

L^AT_EX for Linguists

Jonathan Havenhill

Graduate Linguistics Student Association
Research Tool Workshop Series
Georgetown University
jeh241@georgetown.edu

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- You should download the following files:
- github.com/jhavenhill/latex-for-linguists
- If you don't have L^AT_EX installed, you should download it:
 - MikTeX for Windows
 - MacTeX for Mac
 - Or, sign up for a free account at [writelatex.com](https://www.writelatex.com)

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- First, how do you pronounce L^AT_EX?
 - Usually [leɪtɛk] or [lɑ:tɛk], not [lɑ:tɛks]
- It's a typesetting system, not a word processor
- L^AT_EX documents are written with markup code, which is then interpreted and compiled by the T_EX system
- It has a learning curve, but there are a number of advantages. . .

The structure of a \LaTeX document

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- Every document must contain the following lines:

```
\documentclass{...}
```

```
...
```

```
\begin{document}
```

```
...
```

```
\end{document}
```

Let's start with a basic document

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```
\documentclass{article}
```

```
\begin{document}
```

```
Hello world!
```

```
\end{document}
```

\documentclass{}

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Resources

- The document classes you are most likely to use are:
 - `article` (for articles)
 - `beamer` (for slideshows like this)
 - `res` (for résumés and CVs)

\documentclass{}

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Resources

- The document classes you are most likely to use are:
 - `article` (for articles)
 - `beamer` (for slideshows like this)
 - `res` (for résumés and CVs)
- The `\documentclass` command can have options, which are specified as such:

```
\documentclass[10pt,a4paper,landscape]{article}
```


The preamble

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- The preamble comes between ‘documentclass{ }’ and ‘begin{document}’

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Resources

- The preamble comes between ‘documentclass{ }’ and ‘begin{document}’
- Here, you list the packages you will be using, e.g.:

```
\documentclass{article}
```

```
\usepackage{gb4e}
```

```
\usepackage{qtree}
```

```
\usepackage{tipa}
```

```
\begin{document}
```

```
...
```

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Resources

- The preamble comes between ‘documentclass{ }’ and ‘begin{document}’
- Here, you list the packages you will be using, e.g.:

```
\documentclass{article}
```

```
\usepackage{gb4e}
```

```
\usepackage{qtree}
```

```
\usepackage{tipa}
```

```
\begin{document}
```

```
...
```

- You can also define new commands

Titles

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Resources

- A set of commands are available for creating titles and abstracts:

```
\title{...}
```

```
\author{...}
```

```
\date{...}
```

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Resources

- A set of commands are available for creating titles and abstracts:

```
\title{...}  
\author{...}  
\date{...}
```

- These are inserted into the document with the `\maketitle` command

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- Let's add a title to our document:

```
\begin{document}
\title{A sample \LaTeX document}
\author{Your name here}
\date{\today}
\maketitle
Hello world!
```

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- And an abstract:

```
\maketitle
```

```
\begin{abstract}
```

```
Lorem ipsum dolor sit amet...
```

```
\end{abstract}
```

```
Hello world!
```

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■ `\section{}` and `\subsection{}`

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Resources

- `\section{}` and `\subsection{}`
- `\textit{}`, `\textbf{}`, `\underline{}`, `\texttt{}`, and `\textsc{}`

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- `\section{}` and `\subsection{}`
- `\textit{}`, `\textbf{}`, `\underline{}`, `\texttt{}`, and `\textsc{}`
- subscript ($T_{\text{def}}P$) and superscript ($a^2 + b^2 = c^2$):
`T$_\text{def}$P`
`a2 + b2 = c2`

Changing the font

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- The LaTeXfont is called Computer Modern

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- The L^AT_EX font is called Computer Modern
- Times New Roman: `\usepackage{times}`
 - This will set the entire document to Times New Roman

Changing the font

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Resources

- The L^AT_EXfont is called Computer Modern
- Times New Roman: `\usepackage{times}`
 - This will set the entire document to Times New Roman
- Font size can be specified with a `\documentclass` option, e.g., `[10pt]`, `[11pt]`, `[12pt]`
 - This will set the entire document to that font size

Margins and spacing

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- The default margins are designed for readability, but you may require 1 inch margins.
- Margins can be set using the geometry package:

