# Electronic Corpora for Two Semitic Languages

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# Overview

- Project
  - Creation of a Maltese & Hebrew lexical corpus and web-interface to these collections
  - Why Semitic? Our lab is interested in language processing for languages with nonconcatenative morphology.
- Goal
  - Develop sizeable corpora and a set of tools capable of providing lexical statistics relevant for psycholinguistic research

# Hebrew corpus

- Data acquisition
  - Newspapers articles & opinion, TV transcripts & medical forums
    - *2b-bari, Arutz7, Ha'aretz, Doctors, Infomed Medical Forum, Tapuz People Forums, The Marker & Ynet*
  - Date range: 2001-2006
  - MILA Knowledge Center for Processing Hebrew & David Plaut
- Data indexing
  - Tokenized and added to SQL database

# Hebrew corpus

| | Tokens | % of collection |
|---|---|---|
| Sources | | |
| 2b | 709,024 | 1.18% |
| A7 articles | 1,220,090 | 2.03% |
| Doctors | 196,603 | 0.33% |
| Ha'aretz | 8,273,572 | 13.78% |
| Infomed | 163,649 | 0.27% |
| Tapuz | 1,004,998 | 1.67% |
| TheMarker | 559,438 | 0.93% |
| Ynet | 47,924,887 | 79.81% |
| Totals | | |
| | 60,052,261 | Type/token ratio 0.7% |

# Maltese Corpus

- Data acquisition
  - Web crawled a set of Maltese newspapers

    Illum
    L-Orizzont
    Malta Right Now

    - Inconsistent rendering of Maltese characters *ċ*, *ġ*, *ħ*, and *ż*, forced us to eliminate some possible sources.
    - Date range: 2005 - 2007
  - Employed *Wget* to retreive the web data
- Data filtering & indexing
  - Filtered, tokenized and added to SQL database

# Maltese Corpus

- Supplementary data
  - Newspaper data acquired from Albert Gatt

    Kullħadd
    In-Nazzjon
    Lehen is-Sewwa

  - Date range: 1998 - 1999
- Indexing
  - Tokenized and added to SQL database

# Maltese corpus

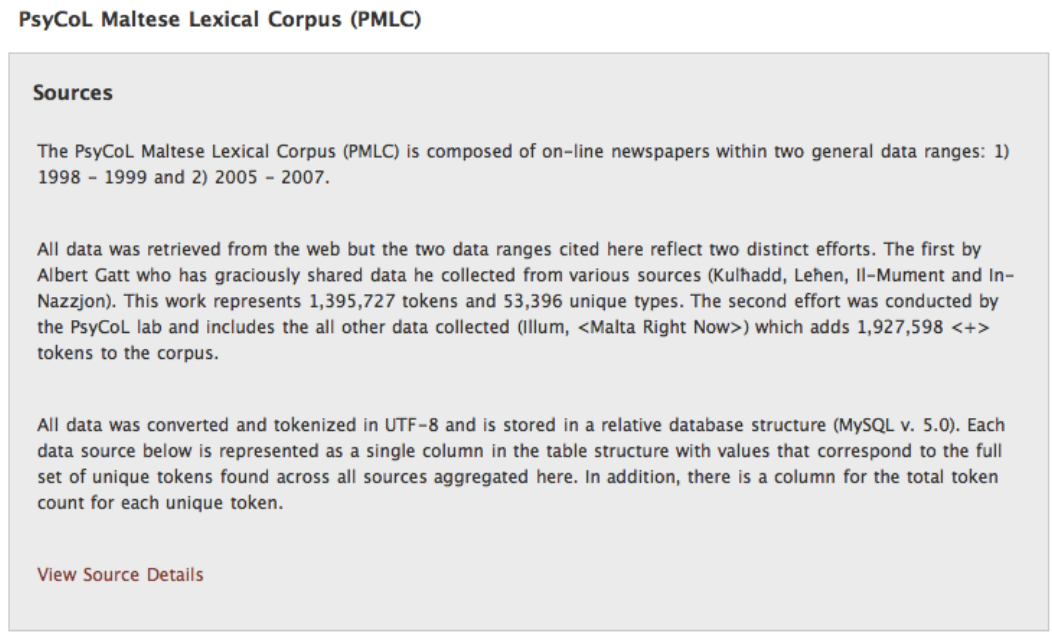
| | Tokens | % of collection |
|---|---|---|
| PsyCoL Web crawl | | |
| Illum | 1,927,598 | 58% |
| L-orizzont | 60,982 | 1.8% |
| Provided by A. Gatt | | |
| Kullħadd | 69,908 | 1.8% |
| In-Nazzjon | 1,240,923 | 37.3% |
| Lehen is-Sewwa | 23,914 | 0.7% |
| Totals | | |
| Web crawl | 1,988,580 | 59.8% |
| A. Gatt | 1,334,745 | 40.2% |
| | 3,323,325 | Type/token ratio 1.6% |

