Incrementality: Evidence for / against incrementality from psycholinguistic research and incremental algorithms in NLP.

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Universität des Saarlandes

– SS 2011 –

April 14th, 2011
What are we going to discuss today?

1. Introduction to Incremental Processing
2. Course Requirements
3. Giving a good talk
4. Topics
5. Organization: Time Slots
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1. Introduction to Incremental Processing
2. Course Requirements
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What does “Incrementality” mean?

- In parsing: word-by-word processing
  - always have to deal with word $w_n$ before dealing with word $w_{n+1}$
- Depending on granularity level you’re interested in, could also refer to syllable by syllable, sound by sound, sentence by sentence processing
- “Incremental Processing” is practically used in different ways:
  - input read in incrementally
  - incremental input processed partially
  - incrementally input processed completely ← “strict incrementality”

This seminar is going to be mostly concerned with strict incrementality
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incremental parsing:

\[
\begin{array}{c}
  \text{NP} \\
  | \\
  \text{Peter}
\end{array}
\]
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```
S
  /    \
/      \
NP     VP
   \
  Peter
  \
   AP   VP
  \
  often sleeps
```
Why should we care about incrementality?

Psycholinguistic motivation:
- Is human sentence processing strictly incremental?
- If yes: learn about cognition by building strictly incremental processing models.
- If yes: what advantages does it have that we can learn from for NLP?

Motivation from language technology:
- Some applications are time-critical.
- Response times can be much faster if we process incrementally.
- Relevant for dialogue systems, speech-to-speech translation, human-robot interaction.
Different angles on incrementality in this course

- **Psycholinguistic Evidence** for different degrees of incrementality
  - Everybody agrees that words are perceived one after the other. :-)  
  - Not everybody agrees that they are eagerly integrated into the context as soon as they are perceived.

- **Examples from Applications** that profit from Incrementality
  - Where can incremental processing improve an application?  
  - Are there also disadvantages related to incrementality?  
  - Is there an optimal degree of incrementality? What might it be?

- Let’s have a look at current **incremental algorithms in NLP**
  - What’s the state of the art? Are there many incremental algorithms to choose from?  
  - What are the challenges in designing an incremental algorithm?  
  - Are some linguistic formalisms more appropriate than others?
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Requirements for this course

- Each student has to give a presentation based on 1-2 papers (70%).
- Each student has to fill in a peer review form for each presentation (15%).
- You have to read one of the papers in advance each week and prepare at least 2 thoughtful questions for each session and participate in the discussion (15%).
- If you registered for the seminar for 7 points, you need to write a term paper (12-15 pages) at the end of the semester.
- Attendance: You can miss ONE seminar without giving an explanation; if you miss more, you have to hand in a critical review for each paper that was presented when you were absent.
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Think of the worst / most boring talk or lecture you’ve ever had to sit through.

Let’s brain storm: Why was it so bad?

And what makes good talks good?
How to give a good talk

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- Let’s brainstorm: Why was it so bad?
- And what makes good talks good?
How to prepare for your presentation

- Read your paper(s) well in advance (2-3 weeks before your presentation date)!
- in order to understand them well, you’ll probably have to read them 3-4 times! Send me an email if there is something you don’t understand.
- prepare your slides
- note: making good slides takes a lot of time!
- meet me one week before your presentation, send me your slides before the meeting
- train your presentation style in front of your flatmate / the mirror / ...
- you’ll probably have to go through your presentation 3-10 times before you’ll be able to give it well.
