Visualization of linguistic information is becoming more important

- Accessibility / Usability aspect of language resources

We need to figure out

- How visualization fits into the linguistic processing pipeline (this presentation)
- How to facilitate incorporating visualization into linguistic applications (continuing discussion and research)
Overview

• What is visualization?
• How is visualization used?
• Visualization in the Linguistic Processing Pipeline
• A model of visualization
• What are the inputs to visualization?
• What are the forms of visualization?
• What is the output of visualization?
• Where do we go from here?
What is visualization?

- Visualization is the presentation of information in a visual way, (primarily) for people
  - Written texts
  - Graphs, networks
  - Charts
  - Diagrams
  - Spectrograms of speech
  - Database layout
  - Etc.

- We will discuss the role of visualization, not how to do visualization (cf. Collins et al. 2008, 2009 for how)
How is visualization used?

- Always a cognitive aid, for
  - Illustration
    - (e.g. in papers)
  - Organization
    - (e.g. terminology database)
    - (e.g. http://www.visuwords.com)
  - Analysis
    - (e.g. concordance)
    - (e.g. WordTrees)
  - Manipulation
    - (e.g. EXMARaLDA Partitur Editor)
    - Loop: visualize - change - visualize
Visualization in the Linguistic Processing Pipeline I

• Process vs. Toolchain
  • **Process**: all the (iterative) aspects of dealing with linguistic data
  • **Toolchain**: the sequence of tools used in the end-to-end processing of the linguistic data

• For this discussion, we will focus on the **toolchain**
Visualization in the Linguistic Processing Pipeline II

- Visualization is relevant at every point of the toolchain!
  - During processing
  - Between processing steps
  - After processing

- Note: if information in the toolchain is not cumulative, visualization could access different stages simultaneously
A reference model of visualization
Based on Card et al. 1999

1. Raw Data, e.g. texts
2. Data transformations, e.g. counting, sorting, tagging
3. Structured data, e.g. document vectors, word/lemma/POS lists
4. Visual mappings = the type of visualization,
   • e.g. POS $\mapsto$ color, scatter plot, tree
5. Visual structures = the general visual form, e.g. chart, tree, text
6. Visual view = the visual appearance, e.g. color, shape, size, position
   • Also includes filtering of data: which data is visible
Data, visual structures, and visual views: an example from word frequencies

<table>
<thead>
<tr>
<th>Raw Data</th>
<th>Data Transformations</th>
<th>Structured Data</th>
<th>Visual mapping</th>
<th>Visual structure</th>
<th>View transformations</th>
<th>Visual views</th>
</tr>
</thead>
<tbody>
<tr>
<td>Text</td>
<td>• Count words</td>
<td>Word /frequency pairs: • Ordered by decreasing frequency</td>
<td>Position: • Vertical • By decreasing frequency Height: • Uniform</td>
<td>Vertical List</td>
<td>• Filter by POS • Distance between words • Height</td>
<td>a cat gray</td>
</tr>
<tr>
<td></td>
<td>• Resort data</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>a cat gray</td>
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<tr>
<td></td>
<td>- Increasing freq</td>
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<td></td>
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<tr>
<td></td>
<td>- Alphabetically</td>
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</tbody>
</table>
What are the *inputs* to visualization?

- What types of information do we have? A partial taxonomy
  - Position
  - Sequence
  - Frequency
  - Distribution (in time, space, category)
  - Association (internal, external)
  - Categories (linguistic and non-linguistic)
  - Physical (wave forms, fMRI)

- Static vs. dynamic inputs
  - Some input may be calculated dynamically, saved on demand
    - e.g. distributions across subsections of corpora
What are the *forms* of visualization? i.e. the visual mappings

- Open-ended question

- For a given type of data, there may be multiple relevant visual models
  - e.g. word frequency information can be presented in lists or inline in the texts.

- There has been some work on automatically generating preferred visual mappings/structures for certain types of data
  - e.g. ordinal and quantitative data are best presented in different types of graphs (Stolte et al. 2002/2008)
What is the *output* of visualization?

1. It depends on the use
   - Illustrations are often graphics
   - Analysis/Manipulation ⇒ (interactive) interface

2. Is the visualization always the end of the line?
   Maybe not.
   - The visualization output could be a visual *structure**
     e.g. an SVG representation that could be given different views and or interacted with by another stage or the user
   - The visualization output could be a visual *mapping*
     e.g. some kind of abstract representation to be implemented in a further stage

*Cf., e.g. for biology: cytoscape (www.cytoscape.org)
Example: changing visual views for analysis

Visual model: A word’s part of speech is indicated by its color

Visual views:

- Every fine-grained part of speech is a different color (!)
- Fine-grained categories in a common super category have the same color (e.g. N,V,Adj,Prep,Adv,Det)
- Minor categories have the same color as the background, effectively hiding them
  - *the* becomes when it is colored white here
Where do we go from here?

