Computer Science and Language

Martin Emms

December 7, 2017
CSL is a combined study of

- Learn
  - French
  - German
  - Irish

- Learn the
  - Science of Language

Computer Science and Language
CSL is a combined study of

- Computer Science

- French
- German
- Irish

**learn**

Computer Science

**learn the**

Science of Language
CSL is a combined study of

- **Computer Science**
- a **Language**, 

**learn**

- **Computer Science**
- **Learn the**
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- **French**
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CSL is a combined study of

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

CSL is a combined study of:

- Computer Science
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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**

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- **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.   }
7.   while(more 'courses') {
8.     c = next 'course';
9.     if (c is 'syntax') {
10.    if (s 'studies' c) {
11.      vp_true++;
12.    }
13.   }
14. }
15. if(vp_true == 0) {
16.   sent_false++;
17. }
18. }
19. if(sent_false > 0) { return false
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

```java
1. sent_false = 0;
2. while (more 'students') {
3.   s = next 'student';
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14.   if (vp_true == 0) {
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19. if (sent_false > 0) { return false }
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```
learn COMPUTER SCIENCE

- master the techniques and technologies that lie behind what you see on the screen of one of today’s computers
- become able to participate in the development of the applications of the future.

```plaintext
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) {
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16. }
17. }  
18. }
19. if (sent_false > 0) { return false }
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```
master the techniques and technologies that lie behind what you see on the screen of one of today’s computers

become able to participate in the development of the applications of the future.

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

```c
1. sent_false = 0;
2. while(more 'students') {
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7.             c = next 'course';
8.             if (c is 'syntax') {
9.                 if (s 'studies' c) {
10.                    vp_true++;
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16.     }
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18. }
19. if(sent_false > 0) { return false }
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```
learn COMPUTER SCIENCE

- master the techniques and technologies that lie behind what you see on the screen of one of today’s computers
- become able to participate in the development of the applications of the future.
- no prior knowledge of computing is required; some aptitude for mathematics, for the analysis of a system, for recognition of structure will help.
- the degree requires a C3 or better in Higher Level maths

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```
master A LANGUAGE
master A LANGUAGE

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

- you will study either German, French or Irish
- reach a sufficient competence to operate in that language in your professional career
Master a language

- 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
study the science of LANGUAGE

- Language can be *scientifically studied* – this is **linguistics**
- 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.
study the science of LANGUAGE

- 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
- Systems in the *words* of languages

- **darwin**  -ian -ism    **good**
- **darwin**  -ism -ian    **bad**
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
- systems in the *words* of languages
- systems in the *grammars* of languages

---

*study the science of LANGUAGE*
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- Systems in the *words* of languages
- Systems in the *grammars* of languages
- Systems relating *grammar* to meaning
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```
learn

Computer Science

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 ⇒ a headstart in linguistics
there are more links than you might think

- mastering a foreign language fosters a feel for grammar ⇒ a headstart in linguistics
- mastering phonetics in linguistics ⇒ insight into the pronunciation of the foreign language
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- notions of recursion, subroutine and substructure are shared between computer science and linguistics
Computer Science and Language

There are more links than you might think:

- Mastering a foreign language fosters a feel for grammar ⇒ a headstart in linguistics.
- Mastering phonetics in linguistics ⇒ insight into the pronunciation of the foreign language.
- 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?

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


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

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**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
Careers

CSL graduates have skills in

Problem-solving • Programming • Analysis
Foreign-language • Self-reliance
Careers

CSL graduates have skills in

**Problem-solving ● Programming ● Analysis**

*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
**Year on Year**

<table>
<thead>
<tr>
<th>First Year</th>
<th>Second Year</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Computing</strong></td>
<td><strong>Computing</strong></td>
</tr>
<tr>
<td>- Fundamentals</td>
<td>- Data Structures and Algorithms</td>
</tr>
<tr>
<td>- Intro to Computer Programming (Java)</td>
<td>- C++ Programming &amp; Computational Linguistics</td>
</tr>
<tr>
<td>- Mathematics – logic linear algebra and calculus</td>
<td>- Discrete Mathematics</td>
</tr>
</tbody>
</table>

**Linguistics**
- Language, Mind and Society
- Syntactic Analysis
- Phonetics and Phonology

**Language (G/F/I)**
- Fluency
- Culture

**Linguistics**
- Formal Syntax & Semantics
- Instrumental Phonetics and Speech Science
- Computational Morphology

**Language (G/F/I)**
- Fluency
- Translation (esp. Comp Sci area)
### Year on Year

<table>
<thead>
<tr>
<th>Third Year</th>
<th>Fourth Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>spent as Erasmus exchange student at partner university with courses on <strong>Computing</strong></td>
<td>Computing</td>
</tr>
<tr>
<td>- A.I./Computational Linguistics</td>
<td>- Databases</td>
</tr>
<tr>
<td>- Software Engineering</td>
<td>- Artificial Intelligence</td>
</tr>
<tr>
<td>- Probability &amp; Statistics and Formal Methods</td>
<td><strong>Linguistics</strong></td>
</tr>
<tr>
<td></td>
<td>- Speech Science</td>
</tr>
<tr>
<td><strong>Linguistics</strong></td>
<td>- Computational Linguistics</td>
</tr>
<tr>
<td>- Lexicology</td>
<td><strong>Language (G/F/I)</strong></td>
</tr>
<tr>
<td>- Language learning</td>
<td>- Fluency</td>
</tr>
<tr>
<td><strong>Language (G/F/I)</strong></td>
<td>- Translation</td>
</tr>
<tr>
<td>- Fluency</td>
<td><strong>Option course</strong>: eg. advanced Comp. Ling.</td>
</tr>
<tr>
<td>- Rhetoric</td>
<td><strong>Project</strong>: substantial research and dissertation supervised by an established researcher.</td>
</tr>
</tbody>
</table>

**Project**: applying linguistics or comp. ling to target language
Some interesting features
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- interdisciplinary: has sometimes suited those undecided between science and arts
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- interdisciplinary: has sometimes suited those **undecided between science and arts**
- has tended to be **gender balanced**
Some interesting features

- interdisciplinary: has sometimes suited those undecided between science and arts
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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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- fosters many talents: problem solving (comp. sci), conceptual analysis (linguistics), cultural awareness (language), self-reliance (year abroad)
- 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/