

# Experimental and Computational Methods in Linguistic Research (COGS/LING 20003) Spring 2025

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## Course information

### Class

Times: Tue & Thu 11:00 AM – 12:20 PM

Location: Harper Memorial Library 104

## Contact information

### Instructor

Name: Sanghee Kim

Email: [sangheekim@uchicago.edu](mailto:sangheekim@uchicago.edu)

Office: Rosenwald 229D

Office hours: Thursday 2:30 pm – 3:20 pm

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## 1 Course description

This course introduces students to experimental and computational methods used in linguistic research. Students will gain foundational knowledge of experimental design, stimuli creation, procedure, and data collection and analysis through hands-on practice. Students will design their own research projects, identify appropriate experimental and/or computational methods, and apply them to investigate their questions. Students will learn to use PCIBex (a web-based platform for constructing experiments), R, and Python throughout the process. Familiarity with R/Python/JavaScript is helpful but not required.

*\*Prerequisites:* Mind, Brain, and Meaning (COGS 20001) or Introduction to Linguistics (LING 20001).

## 2 Course objectives

After this course, students will be able to:

- Understand the process of conducting linguistics research and identify suitable experimental designs and methods for the research question.
- Gain hands-on experience with using experimental and computational tools to construct experiments, create stimuli, and analyze the results for linguistic research.
- Write a research proposal/report for linguistics research.

### 3 Course material

We will read handbook and textbook chapters, journal articles, and tutorials. You do NOT need to purchase the required readings. All required readings will be available on Canvas.

#### Required readings for topic discussion

We will use three companion books, one for concepts in psycholinguistics studies (**Sedivy20**), another for experimental methods (**PS14**), and the other for introduction to computational methods for linguistic research (**Glass24**). Other journal articles or online tutorials relevant to the course topic will be additionally posted on the course website.

- **Sedivy20**: Julie Sedivy. *Language in mind: An introduction to psycholinguistics*. Sinauer Associates, Incorporated, 2020. If you want more in-depth content, click [here](#) for textbook resources (not used for this class, though).
- **PS14**: Robert J Podesva and Devyani Sharma. *Research methods in linguistics*. Cambridge University Press, 2014.
- **Glass24**: Lelia Glass et al. *Language and computers*. Language Science Press, 2024.

#### Required readings for tools

We will be covering PCIBex, R, and Python. Refer to the textbooks/websites for an introduction to tools/languages.

- **LSR** (for R) Daniel Navarro. *Learning statistics with R*. 2013. URL: <https://learningstatisticswithr.com/lsr-0.6.pdf>
- **Py** (for Python) <https://docs.python.org/3/tutorial/> (primarily Sections 3–4; 6–7)
- **Ibex** (for PCIBex) <https://github.com/addrummond/ibex/blob/master/docs/manual.md> and <https://doc.pcibex.net>

#### Optional readings

If you're looking for an encyclopedic-style book that summarizes key concepts discussed in linguistics and even outside linguistics (primarily in the domains of Natural Language Processing), you will find these books useful:

- Emily M Bender. *Linguistic fundamentals for natural language processing: 100 essentials from morphology and syntax*. Morgan & Claypool Publishers, 2013.
- Emily M Bender and Alex Lascarides. *Linguistic fundamentals for natural language processing II: 100 essentials from semantics and pragmatics*. Morgan & Claypool Publishers, 2022.

## 4 Course schedule

*Schedule and reading materials are subject to change. See [Experimental-Methods-for-Linguistic-Research](#) for the most up-to-date Course Schedule.*

