Computer Science and Language

Martin Emms

November 22, 2019
CSL is a combined study of

- Computer Science
- French
- German
- Irish

learn

learn the

Science of Language
CSL is a combined study of

- Computer Science

learn

Computer Science

learn the

Science of Language
CSL is a combined study of

- Computer Science
- a Language,
Computer Science and Language

CSL is a combined study of

- Computer Science
- a Language, one of {German, French, Irish}

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{French, German, Irish}
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- Science of Language
CSL is a combined study of
- **Computer Science**
- a Language, one of **German, French, Irish**
- **Science of Language**

**linguistics** the scientific study of language in general
CSL is a combined study of

- Computer Science
- a Language, one of
  - German, French, Irish
- Science of Language
  - linguistics: the scientific study of language in general
  - computational linguistics: the associated technologies concerning language
learn COMPUTER SCIENCE

1. sent_false = 0;
2. while(more 'students') {
3.   s = next 'student';
4.   if (s is 'CSL') {
5.     vp_true = 0;
6.     while(more 'courses') {
7.       c = next 'course';
8.       if (c is 'syntax') {
9.         if (s 'studies' c) {
10.            vp_true++;
11.        }
12.     }
13.   }
14.   if(vp_true == 0) {
15.     sent_false++;  
16.   }
17. }
18. }
19. if(sent_false > 0) { 
20. else { return true }
learn COMPUTER SCIENCE

- master the techniques and technologies that lie behind what you see on the screen of one of today's computers

```c
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- become able to participate in the development of the applications of the future.

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- no prior knowledge of computing is required; some aptitude for mathematics, for the analysis of a system, for recognition of structure will help.

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- the degree requires a C3 or better in Higher Level maths

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- you will study either German, French or Irish
master A LANGUAGE

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- reach a sufficient competence to operate in that language in your professional career
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- you will study either German, French or Irish
- reach a sufficient competence to operate in that language in your professional career
- your 3rd year is spent abroad as an Erasmus exchange student.
study the science of LANGUAGE

- Language can be *scientifically studied* – this is linguistics
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- Language requires its own *technologies* – this is computational linguistics
Language can be *scientifically studied* – this is *linguistics*

Language requires its own *technologies* – this is *computational linguistics*

systems in the *sounds* of languages, the International Phonetic Alphabet

Where symbols appear in pairs, the one to the right represents a rounded vowel.
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- systems in the *words* of languages

