00
- Evening Lectures commence at 7pm

### 3.4 Timetable of Courses and Workshops

At the east end of the campus is the Lloyd Institute and the O’Reilly Institute. About half of the events that are scheduled take place in the Lloyd. Formal Grammar will take place in its entirety in the Lloyd (refer to the map that follows).
8.1.2 Campus Maps

The most efficient mode of transport between Trinity and the Airport is by Bus. Some are partial to Aircoach (http://www.aircoach.ie/) which has a disembarkation stop just in front of the spot labeled “Provost’s House” on the TCD map below. It is convenient to enter the College through the gate underneath Regent House, entering Parliament Square. It is worth noting that the traffic island opposite Front Gate is the location of a primary taxi rank.

The accommodations office is in House 10, in the corner beside the Chapel, and ESSLII Registration will take place in the Arts Building on the second level. About half of the ESSLII events will take place in the Arts Building.

Some things will happen in the Museum Building. College Park is a very nice place to spend time. Note particularly, the Pavillion; there it will be possible to purchase a reasonable lunch and pleasant accompanying liquids. See also the separate list of recommended venues for food and drink.

1Taxis cost 20 to 30 euro for the same ride, depending on traffic; this bus 7 euro, another few buses are cheaper still.
2The place it makes the return journey to the airport is a sharp left around the corner from there, on the extension of Nassau Street which is Suffolk Street.
3Formal Grammar registration will take place in the Lloyd building, indicated on a later map.

Table 3.1: Timetable of Courses and Workshops for the First Week
### CHAPTER 3. TIMETABLE OF ALL SESSIONS

#### WEEK 2

<table>
<thead>
<tr>
<th>AM 1</th>
<th>Lang &amp; Comp</th>
<th>Lang &amp; Log</th>
<th>Log &amp; Comp</th>
<th>Workshop</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>F: English syntax for computational linguistics (Pullum) [Lloyd1]</td>
<td>A: Temporal &amp; Modal Dimensions... (Condonavdi; Kaufmann) [Davis]</td>
<td>I: Logics of Agency &amp; Multi-Agent systems (Broersen; Herzig) [Lloyd8]</td>
<td></td>
</tr>
<tr>
<td>AM 1</td>
<td>I: Hands-on NLP Applications for Information Access (Saggion) [Swift]</td>
<td>F: Formal Description of Syntax (Rogers) [Lloyd4]</td>
<td>I: Introduction to Unification Theory (Kurria) [UI Chadhain]</td>
<td></td>
</tr>
<tr>
<td>AM 2</td>
<td>I: Introduction to Data-Driven Dependency Parsing (McDonald; Nivre) [Swift]</td>
<td>F: Complexity of Constraint Satisfaction (Bodirsky; Chen) [Lloyd8]</td>
<td>A: Modeling the Dynamics of Knowledge Two Traditions: Logic Programming vs. Modal Logic (Dix; Jamroga) [Davis]</td>
<td>Exemplar-Based Models of Language Acquisition &amp; Use (Bod; Cochran) [UI Chadhain]</td>
</tr>
<tr>
<td>AM 2</td>
<td>I: Introducing Dialogue Games (Piewek; Kibble) [Lloyd1]</td>
<td>A: Symmetric Categorial Grammar (Bernardi; Moortgat) [Lloyd4]</td>
<td>I: Natural Logic (Moss) [Lloyd4]</td>
<td></td>
</tr>
<tr>
<td>PM 1</td>
<td>I: Introduction to Example-based Machine Translation (Carl) [Lloyd1]</td>
<td>A: Human reasoning &amp; cognitive science (Stenning) [Swift]</td>
<td>A: Neighborhood Semantics for Modal Logic (Pacuit) [Lloyd8]</td>
<td>Quantifier Modulation (Nouwen; Dotation) [UI Chadhain]</td>
</tr>
<tr>
<td>PM 1</td>
<td>A: Ontologies &amp; Lexical Semantics in Natural Language Understanding (Buitelaar; Cimiano) [Davis]</td>
<td>I: Natural Logic (Moss) [Lloyd4]</td>
<td>A New directions for proof theory in linguistics. (Barker; Szabolcs) [UI Chadhain]</td>
<td></td>
</tr>
<tr>
<td>PM 2</td>
<td>I: Information Extraction &amp; Weakly Supervised Learning (Stevenson; Yangarber) [Lloyd1]</td>
<td>I Introduction to Formal Epistemology (Pacuit; Parikh) [Davis]</td>
<td>A: Post's Lattice with Applications to Complexity Theory (Vollmer) [ORI LCR]</td>
<td>Model-Theoretic Syntax at 10 (Rogers; Kepser) [Lloyd8]</td>
</tr>
<tr>
<td>PM 2</td>
<td>I: Machine learning algorithms for NLP (Emms; Luz) [Swift]</td>
<td>A New directions for proof theory in linguistics. (Barker; Szabolcs) [UI Chadhain]</td>
<td>A: Post's Lattice with Applications to Complexity Theory (Vollmer) [ORI LCR]</td>
<td>Model-Theoretic Syntax at 10 (Rogers; Kepser) [Lloyd8]</td>
</tr>
<tr>
<td>PM 2</td>
<td>A: Reference &amp; Entity Resolution Beyond the Textual Coreference of Pronouns (McShane) [Lloyd4]</td>
<td>A: New directions for proof theory in linguistics. (Barker; Szabolcs) [UI Chadhain]</td>
<td>A: Post's Lattice with Applications to Complexity Theory (Vollmer) [ORI LCR]</td>
<td>Model-Theoretic Syntax at 10 (Rogers; Kepser) [Lloyd8]</td>
</tr>
</tbody>
</table>

Table 3.2: Timetable of Courses and Workshops for the Second Week

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### CHAPTER 8. USEFUL INFORMATION

#### 8.1 Maps

##### 8.1.1 Dublin City Center

![Map of Dublin City Center](image_url)
Chapter 4

Evening Lectures
CHAPTER 4. EVENING LECTURES

Some thoughts about a computational semantics for the 21st century

Lecturer: Alexander Koller
Date and Time: Tuesday, 7 August, 19:00
Room: Burke Theatre, Arts Block

Description

The history of computational natural-language semantics over the past thirty years can be seen as a success story in implementing formal semantics on the computer. At the beginning of the 21st century, we have access to well-understood representation formalisms, semantics construction algorithms based on large-scale grammars, we have methods of dealing very efficiently with certain types of ambiguity, and our Logic & Computation colleagues are continuously refining the efficiency of theorem provers that computational semanticists can use to compute inferences.

However, in actual real-life applications, the use of the standard formalisms and algorithms of computational semantics is rare. A concrete example of this is the recent PASCAL Textual Entailment challenge, in which a computer system must determine whether one sentence "follows" from another. This is precisely the kind of task that classical computational semantics should be good at; but nonetheless, only a minority of systems even use classical semantic representations, and these mostly in nonstandard ways. In my opinion, this experience points towards a number of critical shortcomings of current approaches: We still don't know how to derive satisfying, useful, wide-coverage semantic representations (or even what "useful" really means); classical logical entailment is not a perfect approximation of natural language inference; and the knowledge bases needed for computing such inferences do not have sufficient coverage.

In this talk, I outline the state of the art in computational semantics as I see it and point out several aspects that I believe work particularly well or not so well at this point. I will then speculate on some recent ideas – such as learning world knowledge from corpora, grounding semantic information in the real world, and investigating alternative representation formalisms – that might help alleviate these problems in the future. Rather than offering final answers to any of these questions, I hope to spark a debate that will bring computational semantics closer to applicability.

Brief biography

Alexander Koller received his PhD from Saarland University in Saarbruecken, Germany in 2004, and is now a DFG Research Fellow at Columbia University. In the past years, his research has focused on a variety of problems in computational semantics. Recently, his focus has widened to the development of efficient algorithms for natural language processing.

CHAPTER 7. WORKSHOPS

First week: 6–10 August

Monday, 6th

Torben Braüner
Philippe Balbiani and Andreas Herzig
Introduction
Talkin’bout Kripke models

Tuesday, 7th

Balder ten Cate (Invited talk)
Abstract model theory for extensions of modal logic
Lutz Strassburger
Deep inference for hybrid logic

Wednesday, 8th

Natasha Alechina, Philippe Balbiani and Dmitry Shkatov
Logics with modalities corresponding to infinite unions and intersections of accessibility relations
Jens Ulrik Hansen
A tableau system for a first-order hybrid logic
Dmitry Sustretov
Topological semantics and decidability

Thursday, 9th

Volker Weber
Hybrid branching-time logics
Vladimir Rybakov
A hybrid LTL$_K$ of linear temporal logic
Mark Kaminski and Gert Smolka
LTL and multi-agent logic K$_n$
A straightforward saturation-based decision procedure for hybrid logic

Friday, 10th

Ian Hodkinson (Invited talk)
Axiomatising an arbitrary elementary modal logic using hybrid logic
Martin Mundhenk and Thomas Schneider
The complexity of hybrid logics over equivalence relations
Hybrid logic is a branch of modal logic allowing direct reference to worlds/times/states. It is easy to justify interest in hybrid logic on the grounds of applications as the additional expressive power is very useful. In addition, hybrid-logical machinery improves the behaviour of the underlying modal formalism. For example, it becomes considerably simpler to formulate modal proof systems, and one can prove completeness and interpolation results of a generality that is not available in orthodox modal logic. The topic of the HyLo workshop of 2007 is not only standard hybrid-logical machinery like nominals, satisfaction operators, and the down-narrow binder, but generally extensions of modal logic that increase its expressive power. The workshop HyLo 2007 will be relevant to a wide range of people, including those interested in description logic, feature logic, applied modal logics, temporal logic, and labelled deduction. The workshop continues a series of previous workshops on hybrid logic, most recently the LICS-affiliated HyLo 2006 (http://hylomol.ruc.dk/HyLo2006/). The workshop aims to provide a forum for advanced PhD students and researchers to present and discuss their work with colleagues and researchers who work in the broad subject areas represented at ESSLLI. For more general background on hybrid logic, and many of the key papers, see the Hybrid Logics homepage (http://hylo.loria.fr/).