```
\usepackage[margin=1.0in]{geometry}
```

Margins and spacing

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- The default margins are designed for readability, but you may require 1 inch margins.

- Margins can be set using the `geometry` package:

```
\usepackage[margin=1.0in]{geometry}
```

- Line spacing can be set with the `setspace` package:

```
\usepackage{setspace}
```

```
%\singlespacing
```

```
\onehalfspacing
```

```
%\doublespacing
```

Miscellaneous formatting issues

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- Footnotes can be added using the footnote command:
`\footnote{Lorem ipsum dolor sit amet...}`

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- Footnotes can be added using the footnote command:

```
\footnote{Lorem ipsum dolor sit amet...}
```

- Quirks of L^AT_EX:

- # \$ % ^ & _ { } ~ \ are reserved characters—you must use a backslash in order to type them, e.g. \&
- LaTeX differentiates left and right quotes: ' and " are right quotes, while left quotes are typed using the ` key (tilde key)

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- Footnotes can be added using the footnote command:
`\footnote{Lorem ipsum dolor sit amet...}`
- Quirks of L^AT_EX:
 - `# $ % ^ & _ { } ~ \` are reserved characters—you must use a backslash in order to type them, e.g. `\&`
 - LaTeX differentiates left and right quotes: `'` and `"` are right quotes, while left quotes are typed using the ``` key (tilde key)
- Accented characters are typed with special codes, e.g.,
`\=o = ō`, `\o = ø`, `\'e = é`

Symbol

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- It's pretty straightforward: IPA in LaTeX

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- It's pretty straightforward: IPA in LaTeX
- It looks like this:

```
\textipa{[D@ "k\super h\ae p\textcorner t\s{n}  
\~\ae nd\textcorner D@ "\t{dZ}\~En\*r@  
l wIl "p\r*{\*r}Ablij: goU:]}
```

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- It's pretty straightforward: IPA in LaTeX

- It looks like this:

```
\textipa{[D@ "k\super h\ae p\textcorner t\s{n}
\~\ae nd\textcorner D@ "\t{dZ}\~En\*r@
l wIl "p\r*{\*r}Ablij: goU:]}
```

- Which produces: [ðə 'k^hæp^ɪtɪ ænd'ðə 'dʒɛnɪəɫ wɪɫ
'pɹəblij: goʊ:]

tipa practice

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- Try typesetting: [hau du ai meik ai pi ei simbəlɜz ɪn leɪtɛk]
- Or: [maɪ: 'hʊzbənʃʊd'æv bɒt'pʰətʰeɪ:rʊʊz]

gb4e package

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- gb4e introduces the `exe` environment.
- This allows you to embed nearly anything in an environment with a typical linguistics citation number: (x)
- It looks like:

```
\begin{exe}  
  \ex  
    \begin{table}  
      ...  
    \end{table}  
    \label{...}  
\end{exe}
```


gb4e package

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- Glosses are introduced using the `\gll` command.
- It looks like:

```
\begin{exe}  
  \ex{\gll Mi griast der Bua, (der) wo aus Ming  
me.\textsc{acc} greets the.\textsc{m.nom} boy  
  \glt ‘The boy who comes from Munich greets me  
\end{exe}
```

gb4e package

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Resources

■ This code produces:

- (3) a. Mi griast der Bua, (der) wo aus Minga
me.ACC greets the.M.NOM boy who.M.NOM that from Munich
kummt.
comes
'The boy who comes from Munich greets me.'

gb4e package

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■ This code produces:

(3) a. Mi griast der Bua, (der) wo aus Minga
me.ACC greets the.M.NOM boy who.M.NOM that from Munich
kummt.
comes
'The boy who comes from Munich greets me.'

■ Use curly brackets to group multiple words, or empty curly brackets to skip words.

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Resources

- Lists can be embedded within the example environment using the `xlist` environment:

```
\begin{exe}  
  \ex  
  \begin{xlist}  
    \ex{...}  
    \ex{...}  
    \ex{...}  
  \end{xlist}  
\end{exe}
```

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- Examples can be labeled and cross-referenced using the `\label{...}` and `\ref{...}` commands.

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Resources

- Examples can be labeled and cross-referenced using the `\label{...}` and `\ref{...}` commands.
- The `\label{...}` command must come *after* the example:

```
\ex{Mi griast der Bua, (der) wo  
aus Minga kummt.}\label{ex:MascNom}
```

gb4e package

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- Examples can be labeled and cross-referenced using the `\label{...}` and `\ref{...}` commands.
- The `\label{...}` command must come *after* the example:

```
\ex{Mi griast der Bua, (der) wo  
aus Minga kummt.}\label{ex:MascNom}
```

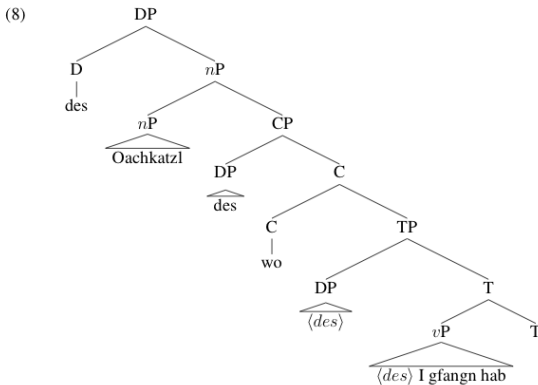
- Check out the `\exr`, `\exp`, and `\exi` commands for other useful ways of labeling and referencing examples.

qtree package

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- qtree lets you make...trees



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qtree

- The code looks like this:

```
\Tree [.DP [.D des ] [.$n$P  
\qroof{Oachkatzl}.$n$P [.CP  
\qroof{des}.DP [.C [.C wo ]  
[.TP \qroof{$\langle des  
\rangle$}.DP [.T \qroof{$\langle  
des \rangle$ I gfangn hab}.$v$P T ] ] ] ] ] ]
```
- It's fairly straightforward once you get the hang of it.
 - It's more or less typical syntactic bracketing
- Try bracketing something yourself

ot-tableau package

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/ri-afɔ/	*VV	DEP	MAX
a. ri-afɔ	*!		
 b. r-afɔ			*
c. ri-jaɔ		!*	

Vowel deletion in Yoruba

ot-tableau package

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```
\begin{tableau}{c:c|c}
  \inp{\ips{ri-aS0}}      \const{*VV}      \const{Max} \
  \cand{ri-aS0}           \vio{*!}          \vio{}      \
  \cand[\Optimal]{r-aS0}  \vio{}            \vio{}      \
  \cand{ri-jaS0}          \vio{}            \vio{!*}    \
\end{tableau}
```

ot-tableau package

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■ What you need to know:



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- <http://yihui.name/knitr/>
- knitr is a way to incorporate R code into your documents.

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- knitr is a way to incorporate R code into your documents.
- This allows you to include dynamically-generated tables, figures, and references.

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- <http://yihui.name/knitr/>
- knitr is a way to incorporate R code into your documents.
- This allows you to include dynamically-generated tables, figures, and references.
- The goal is transparent and reproducible research.
- knitr documents can be written directly in RStudio, or in something like Sublime Text with the SublimeKnitr plugin.

Maintenance of the COT-CAUGHT contrast among Detroit speakers: A multimodal articulatory analysis

Jonathan Havenhill (Georgetown University)

Overview

How do Northern Cities Vowel Shift (NCVS) speakers maintain the contrast between COT and CAUGHT?

- Early stage NCVS involves the fronting of COT and CAUGHT and the lowering of CAUGHT, although these vowels remain distinct.
- Increased formant values may be associated with either tongue-fronting or lip-undoing, both of which shorten the vocal tract.
- Majors & Gordon (2008) find that among St. Louis speakers, rounding is preserved in CAUGHT, suggesting that CAUGHT-fronting and lowering may be accomplished through tongue position alone.
- This study employs video recording and ultrasound tongue imaging to determine the relative contributions of tongue position and lip configuration in maintaining this contrast.
- It is found that speakers employ differing articulatory strategies, despite similar acoustic realizations.

Methods

- Two 22-23 year-old female speakers, born and raised in Metro Detroit, read a randomized list of 100 monosyllabic words containing 20 words for each of the vowels /i/, /u/, /æ/, /a/, and /ɔ/.

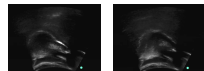


Figure 1: Extracted ultrasound frames for the tokens caught and odd, as produced by Speaker 2. The right side of the image corresponds to the front of the mouth. The tongue surface is visible as the white line near the center of the image.