Peer Review Forms

WHY peer review forms??? and how will it work?

You profit as a reviewer:

- goal: to make you more observant of other’s talks
- learn more from presentations given by others
- all comments to the presenter will be ANONYMOUS

You profit as a presenter:

- know what you’re aiming for: you can check beforehand whether you think your talk meets all the criteria in the review form
- feedback: you will get lots of detailed feedback on your talk which you otherwise don’t usually have the chance to obtain

Note on grading for review forms: good grade = thoughtful comments, give constructive comments in addition to the box ticking and circling.
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Evidence for / against strict incrementality (choose 2)

- Swets et al. (2008): *Underspecification of syntactic ambiguities: Evidence from self-paced reading*
Psycholinguistics topics: PSY2

Incrementality and Prediction (choose 2:)

- Altman, Kamide and Haywood (2003):
  *The time-course of prediction in incremental sentence processing: Evidence from anticipatory eye-movements.*

- Van Berkum et al. (2005):
  *Anticipating upcoming words in discourse: Evidence from ERPs and reading times.*

- Staub and Clifton (2006):
  *Syntactic Prediction in Language Comprehension: Evidence From Either...or*
Psycholinguistics topics: PSY3

Local Coherence Effects

- Tabor et al. (2004)
  *Effects of merely local syntactic coherence on sentence processing.*

- Gibson (2006)
  *The interaction of top-down and bottom-up statistics in the resolution of syntactic category ambiguity.*
How about language production?

- Fernanda Ferreira (2000).
  
  Syntax in Language Production: An Approach Using Tree-Adjoining Grammars
Psycholinguistics topics: PSY5

Arguments for incrementality from a linguistic view point

- Phillips (2002)
  
  *Linear Order and Constituency*

(strong linguistics background required)
Applications topics: APP1

Dialogue systems / interactions with agents

Applications topics: APP2

Machine translation

- Hassan, Sima’an, Way (2009)
  
  *A Syntactified Direct Translation Model with Linear-time Decoding*

- Hefny, Hassan, Bahgat (2011)
  
  *Incremental Combinatory Categorial Grammar and Its Derivations*

(Familiarity with CCG advantageous for this topic, or at least willingness to learn about the CCG grammar formalism)
Applications topics: APP3

Trade-off between incrementality (speed) and accuracy:

- Baumann, Atterer, Schlangen (2009)
  *Assessing and Improving the Performance of Speech Recognition for Incremental Systems*

  *Stochastically evaluating the validity of partial parse trees in incremental parsing*
Applications topics: APP4

Speech Recognition

- Schuler, Wu, Schwarz (2009)
  
  *A Framework for Fast Incremental Interpretation during Speech Decoding*
NLP topics: NLP1

Incremental Parsing with a PCFG

- Brian Roark (2001)
  
  *Probabilistic top-down parsing and language modeling.*
NLP topics: NLP2

Incremental Parsing with Dependency Grammars

  *Incrementality in Deterministic Dependency Parsing*

- Menzel (2009)
  *Towards radically incremental parsing of natural language.*
NLP topics: NLP3

Incremental Parsing with Tree-Adjoining Grammars (choose 3a or 3b)

3a:
- Libin Shen and Aravind Joshi (2005). *Incremental LTAG parsing*
- Mazzei, Lombardo, Sturt (2007). *Dynamic TAG and Lexical Dependencies*

3b:
- Demberg, Keller and Koller, (2011, under review) *Incremental, Predictive Parsing with Psycholinguistically Motivated Tree-Adjoining Grammar*
Incremental Semantic Parsing

- Atterer and Schlangen (2009)
  *RUBISC - a Robust Unification-Based Incremental Semantic Chunker*
- Purver and Kempson (2004)
  *Incremental parsing, or incremental grammar?*

(the latter will require to learn about "Dynamic Syntax")
NLP topics: NLP5

Incremental Parsing with Cascaded / Hierarchical HMMs


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Please:

- Send me an email with your top 3 preferred topics by MONDAY.
- If you want to have a specific time slot, please also let me know in that email.
- If you’re particularly keen on a specific topic and/or time slot, please write me an explanation for why this is so important to you.

EMAIL ADDRESS: vera@coli.uni-saarland.de

Next week:

- finalize time table
- historic background to debate on incremental processing