ORGANIZERS
Torben Braüner (Roskilde University, Denmark) - Chair
Jørgen Villadsen (Technical University of Denmark)

PROGRAM COMMITTEE
Carlos Areces (INRIA Lorraine, France)
Patrick Blackburn (INRIA Lorraine, France)
Thomas Bolander (Technical University of Denmark) - Co-Chair
Torben Braüner (Roskilde University, Denmark) - Chair
Mai Gehrke (New Mexico State University, USA)
Valeria de Paiva (PARC, USA)
Jørgen Villadsen (Technical University of Denmark)

Description
One aspect of Cyc is a very large, logic-based knowledge base, but it is more than that; the Cyc project is an attempt to move us towards general Artificial Intelligence by supporting automated reasoning about a very wide variety of real-world concerns. To support that goal, Cyc also encompasses, obviously enough, and inference engine able to reason over a large, contextual, knowledge base, but it also includes components for interpreting and producing natural language, acquiring knowledge and responding to user queries, and for interfacing with other software. In this talk, I’ll talk about some of what we’ve done to apply logic to representation of general knowledge, at scale, and to use it in the production of (somewhat) intelligent behaviours, and discuss some ways in which we might move closer to artificial intelligence.

Brief biography
Dr. Michael Witbrock serves as the Vice President for Research at Cycorp, Inc. and as CEO of Cycorp Europe. At Cycorp, he has overall responsibility for corporate research, and is particularly interested in automating the process of knowledge acquisition and elaboration, extending the range of knowledge representation and reasoning to mixed logical and probabilistic representations, and in validating and elaborating knowledge in the context of task performance, particularly in tasks that involve understanding text and communicating with users. Michael received his PhD in Computer Science from Carnegie Mellon in 1996 and a BSc in Psychology from Otago University, in New Zealand, in 1985. Prior to joining Cycorp, he was Principal Scientist at Terra Lycos, working on integrating statistical and knowledge based approaches to understanding web user behavior; a research scientist at Just Systems Pittsburgh Research Center, working on statistical text summarization; and a systems scientist at Carnegie Mellon on the Informedia spoken and video document information retrieval project, where he was also involved in the planning of the Experience on Demand Project. He is author of numerous publications in areas ranging across knowledge representation and acquisition, neural networks, parallel computer architecture, multimedia information retrieval, web browser design, genetic design, computational linguistics and speech recognition, and is the holder of four US patents.
Painting and Opacity

Lecturer: Ede Zimmermann
Date and Time: Tuesday, 14 August, 19:00
Room: Burke Theatre, Arts Block

Description

Referentially opaque verbs like "seek", "owe", and "resemble" are known to (a) allow for an ambiguity between an ordinary (specific) and a peculiar unspecific reading of one of their nominal arguments; (b) defy truth-preserving substitution of co-extensional terms; and (c) block existential inferences: (a) one may seek/owe someone/resemble a horse without necessarily seeking/owing/resembling a particular animal; (b) even if all and only arctic horses are striped, one may seek/owe someone/resemble a striped horse without seeking/owing/resembling an arctic horse and (c) without there necessarily even being any striped (i.e. arctic) horses. Similarly, it would seem, one can paint, draw or imagine a striped horse without (a) portraying a particular animal, or (b) painting an arctic horse, or (c) there being any striped, or arctic, horses. As consequence of this analogy, verbs of depiction (like "paint", "draw", and "imagine") have often been taken to be opaque. In particular it has been suggested that the same mechanism that explain the anomalies (a)-(c) of opaque verbs, carry over to them. In this talk I will show that none of the known semantic analyses of opacity extends to verbs of depiction and present evidence that they are simply verbs of creation (as in "paint a picture") that invite a meaning shift of the nominal object as denoting representations of its ordinary denotations (e.g. horse pictures instead of horses).

Brief biography

Thomas Ede Zimmermann has been a professor of linguistics at the University of Frankfurt since 1999. He has previously taught at the universities of Konstanz, Tuebingen, and Stuttgart and held visiting positions at the University of Massachusetts at Amherst and at Rutgers; he has also given courses at various summer schools, including ESSLLI and NASSLI. His main area of expertise is the logical analysis of natural language meaning, about which he has written a number of articles published in major journals.

CHAPTER 7. WORKSHOPS

Second week: 13–17 August

Monday, 13th
Anton Benz, Christian Ebert and Robert van Rooij
Simon Huttegger

Introduction to the Workshop
Selection-Mutation Dynamics of Signalling Games

Tuesday, 14th
Ale Grønn
Michael Franke

Horn Strategies and Contextual Optimization in Russian Aspect
Independence and Decision-Contexts for Non-Interference Conditionals

Wednesday, 15th
Alexander Mehler
Ruth Kempson, Ronnie Cann, Miriam Bouzouita

Evolving Lexical Networks in a Game Theoretical Perspective. A Simulation Model of Lexical Alignment
Production pressures and syntactic change: Towards a new perspective on language evolution?

Thursday, 16th
Bernhard Schröder & Philipp C. Wichardt
Pieter de Bie & Bart de Boer

Modelling Semantic Change as Equilibrium Shift in a Signalling Game
An agent-based model of linguistic diversity

Friday, 17th
Tikitu de Jager
Rohit Parikh (Invited Talk)

Quantity Implicature and Speaker Expertise in Signalling Games
The Pragmatic Approach to Semantics

Alternate Speakers

Mark Jeffreys
Andrew Stivers

Sometimes a signal is just a cigar: methodological challenges to exploiting signaling-games in coordination experiments.
Language Regulation and Dissipation in Meaning
Recent years witnessed an increased interest in formal pragmatics and especially the establishment of game theory as a new research methodology for the study of language use. Within game theoretic pragmatics, two major currents can be distinguished: one is closely related to the Gricean paradigm and aims at a precise foundation of pragmatic reasoning, the other aims at language evolution seen either from a biological or from a cultural perspective. Workshop keywords: Relevance, Language Evolution, Pragmatics of Dialogue, Signalling Games. The workshop should provide a forum for younger researchers to present and discuss their work. In addition it provides an opportunity for other linguists to get acquainted with the style and the problems addressed in this new research paradigm. The workshop was prepared by an advanced course on evolutionary game theory by G. Jäger at ESSLLI05 and an introductory course on signalling games and pragmatics by A. Benz at ESSLLI06.

Organizers
Anton Benz (ZAS Berlin)
Christian Ebert (University of Bielefeld)
Robert van Rooij (ILLC Amsterdam)

Program Committee
Anton Benz (ZAS Berlin)
Christian Ebert (University of Bielefeld)
Simon Huttegger (Konrad Lorenz Institute, Austria)
Gerhard Jäger (University of Bielefeld)
Rohit Parikh (Brooklyn College and CUNY Graduate Center, USA)
Robert van Rooij (ILLC Amsterdam)

A model of grammar acquisition: the importance of complexity
Lecturer: Ronan Reilly
Date and Time: Thursday, 16 August, 19:00
Room: Burke Theatre, Arts Block

Description
This talk will discuss some recent finding in the computer modelling of language acquisition. Contrary to the view enshrined in the poverty of the stimulus argument, I will demonstrate that a grammar as complex as that found in child-directed speech can be learnt by tuning into its statistical properties using a simple recurrent network (SRN). The SRN succeeds in learning a complex grammar and exhibits behaviours comparable to those found in child language development. This demonstrates that statistical information is sufficient to learn the syntactic structures and categories underlying language and that statistical learning is a feasible mechanism for children to employ. Surprisingly, the complexity of the grammar does not hinder performance but rather enables the acquisition of abstract grammatical structures that enhance the network's generalisation abilities.