- Audio, video, and ultrasound recordings were synchronized and measured at the point of F1 maximum.
- F1 and F2 measurements were taken using Praat (Boersma & Weenink, 2014) and normalized following the technique of Lahov et al. (2006).
- Vertical lip openness and horizontal lip spread were calculated by measuring the number of pixels between the top and bottom of the lips and between the lip corners.
- Tongue contours were tracked using EdgeTrak (Li et al., 2005) and modeled with smoothing spline ANOVA (Gu, 2002; Davidson, 2006).

Results: Speaker 1

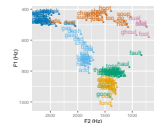


Figure 2: ANAE Normalized Vowel Formant Measurements for Speaker 1.

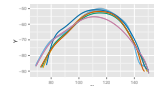


Figure 3: Tongue Contours for Speaker 1 with 95% Confidence Interval. Where CIs for two vowels overlap, the contours are not significantly different.

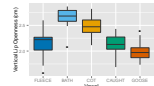


Figure 4: Vertical Lip Opening Measurements for Speaker 1. Lower value indicates greater degree of rounding.

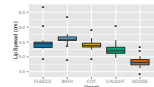


Figure 5: Lip Spread Measurements for Speaker 1. Higher value indicates greater degree of spread.

Results: Speaker 2

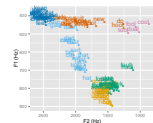


Figure 6: ANAE Normalized Vowel Formant Measurements for Speaker 2.

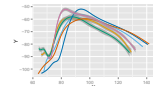


Figure 7: Tongue Contours for Speaker 2 with 95% Confidence Interval. Where CIs for two vowels overlap, the contours are not significantly different.

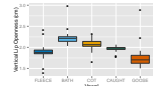


Figure 8: Vertical Lip Opening Measurements for Speaker 2. Lower value indicates greater degree of rounding.

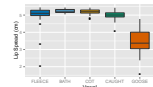


Figure 9: Lip Spread Measurements for Speaker 2. Higher value indicates greater degree of spread.

Discussion

Both speakers maintain an acoustic distinction between COT and CAUGHT, which differ significantly in F1, but not in F2. However, the two speakers differ in articulatory configuration.

Speaker 1

- High degree of overlap between tongue contours for COT and CAUGHT (Figure 3).
- Significant difference between COT and CAUGHT in lip openness (Figure 4). CAUGHT is more round than COT.
- No significant difference between COT and CAUGHT in lip spread (Figure 5).

Speaker 2

- No significant difference between COT and CAUGHT in either lip openness (Figure 8) or lip spread (Figure 9).
- Significant difference in tongue contours for COT and CAUGHT throughout tongue body and tip (Figure 7).

These results suggest that speakers participating in the NCVS may take differing paths in maintaining the contrast between COT and CAUGHT. Additional research is needed to determine the consequences of these findings on the transmission (or diffusion) of articulatory forms, and what implications this type of variation has for future linguistic change.

References

- Boersma, Paul & David Weenink. 2014. Praat: doing phonetics by computer [Computer program]. Version 5.0.41, retrieved 24 Jan. 2014 from <http://www.praat.org/>.
- Davidson, Lisa. 2006. Comparing tongue shapes from ultrasonic imaging using smoothing spline analysis of variance. *Journal of the Acoustical Society of America* 120, 3, 167-172.
- Gu, Qing. 2002. *Smoothing spline ANOVA Models*. New York, NY: Springer.
- Lahov, William, Sharon Ash & Charles Bohannon. 2006. *The Atlas of North American English*. Walter de Gruyter.
- Li, M. C., Kishikawa, Y. & Matsuo, T. 2005. Automatic contour tracking in ultrasound images. *Clinical Linguistics and Phonetics* 19(9-7), 545-554.
- Majors, Tami & Matthew J. Gordon. 2008. The [vowel] of the Northern Cities Shift. *University of Pennsylvania Working Papers in Linguistics* 14(2), 111-126.

Acknowledgements

Many thanks to Jennifer Nye and Elizabeth Zeig for helpful comments on this project and to Jeff Meile and Josef Fruehwald for kindly making public their R Code for SSANOVA.