- **Theory**
  - More on taxonomy of input
  - Relations between data and visual models
  - What is the role of interaction?
  - How can visualizations be the input to other processes?
    - e.g. TIGERSearch tool (Voormann 2002) „draws“ partial graph as query
  - Evaluation

- **Practice**
  - What kinds of formats/specifications should be developed?
  - What is the balance between applications, tools, toolkits?
Thank you

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Rabbit with pink eyes ran close by her.
ALICE'S ADVENTURES IN WONDERLAND

Lewis Carroll

THE MILLENNIUM FULCRUM EDITION.

CHAPTER I

Down the Rabbit-Hole

Alice was beginning to get very tired of sitting by her sister on the bank, and of having nothing to do: once or twice she had peeped into the book her sister was reading, but it had no pictures or conversations in it, 'and what is the use of a book,' thought Alice 'without pictures or conversation?'

So she was considering in her own mind (as well as she could, for the hot day made her feel very sleepy and stupid), whether the pleasure of making a daisy-chain would be worth the trouble of getting up and picking the daisies, when suddenly a White Rabbit with pink eyes ran close by her.

There was nothing so very remarkable in that; nor did Alice think it so very much out of the way to hear the Rabbit say to itself, 'Oh dear! Oh dear! I shall be late!' (when she thought it over afterwards, it occurred to her that she ought to have wondered at this, but at the time it all seemed quite natural); but when the Rabbit actually took a watch out of its waistcoat-pocket, and looked at it, and then hurried on, Alice started to her feet, for it flashed across her mind that she had never before seen a rabbit with either a waistcoat-pocket, or a watch to take out of it, and burning with curiosity, she ran across the field after it, and fortunately was just in time to see it pop down a large rabbit-hole under the hedge.
DocuBurst (Collins, 2007)
Burch et al. (2008)
Richter (2005)

Papst
Benedikt XVI
Johannes Paul II
Tod
Ratzinger
Wahl
As soon as he regained the use of his senses, he said, trembling and stuttering from fright: ‘Where did that voice come from, when there is no one around?’

Appena riebbe l’uso della parola, cominciò a dire tremando e balbettando dallo spavento: ‘Ma di dove sarà uscita questa voce che ha detto oh?’
**contratto**

**Grammatic: s.m.**

**Definizione:** Accordo di due o più parti per costituire, regolare o estinguere tra loro un rapporto giuridico patrimoniale.

**Fonte_Definizione:** CC, art. 1321

**Contesto:** Le obbligazioni derivano da contratto, da fatto illecito, o da ogni altro atto o fatto idoneo a produrle in conformità dell'ordinamento giuridico.

**Fonte_Contexto:** CC, art. 1173

**Contesto:** Il contratto è il prototipo di negozio perché le norme dette per la sua disciplina, secondo l'espressa disposizione dell'art. 1324 [CC], sono applicabili, in quanto compatibili, anche agli atti unilaterali tra vivi aventi contenuto patrimoniale (es. procura, disdetta, ecc.).

**Fonte_Contexto:** TRAB 93:125

**Deutsch**

**Vertrag**

**Grammatic: m.**

**Sprachgebrauch:** AT, CH, DE, STAA

**Terminstatus:** Entscheidung TerKom

**Definition_DE:** Die von zwei oder mehreren Personen erklärte Willensübereinstimmung über die Herbeiführung eines bestimmten rechtlichen Erfolgs.

**Quelle_DE:** PAL 94 v § 195, Rz. 1

**Definition_IT:** Der Vertrag ist die Einigung von zwei oder mehreren Parteien, um untereinander ein vermögensrechtliches Rechtsverhältnis zu begründen, zu regeln oder aufzugeben.

**Quelle_IT:** CC BL 92, Art 1321

**Definition_CH:** Zum Zustandekommen eines Vertrages ist außer der Einigung über den Vertragsinhalt noch die ausdrückliche oder stillschweigende Erklärung des Abschlußwillens erforderlich.

**Quelle_CH:** OR Art 1, Abs. 1

**Korrelationen:**

**adicciare un contratto**

**Traduzione:** einvernehmlich Vertrag erfüllen

**Sprachgebrauch:** AT, DE, STAA

**aderire a un contratto**

**Traduzione:** anbitmap Vertrag beitreten

**Sprachgebrauch:** STAA

**annullare un contratto**

**Traduzione:** einen Vertrag für nichtig erklären

**Sprachgebrauch:** STAA

**Traduzione:** einen Vertrag aufheben

**Sprachgebrauch:** AT, CH, DE, STAA
i have a dream that one day

my four little children will be able to live in a nation where they will not be judged by the color of their skin but by the content of their character.

today i have a dream that one day

the sons of former slaves and the sons of former slave owners will be able to sit together at the table of brotherhood.

today i have a dream that one day

every valley shall be exalted, and every hill shall be made low; the rough places will be made plain, and the crooked straight; the glory of the Lord shall be revealed, and all flesh shall see it together.
EXMARaLDA (Schmidt, 2009)

Oh what is my theory?
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