Brief biography
Ronan Reilly is Professor of Computer Science at NUI Maynooth. He has a background in computer science and psychology and his research interests are in the areas of vision and language, with a specific interest in their intersection in reading (cf. http://cortex.cs.nuim.ie).
## Chapter 5

### Course Descriptions

#### Chapter 7. Workshops

<table>
<thead>
<tr>
<th>Date</th>
<th>Speaker(s)</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Monday, 13th</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Rick Nouwen and Jakub Dotlacil, Mana Kobuchi-Philip</td>
<td>Introduction to the workshop topic</td>
</tr>
<tr>
<td><strong>Tuesday, 14th</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Marcello Ferreira</td>
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<td>Stephanie Solt</td>
<td>Few more and many fewer: complex quantifiers based on many and few</td>
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<td>Alda Mari</td>
<td>Strengthening GEN: semantic conditions for a posteriori analytic genericity</td>
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<td>Fabienne Martin</td>
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<td>Aystein Nilsen, Jacques Jayez and Lucia Tovenia</td>
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<td>Discourse inference and the meaning of almost</td>
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<td>Bart Geurts, Jorie Koster-Moeller, Jason Varvoutis, and Martin Hackl</td>
<td>Processing scalar quantifiers</td>
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<td>Robert Cirillo (Alternate Speaker)</td>
<td>Verifying statements containing modified numeral quantifiers</td>
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<td>The phrase 'all three': modified quantifier or indivisible compound?</td>
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Quantifier Modification

Lecturers: Nouwen, Rick and Dotlacil, Jakub
Details: ID71: Logic and Language (Workshop)
Week: 2
Time: 2-3:30
Room: UI Chadhain

From the eighties onwards, logicians and linguists have studied the properties of quantifying expressions by assigning them generalised quantifier meanings. While this line of research has been successful in isolating formal generalisations about the expression of quantity, it has ignored the internal composition of complex quantifiers. Recently, this has changed, mostly thanks to studies of modifiers like those applying to numerals (comparatives, prepositions), approximatives, except phrases. With this workshop we wish to bring together analyses of such modificational structures within quantifiers as well as studies that focus on the cross-categorial application of modifiers. This bring up questions like: Is it tenable to retain a single analysis for any modifier? What are the restrictions on the combinations of quantifiers and modifiers? Is there cross-linguistic variation w.r.t. these restrictions? What is the categorial status of a modified quantifier? The general aim is to bring together researchers of different fields (syntax, semantics, logic) and thereby deepen our understanding of the role of modification within the internal structure of quantifiers.

Organizers
Rick Nouwen (Utrecht University, the Netherlands)
Jakub Dotlacil (Utrecht University, the Netherlands)

Program Committee
Jenny Doetjes (Leiden)
Jan van Eijck (Amsterdam/Utrecht)
Bart Geurts (Nijmegen)
Martin Hackl (Pomona)
Manfred Krifka (Berlin)
Marcin Morzycki (Michigan)
Doris Penka (Tbingen)
Anna Szabolcsi (New York)
Richard Zuber (Paris)

5.1 Language and Computation

Information Extraction and Weakly Supervised Learning

Lecturers: Stevenson, Mark and Yangarber, Roman
ID29: Language and Computation (Introductory)
Week: 2
Time: 5:00-6:30
Room: Lloyd 1

Information Extraction (IE) is a core language technology with wide application in industry and research. It is applied in a variety of domains, including the mining of text, such as news or biomedical articles, and the SemanticWeb. The development of systems for IE is a time-consuming process which generally requires expert domain knowledge. Much recent research employs machine learning to assist in the development and adaptation of IE systems. Our particular focus will be on weakly supervised algorithms, because they require minimal human input. This course will present recent advances in the application of weakly supervised learning algorithms to a range of IE problems, from name and entity classification to co-reference and relation extraction.
Hands-on Natural Language Processing Applications for Information Access

Lecturer: Saggion, Horacio
Details: http://www.dcs.shef.ac.uk/~saggion
ID26: Language and Computation (Introductory)
Week: 2
Time: 9-10:30
Room: Swift

This course focuses on the development of practical applications which involve the use of natural language technology. The course will introduce NLP concepts which will be reinforced by the development, testing, and evaluation of technology in an NLP laboratory. Four main applications will be studied in the course: Information Extraction, Information Retrieval, Question Answering, and Text Summarization. None of the applications will be studied in detail; the main objective of the course is to promote the use of NLP and to facilitate access to available technology which can be adapted to specific application domains so that students can go home motivated to develop their own tools/systems.

- Overview of Natural Language Processing technologies including parts of speech tagging, named entity recognition, parsing, semantic interpretation and coreference resolution.
- Natural Language Technology for Information access: existent systems and projects combining advanced NLP (e.g. Cubereporter and NewsBlaster).
- Information Retrieval: documents and queries, document indexing, query analysis and formulation, document retrieval, evaluation, TREC.
- Information Extraction: named entity recognition, relation extraction, event extraction, rule-based and machine learning approaches, evaluation, MUC. Question Answering: QA architecture, questions and answers, passage selection, answer identification, evaluation, TREC/QA.
- Text Summarization: sentence extraction, superficial features for sentence extraction, feature combination, multi-document summarization, evaluation, Document Understanding Conference.

Tools to be used for teaching and developments: the GATE System a Text Summarization Toolkit developed by Horacio Saggion, the SUPPLE parser developed at Sheffield, a QA system developed at Sheffield, Lucene will be used to develop an IR system for Question Answering, data sources such as the AQUAINT collection and the DUC corpus will be used as sources for the developed applications.

CHAPTER 7. WORKSHOPS

Second week: 13–17 August

Monday, 13th
Geoffrey K. Pullum  The Evolution of Model-Theoretic Frameworks in Linguistics
Edward Keenan and Edward Stabler  Language Similarity

Tuesday, 14th
Hans-Jörg Tiede  Applications of Modal Logic in Model Theoretic Syntax
Adi Palm  Parsing Complexity and Model-Theoretic Syntax
Anders Sógaard  Operations on Polyadic Structures

Wednesday, 15th
Ralph Debusmann  Scrambling as the Combination of Relaxed Context-Free Grammars in a Model-Theoretic Grammar Framework
Joan Chen-Main and Aravind Joshi  Some Observations on a “Graphical” Model-Theoretical Approach and Generative Models
Drew Moshier  Domain Theory and MTS

Thursday, 16th
Gregory Kobele, Christian Retoré, and Sylvain Salvati  An Automata-Theoretic Approach to Minimalism
Uwe Mönich  Minimalist Syntax, Multiple Regular Tree Grammars and Direction Preserving Tree Transductions
Hans-Martin Grtner and Jens Michaelis  Locality Conditions and the Complexity of Minimalist Grammars: A Preliminary Survey

Friday, 17th
Frank Richter  Closer to the Truth: A New Model Theory for HPSG
Larry Moss  Coalgebra, Trees, and Grammars
Model-Theoretic Syntax at 10

Lecturers: Rogers, James and Kepser, Stephan
Details: http://cs.earlham.edu/esslli07mts/
ID53: Logic and Language (Workshop)
Week: 2
Time: 5-6:30
Room: Lloyd 8

In 1996 ESSLLI hosted a workshop on “The Mathematics of Syntactic Structure” that covered a range of topics in the area now known as Model-Theoretic Syntax which was then just emerging. Over the ensuing decade MTS has established itself as a subdiscipline, focusing on descriptive approaches to formalizing theories of syntax by defining classes of ordinary mathematical structures directly in terms of linguistically relevant structural properties rather than in terms of generative or automata-theoretic processes. The 2001 FG/MoL meeting, affiliated with ESSLLI’01, included a symposium on the then current state of MTS. This workshop aims to survey the developments in this area over its first decade and to lay the foundations for its further development in the decades to come. The workshop includes invited talks by participants of previous meetings as well as papers from the wider community.

Organizers
James Rogers (Earlham College Richmond, USA)
Stephan Kepser (Eberhard Karls Universität Tübingen)

Program Committee
Patrick Blackburn (INRIA Lorraine)
Laura Kallmeyer (Universität Tübingen)
Stephan Kepser (Universität Tübingen, co-chair)
Marcus Kracht (UCLA)
Jens Michaelis (Universität Osnabrück)
Uwe Mönich (Universität Tübingen)
Drew Moshier (Chapman University)
Lawrence Moss (Indiana University)
Adi Palm (Universität Passau)
Geoffrey Pullum (University of California, Santa Cruz)
Frank Richter (Universität Tübingen)
James Rogers (Earlham College, co-chair)
Edward Stabler (UCLA)
Hans-Jürg Tiede (Illinois Wesleyan University)

Introduction to corpus-based computational semantics

Lecturers: Koller, Alexander and Schulte im Walde, Sabine
Details: http://www.ims.uni-stuttgart.de/~schulte/Teaching/ESSLLI-07
ID34: Language and Computation (Introductory)
Week: 1
Time: 10:45-12:15
Room: Davis

This course provides an overview of resources and corpus-based approaches in computational lexical semantics. We introduce theoretical issues (such as polysemy), describe related resources (such as WordNet), and present a selection of computational approaches for lexical semantic acquisition (such as learning noun classes from unannotated corpora). We aim for covering the breadth of the field rather than going into detail. Therefore the course presupposes only elementary knowledge of linguistics and machine learning methods. The course is relevant for linguists to learn about an alternative perspective on semantic information; (computational) logicians to learn about potential ways to obtain world knowledge; and computational linguists to learn how to obtain resources for building better applications. The topics of the course include:

1. word senses, polysemy, Wordnet, Word Sense Disambiguation, Senseval;
2. noun similarity/relations/classes, OntoBank;
3. verb similarity/relations/classes, PropBank;
4. selectional preferences, semantic roles, semantic parsing, FrameNet;
5. learning paraphrases and world knowledge, RTE.
Introduction to Data-Driven Dependency Parsing

Lecturers: McDonald, Ryan and Nivre, Joakim
Details: http://dp.esallli07.googlepages.com
ID35: Language and Computation (Introductory)
Week: 2
Time: 10:45-12:15
Room: Swift

Syntactic dependency representations of sentences have a long history in theoretical linguistics. Recently, they have found renewed interest in the computational parsing community due to their efficient computational properties and their ability to naturally model non-nested constructions, which is important in freer-word order languages such as Czech, Dutch, and German. This interest has led to a rapid growth in multilingual data sets and new parsing techniques. One modern approach to building dependency parsers, called data-driven dependency parsing, is to learn good and bad parsing decisions solely from labeled data, without the intervention of an underlying grammar. This course will cover:

- Dependency parsing (history, definitions, motivation, etc.);
- Grammar-driven versus data-driven parsing;
- Brief intro to learning algorithms: Generative, Memory-based, SVM, etc;
- Greedy parsing algorithms: Covington, Nivre, Yamada and Matsumoto;
- Graph-based algorithms: MST algorithms (Eisner, McDonald et al);
- Other approaches;
- Empirical results and applications;
- Available software;

First week: 6–10 August

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<td>Monday, 6th</td>
<td>Reinhard Muskens</td>
<td>Introduction: New Directions in Type-theoretic Grammars</td>
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<td>Tuesday, 7th</td>
<td>David Dowty, Bruno Mery, Christian Bassac and Christian Retoré</td>
<td>The GF Grammar Compiler</td>
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<td>Wednesday, 8th</td>
<td>Carl Pollard</td>
<td>Nonlocal Dependencies via Variable Contexts</td>
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<td>Thursday, 9th</td>
<td>Sylvain Salvati, Sylvain Salvati and Christian Retoré</td>
<td>Type-theoretic Extensions of Abstract Categorial Grammars</td>
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<td>Friday, 10th</td>
<td>Makoto Kanazawa, Roussanka Loukanova, Richard Oehrle</td>
<td>On the Membership Problem for Non-linear Abstract Categorial Grammars</td>
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<td>Richard Oehrle, Gilad Ben-Avi, Yoad Winter</td>
<td>Dimensions of Grammatical Deduction (invited talk)</td>
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<td>Gilad Ben-Avi, Yoad Winter</td>
<td>The Semantics of Intensionalization</td>
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Enriched Lexical Ontologies

Lecturer: Veale, Tony
Details: http://afflatus.ucd.ie
ID16: Language and Computation (Introductory)
Week: 1
Time: 2-3:30
Room: Swift

A lexical ontology is a system of categories for bridging the realms of words and concepts, combining elements of a thesaurus, dictionary and encyclopaedia. The most well known of such ontologies is Princeton WordNet, a comprehensive electronic database of English words and their meanings, but others exist also, such as HowNet (for Chinese and English), KorTerm (for Korean, Chinese and Japanese), and various EuroWordNets for French, German, Italian and so on. In ontological terms, WordNet is a ‘lightweight ontology’-- it relies heavily on taxonomic organization to discriminate meanings, and is somewhat under-nourished from the perspective of other forms of ontological structure. It has a meagre repertoire of relational types, and does not encode word meanings in an explicit logical form. Importantly, however, WordNet is both widespread and free, and is the subject of countless on-going research projects and language applications.

In this course I will survey the field of lexical ontologies, comparing the pros and cons of each, while outlining applications and presenting demos where possible. From this foundation, I will then proceed to consider ways in which such ontologies can be enriched. I will explore four approaches in depth:

1. Mining implicit meaning from ontological resources: e.g., parsing textual glosses, Chinese orthographic structure, etc.
2. Integrating outside resources, such as Wikipedia: how the cross-reference topology of Wikipedia can be used to enhance resources like WordNet.
3. Dynamic growth: how lexical ontologies can update themselves automatically by harvesting new terms from the web.
4. Contextualization: how the category structure of a lexical ontology can be trained from a specific textual context or corpus.
CHAPTER 5. COURSE DESCRIPTIONS

NLP for Multimedia Applications

Lecturer: Declerck, Thierry
Details: http://www.dfki.de/~declerck/esslli07.html
ID59: Language and Computation (Introductory)
Week: 1
Time: 5-6:30
Room: Lloyd 1

This course will address the topic of the so-called “semantic gap” in the analysis and generation of multimedia (MM) content. NLP and Semantic Web (SW) technologies can help on this in providing for ontology-based semantic annotation of textual documents (including speech transcripts) that are associated with video and images. We will describe some work dedicated to the description of an ontological framework that combines annotations provided by the combination of NLP and SW on the one side, and the so-called low level annotation features provided by MM analysis on the other side. The course will focus on:

1. the ontology-driven approach to the semantic annotation of textual documents;
2. the ontological organisation of low-level features in the MM context;
3. the integration of linguistic features and image/video low-level features in a joint ontological description scheme, supporting eventually reasoning on combined text and multimedia material.

The course will rely on the most recent advances in this field, as proposed by the EU Network of Excellence “K-Space” (Knowledge Space of semantic inference for automatic annotation and retrieval of multimedia content).

CHAPTER 7. WORKSHOPS

New Directions in Type-theoretic Grammars

Lecturer: Muskens, Reinhard
Details: http://let.uvt.nl/general/people/muskens/ndttg/
ID83: Logic and Language (Workshop)
Week: 1
Time: 2-3:30
Room: Ui Chadhain

In 1961 Haskell Curry published his by now famous paper on ‘Some Logical Aspects of Grammatical Structure’. In this paper (large parts of which had already been written in the 1940's) he made a distinction between the ‘tectogrammatics’ and ‘phenogrammatics’ of language (a distinction similar to that between abstract syntax and concrete syntax in compiler theory), while also arguing against directionality in the type system used for language description. In 1953 Bar-Hillel had introduced a distinction between categories seeking material to their right and categories seeking material to the left. To date most categorial grammarians follow Bar-Hillel in this, but in Curry’s architecture phenogrammatical structure can take care of word order, making directionality unnecessary. Curry’s proposal was part of a classical phase in categorial grammar that started with Ajdukiewicz’s paper on syntactic connexity and also included Joachim Lambek’s pivotal work on the introduction of hypothetical reasoning. It led to many follow-ups. For example, in Richard Montague’s work the tectogrammatics/phenogrammatics distinction reappeared as one between analysis trees and surface strings, while Montague also added a level of meaning as a third component. The grammatical architecture thus became one in which a central abstract component is interpreted on two levels. An explicit connection between Montague’s set-up and that of Curry was given in David Dowty’s work in the 1980’s. Also in the 1980’s, Aarne Ranta used the idea in a constructive type theory setting, while Reinhard Muskens used it for his Partial Montague Grammar and Johan van Benthem explored the logical and linguistic implications of LP*, the undirected version of the Lambek Calculus, or, in other words, the logic of simply typed linear lambda terms. Later years brought Richard Oehrle’s insight that the interpreting levels of the theory (not only semantics but also phenogrammar) can be represented with the help of lambda terms. Since the central abstract component consists of LP* derivations in Oehrle’s set-up, equivalent with linear lambda terms, in fact all levels of the grammar can now be represented with the help of lambda terms and the typed lambda calculus becomes the central mechanism for grammatical Since the turn of the century there has been a heightened activity within a series of type-theoretical formalisms bearing a family resemblance to one another. All of these adopt the pheno/tecto distinction or undirectedness in one way or another and claim various descriptive and formal advantages. We mention Abstract Catego-
### Second week: 13–17 August

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<td>Rens Bod &amp; Dave Cochran (30 min)</td>
<td>Introduction. Effects of Word-Chunk Frequency on Language Acquisition and Use (Invited Talk).</td>
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<td>Morten Christiansen (60 min)</td>
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<td>Sabine Lappe &amp; Ingo Plag index Plag, Ingo</td>
<td>The Variability of Compound Stress in English: Towards an Exemplar-Based Alternative to the Compound Stress Rule</td>
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<td>Hinrich Schütze, Michael Walsh, Travis Wade &amp; Bernd Möbius</td>
<td>Accounting for Phonetic and Syntactic Phenomena in a Multi-Level Competitive Interaction Model</td>
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<td>Jacqueline van Kampen &amp; Remko Scha</td>
<td>Modelling the steps of early syntax acquisition Exemplars in Syntax: Evidence from Priming</td>
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<td>Neal Snider</td>
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<td>Doug Arnold &amp; Evita Linardaki</td>
<td>HPSG-DOP: Towards Exemplar-based HPSG</td>
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<td>David Eddington &amp; Deryle Lonsdale</td>
<td>Analogical Modeling of Language: An Update</td>
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<td>Laurent Bonnasse-Gahot &amp; Jean-Pierre Nadal</td>
<td>From Exemplar Theory to Population Coding and Back: An Ideal Observer Approach</td>
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<tr>
<td>Rens Bod &amp; Dave Cochran</td>
<td>Closing remarks</td>
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### A Hands-on Introduction to Example-based Machine Translation