Contact Information

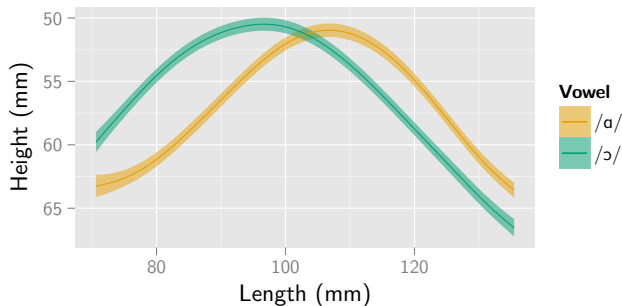
Email: jeh241@georgetown.edu
Web: <http://jhavenhill.com>
Twitter: @jhavenhill



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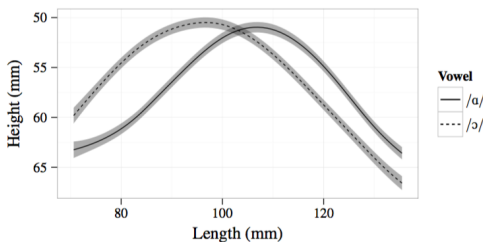
Articulatory Patterns: Speaker 2

Figure: Tongue contours for /ɑ/ and /ɔ/



- ▶ Significant contrast between tongue contours for /ɑ/ and /ɔ/.
- ▶ Greater degree of pharyngeal constriction for /ɔ/, higher tongue position for /ɑ/.
- ▶ Similar pattern for Speakers 1, 3, and 4.

Figure 3: Tongue contours for /a/ and /ɔ/, Speaker 2.



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- Numbered lists are introduced and ended with the `enumerate` environment:

```
\begin{enumerate}  
  \item{...}  
\end{enumerate}
```

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```
\begin{enumerate}  
  \item{...}  
\end{enumerate}
```

- `\item{}` encloses each item

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- Numbered lists are introduced and ended with the `enumerate` environment:

```
\begin{enumerate}  
  \item{...}  
\end{enumerate}
```

- `\item{}` encloses each item
- Bulleted lists are the same, except they use the `itemize` environment.

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- Numbered lists are introduced and ended with the `enumerate` environment:

```
\begin{enumerate}  
  \item{...}  
\end{enumerate}
```

- `\item{}` encloses each item
- Bulleted lists are the same, except they use the `itemize` environment.
- Numbered and bulleted lists can be embedded within one another.

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- Which numbering system is used can be chosen with the `enumerate` package:

```
\usepackage{enumerate}
```

```
...
```

```
\begin{enumerate}[I.]
```

```
  \item{...}
```

```
\end{enumerate}
```


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- Which numbering system is used can be chosen with the `enumerate` package:

```
\usepackage{enumerate}
```

```
...
```

```
\begin{enumerate}[I.]
```

```
  \item{...}
```

```
\end{enumerate}
```

- Or, items can be given individual bullet symbols:

```
\usepackage{enumerate}
```

```
...
```

```
\begin{itemize}
```

```
  \item[-]{...}
```

```
  \item[+]{...}
```

```
\end{itemize}
```

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- `\setcounter{enumi}{4}` can be used to set the counter for numbered lists:

```
\usepackage{enumerate}
```

```
...
```

```
\begin{enumerate}
```

```
    \setcounter{enumi}{4}
```

```
    \item{The fifth item}
```

```
\end{enumerate}
```

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\usepackage{enumerate}
```

```
...
```

```
\begin{enumerate}
```

```
    \setcounter{enumi}{4}
```

```
    \item{The fifth item}
```

```
\end{enumerate}
```

- There are separate counters for each level of embedding:
`enumi`, `enumii`, `enumiii`, `enumiv`

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- `\setcounter{enumi}{4}` can be used to set the counter for numbered lists:

```
\usepackage{enumerate}
```

```
...
```

```
\begin{enumerate}
```

```
    \setcounter{enumi}{4}
```

```
    \item{The fifth item}
```

```
\end{enumerate}
```

- There are separate counters for each level of embedding:
`enumi`, `enumii`, `enumiii`, `enumiv`
- Additional counters operate for sections, tables, pages, etc.