# Description of the corpus interface

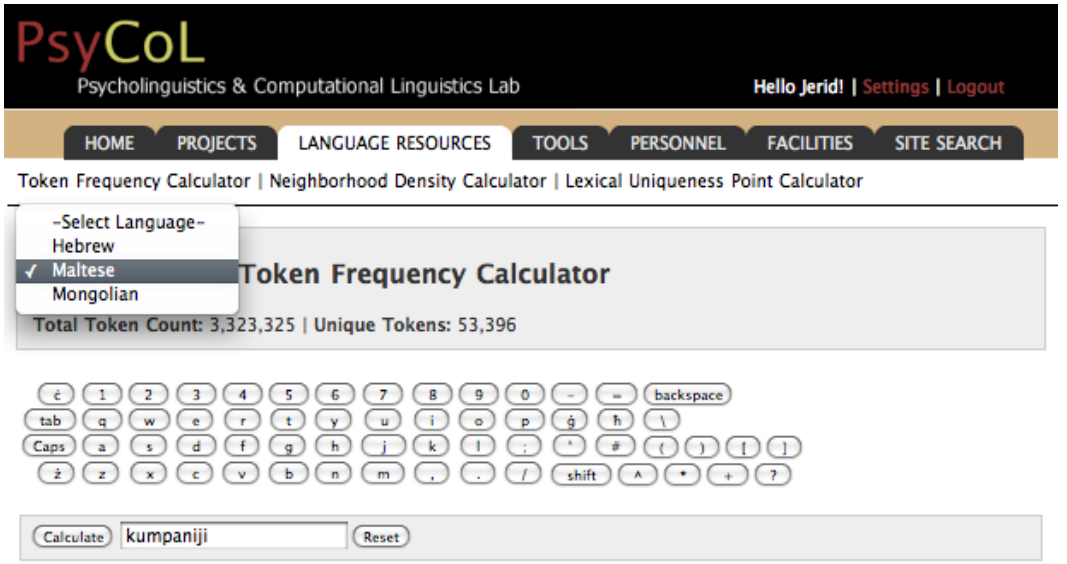
- Goals
  - Provide international, cross-platform access to the lexical corpora
- Tools
  - General workbench
  - Specific information extraction tools
    - Lexical frequency
    - Uniqueness point
    - Neighborhood density

# General tools

- Documentation *http://psycol.arizona.edu*




- Language selector
- Search field *(RegExp enabled - important for Semitic)*
- Virtual keyboard



# Specific tool: lexical frequency

- What it measures
- Use in research

Frequency plays a role in lexical access, as shown by numerous studies.

In general, the more frequent a word, the easier it is to retrieve.

**Results for:** **tuffieħa**

Prev 0 > 500 > 1000 > 1500 Next

| Index | Token | Count Per Million | Natural Log | Db Count | Kullhadd | InNazzjon | MaltaRightNow | Lorizont | Lehen_isSewwa | % | Query Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| up dn | up dn | | | up dn | up dn | up dn | up dn | up dn | up dn | | |
| 17668 | tuffieħa | 1.805 | 1.79176 | 6 | 0 | 6 | 0 | 0 | 0 | 2E-06 | 6 |

Prev 0 > 500 > 1000 > 1500 Next

**Query Specific Counts**

| | |
|---|---|
| Db Unique Tokens | 1 |
| Query Specific Tokens | 6 |
| *Kullhadd* | 0 |
| *InNazzjon* | 6 |
| *MaltaRightNow* | 0 |
| *Lorizont* | 0 |
| *Lehen_isSewwa* | 0 |

# Specific tool: uniqueness point

- What it measures
- Use in research

The lexical uniqueness point of a given word plays a role in lexical access (e.g., Marslen-Wilson 1978, Wurm 2007).

Lexical access of an auditorily-presented word can proceed more deterministically from the point in time corresponding to the lexical uniqueness point of the word.

**Results for: tuffieħa**

| Word | Left Index | Right Index |
|---|---|---|
| tuffieħa | 8 | 1 |

**Results for: כמה**

**Word: Not Unique**

36 Overlapped words

Word list:כמהמערכות, כמהמר, כמהמהם, כמהאבות, כמהנתונים, כמהנדס, כמהנדסים, כמהנדרשת, כמהססת, כמהפאזלים, כמהפנט, כמהפכן, כמהפכניות, כמהפכה, כמהתלה, כמהתלים, כמהתוכניות, כמהלך, כמהלומה, כמהגרים, כמהדורה, כמהה, כמהההההה, כמהו, כמהופנט, כמהופנטים, כמהות, כמהותה, כמהותיים, כמהווים, כמהין, כמהימן, כמהימנה, כמהימנים, כמהים, כמהיר

# Specific tool: neighborhood density

- What it measures
- Use in research

Neighborhood density also plays an important role in lexical access (e.g., Goldinger, Luce, andPisoni, 1989; Cluff and Luce, 1990; Luce and Pisoni, 1998).

In visual studies, higher neighborhood density correlates with faster lexical access.

In auditory studies, higher neighborhood density correlates with slower lexical access.

**Results for: tuffieɦa**

**Density Measures:**
**Number of neighbors: 1**
**Frequency of this neighborhood in corpus: 9**
**Neighborhood count per million: 2.7081312**
**Natural log frequency: 2.1972246**

**Neighborhood Statistics**

| **Word Neighbors** | **Frequency of Neighbor** |
|---|---|
| tuffieh | 3 |
| **Query Word** | **Frequency** |
| tuffieha | 6 |

# Project assessment

- Size

  PsyCoL Hebrew Lexical Corpus (PHLC)
  Total Token Count: 60,052,261 Unique Tokens: 396,469

  PsyCoL Maltese Lexical Corpus (PMLC)
  Total Token Count: 3,323,325 Unique Tokens: 53,396

- Accessibility

  Web interface

- Extensibility

  Khalkha Mongolian already added
  Additional tools can be integrated

# Conclusion

- Creation of lexical corpora for Maltese & Hebrew
- Developed of a set of tools particularly useful for psycholinguistic research
  - Contributes to growing body of research to connections between corpus and behavioral inquiry.

Thank you!