- **Lecturer:** Carl, Michael
- **Details:** [link to course page](http://iai.iai.uni-sb.de/~carl/ESSLI07_course)
- **ID2:** Language and Computation (Introductory)
- **Week:** 2
- **Time:** 2-3:30
- **Room:** Lloyd 1

The course provides an introduction to Example-based Machine Translation (EBMT). It will focus on the interplay of rule-based and data-driven methods and point out solutions on how these methods complement each other. Hands-on exercises will acquaint the participant with major techniques used in the field and train the student's skills for understanding the nature of the problems, their representation and engineering solutions. The course will give a historical review of EBMT approaches as well as state-of-the art methods. It will also point to new directions in data-driven MT.
Machine learning algorithms for natural language processing

Lecturers: Emms, Martin and Luz, Saturnino
Details: www.cs.tcd.ie/Martin.Emms/MLforNLP
ID49: Language and Computation (Introductory)
Week: 2
Time: 5-6.30pm
Room: Swift

Over the past decade Machine Learning techniques has become an essential tool for Natural Language Processing. This introductory course will cover the basics of Machine Learning and present a selection of widely used algorithms, illustrating them with practical applications to Natural Language Processing. The course will start with a survey of the main concepts in Machine Learning, in terms of the main decisions one needs to make when designing a Machine Learning application, including: type of training (supervised, unsupervised, active learning etc), data representation, choice and representation of target function, choice of learning algorithm. This will be followed by case studies designed to illustrate practical applications of these concepts. Unsupervised learning techniques (clustering) will be described and illustrated through applications to tasks such as thesaurus induction, document class inference, and term extraction for text classification. Supervised learning techniques covering symbolic (e.g. decision trees) and non-symbolic approaches (e.g. probabilistic classifiers, instance-based classifiers, support vector machines) will be presented and case studies on text classification and word sense disambiguation analysed in some detail. Finally, we will address the issue of learning target functions which assign structures to linear sequences covering applications of Hidden Markov Models to part-of-speech tagging and Probabilistic Grammars to parsing of natural language.
Exemplar-based models conceive of linguistic representations as being directly shaped by speakers’ memories of specific tokens of linguistic items. Such models are being considered by a growing number of researchers in virtually all areas of linguistics, from phonology (Pierrehumbert 2001; Bybee 2003), language acquisition (Tomaseo 2000) and psycholinguistics (Baayen 2003) to computational linguistics and statistical natural language processing (Bod 2001; Manning 2003). Shared strengths of such models lie in their ability to model gradient and highly variable phenomena, and in their readiness to utilize data-rich resources, such as large and/or detailed corpus-based databases. Shared challenges lie in the need to account for speakers’ ability to generalize, i.e. to learn and apply abstract patterns - those facts that inspired the notion of “infinite generative capacity”. This workshop aims at bringing together linguists working to expand their exemplar-based models by computational modeling, and computational linguists/computer scientists interested in extending exemplar-based models beyond technological considerations to its potential for modeling the reality of human cognition of language. We aim at one invited speaker of international standing in this area, and invite submissions from both PhD students and more senior researchers working in the cross-disciplinary area of exemplar-based linguistics and statistical natural language processing.

ORGANIZERS
Rens Bod (University of St Andrews)
Dave Cochran (University of St Andrews)

PROGRAM COMMITTEE
Rens Bod (University of St Andrews)
Nick Chater (University College London)
Alexander Clark (Royal Holloway University of London)
Dave Cochran (University of St Andrews)
Walter Daelemans (University of Antwerp)
Tecumseh Fitch (University of St Andrews)
Susanne Gahl (University of Chicago)

Analysis and modelling of dialogue poses challenges for many disciplines represented at ESSLLI including rational agency, multi-agent logics, knowledge representation and automated reasoning, statistical techniques, formal grammars, etc. In this tutorial, formal and computational approaches to dialogue are dealt with from the perspective of the unifying notion of a dialogue game. Day 1 is dedicated to introducing this notion, providing some historical background and methodological assumptions. The theme of days 2 and 3 is public commitment in dialogue as an alternative to private intentions and beliefs. On days 4 and 5, the focus is shifted to the structures (such as adjacency pairs and insertion sequences) that emerge when two or more autonomous interlocutors engage in a dialogue game. Basic knowledge of propositional and predicate logic is required to follow this tutorial.
Wikipedia started out a few years ago with rather modest goals. Now a full-blown electronic encyclopedia available in many languages, it represents a valuable resource to be exploited for Natural Language Processing applications. Its main strength is that it provides (1) a large amount of structured text, as well as (2) a collaboratively generated taxonomy (folksonomy) on the basis of its categories. In this course we will demonstrate that ‘the encyclopedia that anyone can edit’ is in fact useful for research in NLP. In particular, we will show how to induce measures of semantic relatedness on top of the category tree, and how to integrate text and categorization to turn the folksonomy into a fully-fledged ontology. We will conclude by demonstrating how to include semantic knowledge mined from Wikipedia into NLP components dealing with coreference resolution, lexical chains, determining coherence, etc.
### CHAPTER 6. STUDENT SESSION

#### 6.2 Time Table: 3:30-5:00 in Lloyd 11

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<td><strong>Kevin Demiddele</strong> - No future Adams pairs: applying the global/local conditional probability distinction.</td>
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<td><strong>Thomas Icard</strong> - Towards An Alternative Proof of Solovay's Arithmetical Completeness Theorem.</td>
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<td><strong>Simone Bova</strong> - A Bottom-Up Algorithm for t-Tautologies.</td>
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<td>Friday, 10th</td>
<td><strong>Olestein E. Andersen</strong> - Grammatical error detection using corpora and supervised learning.</td>
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<td><strong>Voula Gotsoulia</strong> - Foundations of Semantic Role Annotation: An Entailment-based Annotation Scheme.</td>
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<td>Monday, 13th</td>
<td><strong>Bert Le Bruyn</strong> - Parititivy in natural language.</td>
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<td><strong>Eleni Kalyvianaki</strong> - Factual Content in Algorithmic Natural Language Semantics.</td>
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<td>Tuesday, 14th</td>
<td><strong>Andrew Gargett</strong> - An Incremental Model of Fragments in Dialogue.</td>
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<td><strong>Olga Pustylnikov</strong> - Guessing Text Type by Structure.</td>
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<td>Wednesday, 15th</td>
<td><strong>Camilo Thorne</strong> - Managing Structured Data with Controlled English and Description Logics.</td>
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<td><strong>Nicolas Troquard</strong> - Some clarifications in logics of agency.</td>
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<td>Thursday, 16th</td>
<td><strong>Sabine Gründer</strong> - Asp ectual Shift via Supervaluation.</td>
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<td><strong>Márta Peredy</strong> - Obligatory adjuncts in weak accomplishments.</td>
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<td><strong>Poster session</strong></td>
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### CHAPTER 5. COURSE DESCRIPTIONS

#### Figurative Language Processing

<table>
<thead>
<tr>
<th>Lecturer:</th>
<th>Lönneker-Rodman, Birte</th>
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This course will be concerned with computational approaches to figurative language (e.g. idiom, metonymy, metaphor, and indirect speech acts). Non-literal phenomena are generally recognized as the most difficult for natural language processing tasks such as machine translation, text summarization, information retrieval, and question answering. We will begin with a discussion of the linguistic properties of the various types of figurative language and a review of the cognitive approaches to figurative language. We will then introduce students to a variety of computational approaches to figurative language processing, including approaches for computing non-literal meaning, extracting idioms and non-compositional phrases from large corpora, and classifying metaphoric/non-metaphoric and humorous/non-humorous language use. By discussing various non-literal phenomena and approaches to treat them, the course will introduce the students to classification techniques, word sense disambiguation (WSD) algorithms, and reasoning approaches. We also discuss the role of general lexical resources such as WordNet for figurative language processing.
Ontologies and Lexical Semantics in Natural Language Understanding

Lecturers: Buitelaar, Paul and Cimiano, Philipp
Details: http://www.dfk1.de/~paulb/
ID62: Language and Computation (Advanced)
Week: 2
Time: 2:00 - 3:30
Room: Davis

The course will be concerned with the interaction between ontologies (as originating out of knowledge representation and developed currently in the context of the Semantic Web) and lexical semantic theory and resources (e.g. WordNet, FrameNet, Generative Lexicon) and their role in natural language understanding tasks. In particular, we will discuss the role that foundational and domain ontologies can play in sense disambiguation, discourse and temporal interpretation, and in applications such as ontology-based information extraction and semantic information integration and fusion. Further, we will look at the role that natural language processing and understanding can have in the incremental acquisition of domain ontologies from textual data, i.e. through text and web mining. The course will be suitable for advanced students in the areas of AI, NLP and Semantic Web.

Chapter 6
Student Session

The 12th ESSLLI Student Session is co-chaired by Ville Nurmi and Dmitry Sustretov.