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- The `graphicx` package is used for inserting pictures

```
\usepackage{graphicx}
```

```
...
```

```
\begin{figure}[h]
```

```
\includegraphics{LabovGraph.pdf}
```

```
\end{figure}
```

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```
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```

```
...
```

```
\begin{figure}[h]
```

```
\includegraphics{LabovGraph.pdf}
```

```
\end{figure}
```

- Graphic width can be controlled with `[width=...]` option.
 - It can be an absolute value (4in) or a relative value (`.95\textwidth`)

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- Some more graphics options:

```
\usepackage{graphicx}
```

```
...
```

```
\begin{figure}[H]
```

```
    \centering
```

```
    \includegraphics[width=...]{VowelSpace.png}
```

```
    \caption{...}
```

```
    \label{...}
```

```
\end{figure}
```

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```
...
```

```
\begin{figure}[H]
```

```
\centering
```

```
\includegraphics[width=...]{VowelSpace.png}
```

```
\caption{...}
```

```
\label{...}
```

```
\end{figure}
```

- H requires the package `float` and inserts a graphic in that exact spot—`h` will only attempt to put a graphic in that spot. `!htbp` allows a figure to be placed here *h*, at the top *t*, at the bottom *b*, or on a float page *p*.

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- `\label{...}` is used to label objects for cross-reference.

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- `\label{...}` is used to label objects for cross-reference.
- These objects can then be referred to with the `\ref{...}` command.

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- `\label{...}` is used to label objects for cross-reference.
- These objects can then be referred to with the `\ref{...}` command.
- You can label graphics, tables, sections, pages, etc.

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- Tables are enclosed in the `tabular` environment.

```
\begin{tabular}{c|c|c}  
1 & 2 & 3\\  
\end{tabular}
```

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- Tables are enclosed in the `tabular` environment.

```
\begin{tabular}{c|c|c}
```

```
1 & 2 & 3\\
```

```
\end{tabular}
```

- `&` separates cells and `\\` ends the row.

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```
\begin{tabular}{c|c|c}
```

```
1 & 2 & 3\\
```

```
\end{tabular}
```

- `&` separates cells and `\\` ends the row.
- `{c|l|r}` controls the alignment of the text in each column.

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- Tables are enclosed in the `tabular` environment.

```
\begin{tabular}{c|c|c}
```

```
1 & 2 & 3\\
```

```
\end{tabular}
```

- `&` separates cells and `\\` ends the row.
- `{c|l|r}` controls the alignment of the text in each column.
- Horizontal dividers are marked with `|` and horizontal dividers can be created with `line` between rows.

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- Tables can be embedded in the `table` environment.

```
\begin{table}  
  \caption{...}  
  \label{table:...}  
  \begin{tabular}{c|c|c}  
    ...  
  \end{tabular}  
\end{table}
```


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```
\begin{table}  
  \caption{...}  
  \label{table:...}  
  \begin{tabular}{c|c|c}  
    ...  
  \end{tabular}  
\end{table}
```

- This allows you to add captions/titles and references.

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- `natbib` is a package for creating bibliographies and in-text citations.

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- natbib is a package for creating bibliographies and in-text citations.
- It (and the built-in) citation system use a .bib file, which stores your bibliography

natbib

L^AT_EX for
Linguists

Jonathan
Havenhill

Files for today

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Lists, tables,
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- Programs like Mendeley can manage your `.bib` file automatically

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- It (and the built-in) citation system use a .bib file, which stores your bibliography
- Programs like Mendeley can manage your .bib file automatically
- You can specify which citation style you'd like using `\bibliographystyle{...}` and by specifying unified for linguistics, apalike for APA, chicago for Chicago style, etc.

- There are many ways to cite things:
- - `\citep{...}` for (Author, Year)
 - `\citet{...}` for Author (Year)
 - `\citep{paper1,paper2}` for (Author1, Year; Author2, Year)

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- Cheat sheet for citation commands:
<http://merkel.zoneo.net/Latex/natbib.php>

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<http://merkel.zoneo.net/Latex/natbib.php>
- Unified style sheet for linguistics:
<https://linguistlist.org/pubs/tocs/JournalUnifiedStyleSheet2007.pdf>

L^AT_EX resources

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- <http://en.wikibooks.org/wiki/LaTeX/>
- Twitter: @TeXtip
- LaTeX4Ling: <http://www.essex.ac.uk/linguistics/external/clmt/latex4ling/>
- Google (of course)