```
darwin  -ian-ism  good
```

```
darwin  -ism-ian  bad
```
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- Systems in the *grammars* of languages
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- Systems relating *grammar* to meaning
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learn French, German, Irish

learn the Science of Language
there are more links than you might think

- mastering a foreign language fosters a feel for grammar \(\Rightarrow\) a headstart in linguistics
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- mastering a foreign language fosters a feel for grammar ⇒ a headstart in linguistics
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- notions of recursion, subroutine and substructure are shared between computer science and linguistics
- linguistics and computer science are joined in computational linguistics
What is Computational Linguistics?

Sergei Brin is the founder of Google. When he founded the company in 2001.

<table>
<thead>
<tr>
<th>Name</th>
<th>Founder</th>
<th>StockPrice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Google</td>
<td>Sergei</td>
<td>$4.00</td>
</tr>
<tr>
<td></td>
<td>Brin</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Microsoft</td>
<td>Bill</td>
<td>$3.00</td>
</tr>
<tr>
<td></td>
<td>Gates</td>
<td></td>
</tr>
</tbody>
</table>

Finding Answers in Text
Finding Answers in Databases
Translation
Speech Synthesis

wann wurde Google gegründet?

when was Google founded?
What is Computational Linguistics?

- answering questions using texts
- machine translation
- document summarisation
- speech synthesis
- speech recognition
- language generation
- document categorisation
- speaker identification
- lie detection
- sentiment analysis
Careers
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CSL graduates have skills in

*Problem-solving* • *Programming* • *Analysis*

*Foreign-language* • *Self-reliance*
Careers

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Foreign-language • Self-reliance*

CSL graduates gone into a wide range of careers, for example

- IBM, Microsoft, Trados
  *developing language technology*
- Google, Accenture
  *general software engineering*
- BMW, Ingersoll Rand
  *technological and organisation roles within IT or other sections of multinationals*
- Deutsche Bank, DEPFA
  *Banking and finance*
- Irish Diplomatic Corps
  *combining language with analytical skills*
- the European Patent Office
  *combining language with technical knowledge*
- Transpiral
  *direct use of language skills in translation consultancy*
- speech and language therapy
<table>
<thead>
<tr>
<th>Year on Year</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>First Year</strong></td>
</tr>
<tr>
<td><strong>Computing</strong></td>
</tr>
<tr>
<td>▶ Fundamentals</td>
</tr>
<tr>
<td>▶ Intro to Computer Programming (Java)</td>
</tr>
<tr>
<td>▶ Mathematics – logic linear algebra and calculus</td>
</tr>
<tr>
<td><strong>Linguistics</strong></td>
</tr>
<tr>
<td>▶ Language, Mind and Society</td>
</tr>
<tr>
<td>▶ Syntactic Analysis</td>
</tr>
<tr>
<td>▶ Phonetics and Phonology</td>
</tr>
<tr>
<td><strong>Language (G/F/I)</strong></td>
</tr>
<tr>
<td>▶ Fluency</td>
</tr>
<tr>
<td>▶ Culture</td>
</tr>
<tr>
<td><strong>Second Year</strong></td>
</tr>
<tr>
<td><strong>Computing</strong></td>
</tr>
<tr>
<td>▶ Data Structures and Algorithms</td>
</tr>
<tr>
<td>▶ C++ Programming &amp; Computational Linguistics</td>
</tr>
<tr>
<td>▶ Discrete Mathematics</td>
</tr>
<tr>
<td><strong>Linguistics</strong></td>
</tr>
<tr>
<td>▶ Formal Syntax &amp; Semantics</td>
</tr>
<tr>
<td>▶ Instrumental Phonetics and Speech Science</td>
</tr>
<tr>
<td>▶ Computational Morphology</td>
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<td>▶ Fluency</td>
</tr>
<tr>
<td>▶ Translation (esp. Comp Sci area)</td>
</tr>
</tbody>
</table>
Year on Year

Third Year
spent as Erasmus exchange student at partner university with courses on
Computing
► A.I./Computational Linguistics
► Software Engineering
► Probability & Statistics and Formal Methods
Linguistics
► Lexicology
► Language learning
Language (G/F/I)
► Fluency
► Rhetoric
Project: applying linguistics or comp. ling to target language

Fourth Year
Computing
► Databases
► Artificial Intelligence
Linguistics
► Speech Science
► Computational Linguistics
Language (G/F/I)
► Fluency
► Translation
Option course: eg. advanced Comp. Ling.
Project: substantial research and dissertation supervised by an established researcher.
Some interesting features
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- interdisciplinary: has sometimes suited those *undecided between science and arts*
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- has tended to be gender balanced
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- fosters many talents: problem solving (comp. sci), conceptual analysis (linguistics), cultural awareness (language), self-reliance (year abroad)
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- through projects in years 2, 3 & 4 CSL undergraduates are *encouraged to develop their own ideas and solutions.*
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- through projects in years 2, 3 & 4 CSL undergraduates are encouraged to develop their own ideas and solutions.
- CSL students attend a weekly research seminar, *The Dublin Computational Linguistics Research Seminar*
And finally

This is a challenging, useful and fascinating degree (and that's not just my opinion)
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the skills I learned as a result of this degree both in terms of personal development and technical and language skills have led me to a career that I find personally and professionally fulfilling. I have been shaped by my experiences in Trinity and I can certainly say that I couldn't be happier with the result

Anne McCarvill
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for further opinions and many more details see the web site

www.scss.tcd.ie/undergraduate/