6.1 Program Committee

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CHAPTER 5. COURSE DESCRIPTIONS

Complexity of Constraint Satisfaction

Lecturers: Bodirsky, Manuel and Chen, Hubert
Details: http://www
ID8: Logic and Computation (Foundational)
Week: 2
Time: 10:45-12:15
Room: Lloyd 8

In this course we give a gentle introduction to the theory of constraint satisfaction. The course covers algorithmic techniques, for example techniques based on various notions of local consistency, and systematic complexity results, that help to clarify the borderline between tractable and intractable constraint satisfaction problems. Constraint satisfaction originates in artificial intelligence, and draws its motivation from various fields of applications such as database theory, computational linguistics, computational biology, and many others. One of the fascinating aspects of the theory of constraint satisfaction is that it links the areas of logic, graph theory, and universal algebra. The links are strong, and cover the core concepts of these three fields. Our presentation will be example-based and application-driven, and we use the language of directed graphs as a convenient playground to explore definitions and pose exercises. We also lead the audience to the most powerful results related to the famous unresolved dichotomy conjecture--a conjecture that continues to stimulate a huge amount of research activity.

Reference and Entity Resolution Beyond the Textual Coreference of Pronouns

Lecturer: McShane, Majorie
Details: http://ilit.umbc.edu/PubMcShane.htm
ID73: Language and Computation (Advanced)
Week: 2
Time: 5:00 - 6:30
Room: Lloyd 4

The history of work on reference resolution has shown a strong emphasis on establishing textual coreference links for pronouns. However, the actual coreference needs of high-end computer applications extend far beyond this narrow purview. On day 1 of this tutorial, we will review the mainstream computational work on reference resolution, including extant systems. On the remaining days we will target more difficult aspects of reference resolution that require significant linguistic work and represent wide open research opportunities. Topics covered will include: syntactic and semantic ellipsis; referring expressions that refer to chunks of discourse with sometimes inexact spans (e.g., demonstratives); so-called "bridging" contexts; fragment sentences; entity resolution against a repository of stored knowledge; cross-linguistic mismatches in referring strategies; and script-based reference resolution methods. Material will include cross-linguistic descriptions of phenomena, resolution algorithms, and how these might be incorporated into future practical systems.
Evaluation in natural language processing

Lecturer: Santos, Diana
Details: http://www.linguateca.pt/Diana/esslli07.html
ID17: Language and Computation (Foundational)
Week: 1
Time: 10:45-12:15
Room: Lloyd 1

What are the purposes of evaluation. Different kinds of evaluation (of an hypothesis, of a resource, of a system in terms of its requirements, of a system in terms of usability, of model adequacy, of economical impact). Measures and concepts (properties of measures, relationship with desirable properties, statistical remarks). Evaluation of user-visible vs. user-transparent tasks; black-box vs. glass-box evaluation. The evaluation contest paradigm. Evaluation resources (golden resources, pooling, ablation). Baselines, ceilings, inter-annotator agreement. Corpus-based evaluation. Detailed examples: parsing, information retrieval, information extraction, machine translation, morphological analysis, and generation.

Nonmonotonic Reasoning: Logical Foundations

Lecturer: Bochman, Alexander
Details: http://www.hit.ac.il/departments/computers/staff/Bochman/index.htm
ID60: Logic and Computation (Advanced)
Week: 1
Time: 2-3:30
Room: Lloyd 4

The course is intended to provide a rigorous and uniform account of nonmonotonic reasoning as it emerges after a quarter of century of its development in Artificial Intelligence and Logic. We discuss first a general framework of nonmonotonic reasoning formalisms as two-tier systems consisting of logic and nonmonotonic semantics. Then we describe two basic approaches to nonmonotonic reasoning, preferential and explanatory nonmonotonic reasoning. The preferential approach is based on the notion of normality, and we provide a uniform formalization of this approach using a semantic notion of an epistemic state. We discuss also the main objective of this approach, a construction of a theory of defeasible entailment. Then we turn to describing an alternative, explanatory approach to nonmonotonic reasoning that includes default and modal nonmonotonic logics, logic programming with negation as failure, argumentation theory and causal reasoning. A uniform description of this approach will be provided using the notion of a biconsequence relation and its derivatives. We conclude with discussing perspectives and problems for the future development of the field.
Post’s Lattice with Applications to Complexity Theory

Lecturer: Vollmer, Heribert
Details: http://www.thi.uni-hannover.de/lehre/ss07/esslli07/
ID68: Logic and Computation (Advanced)
Week: 2
Time: 5-6:30
Room: ORI LCR

Post’s lattice is the lattice of all classes of Boolean functions that contain the identity functions and are closed under composition—these classes are also known as clones. In the past few years, this lattice found many applications in computer science, among others it has turned out to be a powerful tool for complexity-theoretic studies of problems related to Boolean circuits, propositional formulas, and constraint satisfaction. In this course we will give a basic introduction to Post’s lattice and demonstrate its applications in complexity theory. Overview of the lectures:

1. Boolean functions and closed classes;
2. Complexity of membership problems;
3. Applications: Boolean circuits and propositional logic;
4. Applications: Modal logic and database problems;
5. Applications: Constraint satisfaction problems.

The course will be aimed at advanced Masters or Ph.D. students with a minimal background in computational complexity (basic time and space bounded classes such as LogSpace, PTime, NPTime, basic reducibilities). It will introduce them to the lattice of Boolean clones and its applications and will lead them to the study of current research problems in the field.

Computational Anaphora Resolution

Lecturer: Hinrichs, Erhard
Details: http://www.sfs.uni-tuebingen.de/~eh
ID10: Language and Computation (Foundational)
Week: 1
Time: 2:00-3:30
Room: Lloyd 1

Computational anaphora resolution (CAR) has been a very active research area in computational linguistics for over 20 years. The topic seems particularly suitable for the language and computation section of ESSLLI since CAR combines insights from theoretical linguistics (e.g. binding theory, discourse semantics, and information structure) with insights from computational linguistics (e.g. computational modelling of discourse, computational semantics, and statistical modelling of language). The course has three major goals: to introduce rule-based, statistical, and machine-learning approaches to CAR; to provide an overview of tools necessary for CAR, including morphological analyzers, taggers, named-entity recognizers, shallow and deep parsers; to give tutorial introductions to computational tools and machine learning software (such as Java-RAF, C4.5 and TiMBL) that are central to modeling CAR. The course is planned as an advanced course, but could be offered also at the introductory level.
English syntax for computational linguistics

Lecturer: Pullum, Geoffrey K.
Details: http://people.ucsc.edu/~pullum
ID15: Language and Computation (Foundational)
Week: 2
Time: 9:00 - 10:15
Room: Lloyd 1

This course provides a foundational introductory survey of English syntax from a modern perspective, showing with detailed examples how / The Cambridge Grammar of the English Language / (henceforth CGEL) can provide a sound basis for both research and applied work in computational linguistics. The lectures cover:

1. a top-level introduction to the assumptions, organization, and content of CGEL, and how to use it as a reference work;

2. an explication of CGEL’s largely implicit conception of syntactic structures (despite their edge labels and the use made of downward branch convergence, there is a faithful interpretation under which they reduce to trees);

3. comparison with other grammar formalisms, including the correspondence between CGEL’s categories and the tags used in the Penn Treebank (the fit is remarkably good);

4. detailed examination of specific sentence analyses (examples proposed by class participants);

5. exploration of certain areas of English syntax having particular theoretical significance.

Neighborhood Semantics for Modal Logic

Lecturer: Pacuit, Eric
Details: http://staff.science.uva.nl/~epacuit/nbhd_esslli.html
ID57: Logic and Computation (Advanced)
Week: 2
Time: 2:00-3:30
Room: Lloyd 8

Dana Scott and Richard Montague (influenced by a paper written by McKinsey and Tarski in 1944) proposed independently in 1970 a new semantic framework for the study of modalities, which today is known as neighborhood semantics. The semantic framework permits the development of elegant models for the family of classical modal logics, including many interesting non-normal modalities from Concurrent Propositional Dynamic Logic to Coalition Logic to monadic operators of high probability used in various branches of game theory. We will introduce neighborhood semantics for modal logic and discuss some applications (including recent application to first-order modal logic and the semantics of common knowledge). The main goal of the course is to understand the basic techniques and results of neighborhood semantics for modal logics and to understand the exact relationship between the standard relational semantics and neighborhood semantics for modal logics. In particular, we will discuss completeness and incompleteness results, decidability and complexity issues, the Kracht-Wolter simulation of non-normal modal logics by normal ones and some model-theoretic issues (such as bisimulations). Although the course will be completely self-contained, it will be assumed that the students are familiar with the main results of propositional modal logic with respect to relation semantics (for example, the first five chapters of the Blackburn et al. book on modal logic).

The main prerequisite is a certain level of mathematical maturity (for example, at the level of an advance Masters student or first-year Ph.D. student in mathematics or computer science).
Knowledge is a key concept in many branches of computer science (including AI, multi-agent systems, deductive databases etc.), and one for which logic-based methods proved highly suitable. In this lecture, we want to discuss two traditions of modeling knowledge and its evolution. Firstly, a dynamic view offered by logic programming and belief update/revision: an epistemic state is represented by a logical theory (logic program), to which nonmonotonic operations of belief update (or revision) can be applied. Secondly, a "static" view offered by modal logics of knowledge and action, in which all the possible epistemic states (and their transformations) are already present in the models. Finally, we point out that both approaches are in fact complementary views of the same notion.

**Prerequisites:** Students should have basic knowledge about propositional and predicate logic (a 1 semester course on formal logic should do). Some elementary knowledge about modal logic and (classical) logic programming would also help. No knowledge about Answer Set Programming and/or belief updates is required.

We propose the following course outline (each chapter will be given in 90 minutes):

1. Basic remarks. Logic programming.
2. Answer Set Programming.
3. Modal logic.
5. Modalities in action. Where the two frameworks meet. From logic programming to modal logic and back.
5.2 Logic and Language

This is a course on ‘surface reasoning’ in natural language. The overall goal is to study logical systems which are based on natural language rather than (say) first-order logic. Most of the systems are complete and decidable, the class will see a lot of technical work in this direction. (At the same time, the work is elementary. One needs only a small logic background to follow the course.) The course will also sample a different topic: current work coming from cognitive science that looks at linguistic phenomena. The topic of natural logic lends itself to philosophical reflections on the nature of semantics and is arguably something all formally-minded linguists and linguistically-minded logicians should know about.

Logics with Counting

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Among the more intriguing decidable fragments of first-order logic to have been studied in recent decades are those involving counting quantifiers. One particularly salient example is the two-variable fragment with counting quantifiers. Logics with counting quantifiers present special difficulties for the student of computational logic, because the analysis of their complexity often requires specialized techniques. This course will give a comprehensive treatment of these techniques, culminating in a proof that the satisfiability and finite satisfiability problems for the two-variable fragment with counting quantifiers are both NEXPTIME-complete.
Verification of temporal logics on infinite-state systems

Lecturers: Demri, Stephane and Goranko, Valentin
Details: http://www.lsv.ens-cachan.fr/~demri/esslli07-course.php
ID85: Logic and Computation (Advanced)
Week: 1
Time: 9:00-10:30
Room: Lloyd 8

This course is dedicated to infinite-state systems with decidable model checking of properties defined in temporal logics. Model-checking of infinite-state systems is a rapidly growing area of formal verification. It has been successfully applied to real-time and hybrid systems, concurrent systems, Petri nets, asynchronous communication devices (unbounded FIFO channels), infinite and unbounded data structures (counters, queues, lists), etc. Temporal logics are one of the most natural and suitable formalisms for specification and verification of properties of infinite state systems. Course outline and tentative daily schedule:

Lecture 1 Finite representations of infinite-state transition systems. Examples: counter systems, timed automata, pushdown systems, rational transition systems; Temporal logics as specification languages; Symbolic model checking.

Lecture 2 Counter systems. Reachability problems; Temporal logics for counter systems; Decidable and undecidable model checking problems for reachability in counter systems.

Lecture 3 Decidable and undecidable fragments of Presburger LTL; LTL/Modal mu-calculus for one-counter systems; CTL* over flat Presburger counter systems. FAST tool.

Lecture 4 Timed automata; Timed temporal logics (TPTL, MTL, TCTL); Complexity of model-checking.

Lecture 5 Model checking temporal logics on pushdown systems; Regular model checking of temporal logic; Model checking temporal logics on rational transition systems.

Prerequisites: basic knowledge of temporal logic, automata, model checking, complexity.

Type Logical Grammar

Lecturer: Morrill, Glyn
Details: http://www.lsi.upc.edu/~morrill/
ID82: Logic and Language (Introductory)
Week: 1
Time: 5-6:30
Room: Museum 20

A self-contained review of the state of the art in Type Logical Grammar with an emphasis on the dichotomy continuous/discontinuous and on linguistic applications. Grammar of continuity: the Lambek calculus; sequent calculus, proof nets and applications. Categorial semantics ‘coming for free’. Syntactic domains: bracket operators; sequent calculus, proof nets and applications to islands. Grammar of discontinuity: the discontinuous Lambek calculus; hypersequent calculus, proof nets for basic discontinuity and applications of discontinuous Lambek calculus: quantification, medial extraction, parentheticals, gapping, particle shift, complement alternation, anaphora, pied-piping, VP ellipsis, reflexivisation and comparative sub-deletion.
Nouns and Verbs

Lecturer: Rathert, Monika
Details: http://web.uni-frankfurt.de/fb10/rathert/
ID61: Logic and Language (Introductory)
Week: 1
Time: 9-10:30
Room: Lloyd 4

This is a mixed semantics/morphosyntax course on verbs, nouns, and elements between these categories. In the first session, we will deal with verbs and verbal phenomena like tense, aspect, Aktionsart, and modality. We will develop a compositional approach to the description of these structures. Session two and three will be devoted to nouns and typically nominal phenomena like referentiality, (in)definiteness, and quantification. The last two sessions will focus on the formal infinitives, deverbal nouns, nouns with tense-marking, gerunds, and nominalized participles. We will work out the verbal and nominal characteristics of these mixed categories and develop a formal apparatus to describe them in a coherent way. Data are drawn from a variety of (typological related and unrelated) languages, as one of the aims of the course it to get a good cross-linguistic overview.

An Introduction to Formal Argumentation

Lecturer: Caminada, Martin
Details: http://www.cs.uu.nl/~martinc
ID5: Logic and Computation (Introductory)
Week: 1
Time: 5:00 - 6:30
Room: Swift

Formal argumentation is a technique for nonmonotonic reasoning that is unique in the sense that instead of a monolithic approach for defeasible entailment as is observed in the field of traditional nonmonotonic logics, entailment under the argumentation approach is defined in a modular and quite intuitive way. The idea is to construct arguments (based on a knowledge base) and to examine how these interact (attack each other). Based on these interactions, an argument-based semantics then defines which extensions of arguments can be distinguished, which ultimately leads to a set of justified conclusions. In the proposed course, we will give a concise treatment of the aspects that play a role in formal argumentation, such as argument-based semantics, the internal structure of arguments and the nature of the defeat relation, proof procedures and the dialectical nature of argumentation, the mapping of traditional defeasible logics into the argumentation paradigm, and argumentation software implementations.
Formal models of knowledge and belief have been used by a wide range of communities including computer scientists, economists and philosophers. One important challenge is to determine to what extent these formal models represent the social situations that they are intended to model. With this challenge in mind, we will survey the main approaches to formalizing social interactive situations from the computer science, game-theoretic and philosophical literature. This includes both probabilistic models (such as Harsanyi type spaces) and non-probabilistic models (such as Kripke structures and Aumann structures). We will then discuss some of the key theorems (such as Aumann’s agreement theorem and related results) and conceptual puzzles (such as the generals problem and the Brandenburger-Keisler Belief paradox). An important part of the course will be a thorough presentation of common knowledge and related concepts (such as distributed knowledge) as well as a discussion of applications in game theory. The goal of this course is to introduce students to the field of formal epistemology. Although formal methods will be used, the focus of the course is not technical but rather on intuitions and the main conceptual issues (such as the logical omniscience problem). As such, there are no prerequisites for this course except some mathematical maturity.
Hyperintensional Semantics

Lecturer: Pollard, Carl
Details: http://ling.osu.edu/~hana/hog
ID28: Logic and Language (Advanced)
Week: 1
Time: 10:45-12:15
Room: Swift

We use higher-order logic with separation subtypes and schematic polymorphism to develop a simple theory of sense and reference free of the usual Logical Omniscience and Hesperus-Phosphorus problems. Also solved is the perplexing Nonprincipal Filters (Missing Worlds) problem of standard possible-worlds theories. The solutions use a generalization of the pre-Kripke (Stone-Tarski-Jonsson) boolean-operators approach to modality. A criterion is given to distinguish modal from other propositional operators. Senses need not have reference in every world. Senses are compositional, but (pace Frege) references need not be. To deal with context dependence, we introduce utterance contexts as a kind (distinguished set of types), with meanings of signs as functions from one type of context to another. Then an utterance interpretation is a transition from one context to another. In this setting, the utterance sense (preferred content) is just one dimension of the output context.

Automata and Logic on Trees

Lecturers: Vansummeren, Stijn and Martens, Wim
Details: http://alpha.uhasselt.be/~lucg5855/
ID1: Logic and Computation (Introductory)
Week: 1
Time: 2-3:30
Room: Davis

Regular languages are a fundamental concept in Computer Science. However, as undergraduate courses usually do not go beyond regular languages over strings, the elegant generalisation to regular tree languages is less known. Nevertheless, regular tree languages have become highly relevant for XML-related research. Indeed, finite automata for tree languages serve as a formal model of XML schema languages such as XML Schema, and their computational properties form the basis of many static analysis algorithms. The logical counterpart of finite automata over trees is Monadic Second Order logic (MSO). This connection allows to infer, e.g., closure properties and decidability of many decision problems. We intend to provide a rigorous introduction to tree automata and their logical counterpart. In particular, we treat ranked tree automata, constructions on automata, closure properties, complexity of decision problems, MSO on trees, its correspondence to tree automata, unranked tree automata, and their application to XML.
Logics of Agency and Multi-Agent systems

Lecturers: Jan Broersen, Andreas Herzig
Details: http://www.irit.fr/ACTIVITES/LILaC/Pers/Herzig/Esslli07
ID47: Logic and Computation (Introductory)
Week: 2
Time: 9:00-10:30
Room: Lloyd 8

This course presents two families of logics that are closely related and that have been introduced and studied independently in different fields in order to reason about agency and time. Belnap's logic of 'seeing to it that' (STIT) and Kanger and Prn's 'bringing it about' logic have been intensely studied and debated in philosophy of action. These logics provide an explanation of the causal relation between an agent and a state of affairs that the agent makes true. They have been extended by Horty with deontic concepts such as obligation and permission. Temporal logics of agency such as Pauly's Coalition Logic (CL) and Alur et al.'s Alternating-time Temporal Logic (ATL) have been proposed more recently in computer science for the specification and verification of multi-agent systems. These logics enable reasoning about what agents and groups of agents can achieve by means of actions from their repertoire. They have been extended by van der Hoek and Wooldridge with the notion of knowledge. The course aims at introducing these two families, and explicating the connections between them. We discuss the choices of the linguistic primitives, semantics, translations and computational properties. In addition, we consider a unifying framework incorporating the general aspects of STIT and ATL. We discuss extensions of the unifying framework that deal with interactions of agency with epistemic notions and deontic notions.

Prerequisites: We assume basic background knowledge of normal modal logics, and some knowledge of semantics for weak modal logics, such as neighborhood semantics.

New directions for proof theory in linguistics

Lecturers: Chris Barker, Anna Szabolcsi
Details: http://homepages.nyu.edu/~as109/barker_szabolcsi_course_esslli2007.html
ID58: Logic and Language (Advanced)
Week: 2
Time: 5-6:30
Room: Ui Chadhain

Proof theory has been fruitfully applied in several areas of linguistics, including theories of syntactic well-formedness, ellipsis resolution, and cross-linguistic variation. We concentrate in this course on new work by various authors using proof theory for characterizing aspects of the syntax/semantics interface, including proof-theoretic accounts of phrase sub-typing for scope interactions; negative polarity and other types of licensing; the differential behavior of quantificational elements; and more. The research question addressed is: What insights does the proof theoretic approach offer in this particular empirical domain and to what extent should linguistic competence be viewed as a system of logical inference? Prerequisites should be familiarity with formal approaches to natural language semantics, including some exposure to formal logic.
### Temporal and Modal Dimensions of Modal and Temporal Expressions

**Lecturers:** Condoravdi, Cleo and Kaufmann, Stefan  
**Details:** [http://www.cs.tcd.ie/esslli2007/content/courses/id76r.html](http://www.cs.tcd.ie/esslli2007/content/courses/id76r.html)  
**ID76:** Logic and Language (Advanced)  
**Week:** 2  
**Time:** 9:00-10:30  
**Room:** Davis

While modal and temporal expressions have long been objects of active research, recent work has shown that a much better understanding of their interpretive possibilities is gained by integrating the modal and temporal dimensions and taking their interactions into account. This course prepares students for advanced work in this area. Following an introduction to the relevant data and formal apparatus, we develop a uniform compositional analysis of a variety of linguistic expressions which showcase the benefit of an integrative modal-temporal perspective.

**Day 1** Temporal interpretation of modals. Hidden modality of tenses and other temporal expressions. Logical analyses of modality and tense.

**Day 2** Two-dimensional modal-temporal logic. Interactions between modal and temporal accessibility relations.

**Day 3** Plain modals and covert modality. Temporal interpretation and selection of modal base. “Scheduling readings” of the bare Present.

**Day 4** Indicative conditionals. Tenses and modals in if-clauses. Temporal relations between antecedent and consequent.

**Day 5** Modal implications of temporal connectives. Predictability, counterfactuality, (non-)veridicality.

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### Introduction to Unification Theory

**Lecturer:** Kutsia, Temur  
**Details:** [http://www.risc.uni-linz.ac.at/people/tkutsia/esslli2007](http://www.risc.uni-linz.ac.at/people/tkutsia/esslli2007)  
**ID40:** Logic and Computation (Introductory)  
**Week:** 2  
**Time:** 9-10:30  
**Room:** Ui Chadhain

Unification is a fundamental process in many areas of computer science. It is in the heart of the applications such as logic programming, automated reasoning, natural language processing, information retrieval, rewriting and completion, type checking, etc. Hence, the suggested course on unification fits with the areas of interest of ESSLLI: Logic, Computation, and Language. It is intended to be an introductory one-week course on unification theory structured into five lectures to cover the following topics:

**Day 1** Introduction, preliminaries, Robinson’s algorithm and its complexity.

**Day 2** Improving efficiency, dags, algorithms of Corbin-Bidoit and Martelli-Montanari.

**Day 3** Equational Unification, unification hierarchy, examples, E-unification in arbitrary theories, survey of results in particular theories.

**Day 4** Higher-order unification and matching. Huet’s algorithm, decidable subcases.

**Day 5** Applications of unification in logic programming, theorem proving, rewriting/completion, natural language processing. Open problems, conclusions.
5.3 Logic and Computation

Foundations of Fuzzy Logics

Lecturers: Metcalfe, George and Preining, Norbert
Details: http://www.math.vanderbilt.edu/people/metcalfe/esslli
ID23: Logic and Computation (Introductory)
Week: 1
Time: 9:00-10:30
Room: Uits Chadhain

Fuzzy logics are a family of many-valued logics suited to reasoning in contexts of vagueness, and are currently the subject of active intensive research in computational logic. The aim of this introductory course is to give a uniform presentation of fuzzy logics across several logical frameworks, most importantly using t-norms, algebraic semantics, and proof theory. We propose the following schedule:

**Day 1** Introduction to many-valued and fuzzy logics, their history and motivation.

**Day 2** Basic techniques of the t-norm based approach, including Lukasiewicz, Godel, and Product logics.

**Day 3** Axiomatizations, algebraic semantics, and standard completeness results for fuzzy logics.

**Day 4** Gentzen-style proof theory for fuzzy logics: techniques and applications.

**Day 5** Introduction to first-order fuzzy logics and axiomatizability/undecidability results.

Human reasoning and cognitive science

Lecturer: Stenning, Keith
Details: http://www.hcrc.ed.ac.uk/~keith/ESSLLIDublin
ID86: Logic and Language (Advanced)
Week: 2
Time: 2-3:30
Room: Swift

The course will be based on a book which should be out by then: Keith Stenning and Michiel van Lambalgen: Human Reasoning and Cognitive Science. MIT Press. Currently available at:

http://www.hcrc.ed.ac.uk/keith/LogicandPsychologyCourse/draft.pdf

The book uses defeasible logics to show that the data used in the psychology of deductive reasoning has to be regarded chiefly as reasoning TO interpretations, rather than reasoning FROM them. This data is modelled in the defeasible logic 'logic programming with negation as failure'. Neural implementations for this defeasible logic are given and implications for the evolution of human reasoning and language, and for understanding developmental syndromes are drawn. The course will be aimed at logic and linguistics students who are interested in getting to grips with the empirical literature on reasoning, or for cognitive psychologists wanting to gain formal understanding.
Formal Description of Syntax

Lecturer: Rogers, James
Details: http://cs.earlham.edu/~jrogers
ID22: Logic and Language (Foundational)
Week: 2
Time: 9:00-10:30
Room: Lloyd 4

This course introduces the basic techniques and results of Formal Language Theory from a foundation in Logic (Finite Model Theory) with a particular focus on issues relevant to the study of Syntax. In addition to providing a route into the material based only on the goal of formalizing notions of syntactic structure, the course addresses the questions of why these techniques are relevant to the study of Syntax and why abstract notions of Language-Theoretic complexity are relevant to the study of human languages. The only prerequisite is a moderate degree of comfort with mathematical precision. Although the material will be situated the context of Syntax, the focus will be formalization of structure in general, not on any particular theory of syntax. While the course is foundational, the approach we will take is distinctive enough that it is likely to be useful even to those with some prior experience with FLT.

Elements of Compositional Semantics

Lecturer: Winter, Yoad
Details: http://www
ID14: Logic and Language (Foundational)
Week: 1
Time: 9-10:30
Room: Swift

The course will give a concise introduction to compositional modeltheoretic semantics in the Montague tradition, with ample discussion and motivation coming from recent research. Concentrating on the underlying methodological principles, I will aim to attract students’ attention to the beauty and scientific value of the rigorously-defined mathematical techniques. The course is intended for students who don’t necessarily have any prior knowledge in logic or linguistics, but have some basic mathematical or general scientific background. The foundational concepts and techniques that will be covered include: entailment as a rich empirical domain, ambiguity, compositionality, direct model-theoretic interpretation, types and model structure, boolean operators and generalized quantifiers. Motivations and examples will draw on recent research of coordination, quantifier scope, intensionality, plurality, and spatial expressions.