| Week | Date (T/Th) | Topic                            | Required Reading   | L: Lecture; T: Tutorial   | Student demo (in class);<br>Assignments                                    |
|------|-------------|----------------------------------|--|---|--|
| 1    | Mar 25      | Overview                         |  | L: Linguistic research and methods  |  |
| 1    | Mar 27      | No class                         | Libben (2017); PS14: Chp8 (optional: LSR; Py)                        |   |  |
| 2    | Apr 1       | Lexical access & word processing | Sedivy19: Chp8   | L: Lexical access and priming effect  | <b>No student demo A1 due</b>  |
| 2    | Apr 3       |                                  | PS14: Chp7; Ibex; PCIBex   | T: A2 Lexical decision task (PCIBex setup and manual material creation)                             |  |
| 3    | Apr 8       |                                  | Glass24 (Chp4)   | L: Word meaning and vector space  | <b>S: A2 demo; A2 due</b>  |
| 3    | Apr 10      |                                  | SLP Chp6   | T: A3 Calculating semantic similarity (Python)<br>T: A3 (PCIBex setup)                              |  |
| 4    | Apr 15      |                                  | Kutas et al. (2011); Hale (2001)                                     | L: Prediction   | <b>S: A3 demo; A3 due</b>  |
| 4    | Apr 17      |                                  | Michaelov et al. (2022); Python <i>minicons</i> tutorial; LSR: Part4 | T: A4 Calculating surprisal (Python)<br>T: A4 Plotting bar graphs (R)                               |  |
| 5    | Apr 22      | Sentence processing              | Sedivy19: Chp9.1-9.4; Phillips et al. (2011)                         | L: Syntactic ambiguity and errors<br>T: A5 Self-paced reading task (PCIBex setup & data collection) | <b>S: A4 demo; A4 due</b>  |
| 5    | Apr 24      |                                  | PS14: Chp2   |   |  |
| 6    | Apr 29      |                                  | Glass24 (Chp2.4); Arehalli & Linzen (2020)                           | L: Surprisal in language processing   | <b>S: A5 demo; A5 due</b>  |
| 6    | May 1       |                                  | LSR: Part4; Python <i>minicons</i> tutorial                          | T: A6 Plotting line graphs (R)<br>T: A6 Calculating surprisal (Python)                              |  |
| 7    | May 6       |                                  | Library information session [TBA]                                    |   | <b>Final project topic should be confirmed by the instructor by Week 7</b> |
| 7    | May 8       |                                  | PS14: Chp8   | L/T: Research proposal workshop   |  |
| 8    | May 13      | Conducting research              | PS14: Chp1   | More topics and methods   |  |
| 8    | May 15      |                                  |  | Wrap-up   | <b>S: A6 demo; A6 due</b>  |
| 9    | May 20      |                                  |  | Final representation  |  |
| 9    | May 22      |                                  |  | Final representation  | <b>Final report due (Week 10)</b>  |

## 5 Course requirements

**Grade components:** Engagement (10%), Assignments (25%), Demonstration (5%), Project Presentation (20%), Final Report (40%).

### 5.1 Engagement

You are expected to participate in class regularly. This includes attending class, and being attentive and engaged in class discussions.

### 5.2 Assignments

You will be given an assignment each week to modify existing code (in PCIBex, R, or Python). Each assignment will relate to experiment setup, data creation, data analysis, or writing a lab report. There will be a lecture and an in-class demonstration on these topics. There will be **6 assignments** in total. Each assignment is **due Thursday** (see Course Schedule). Also, see the Late work section.

### 5.3 Demonstration

You will give an oral demonstration of the step-by-step process to complete your assignment. Your classmates will ask questions, and you should be prepared to answer them. There are 5 slots available (out of 6 assignments), and you will give **1 oral demonstration**. These demonstrations will take place **at the beginning of the class on the day the assignment you chose to demonstrate is due**. Each demonstration should be about 5–10 minutes, including the Q&A period.

### 5.4 Project presentation

You will give a 30-minute oral presentation during finals week on your research project proposal. In addition to presenting your research question and a summary of your methods, you should demonstrate the process of creating your materials and setting up the experiment. You should also outline your plans for analyzing and reporting the results. Be prepared to answer questions from your classmates. Prior to presenting their proposal, students get a confirmation from the instructor for their project topic **by the end of Week 7**.

### 5.5 Final report

You are expected to design relevant experimental methods for the research question, create experimental materials, set up the experiment, plan to analyze the results and make predictions about the results. You should include code or scripts for the experimental setup and material creation that should be runnable and implemented. A well-written final report may be selected for a potential collaborative research project with the instructor, which could be submitted to a conference. More specific guidelines will be provided. **Deadline: May 30; May 29 for graduating students.**

## 6 Policies

### Accessibility and accommodations

If you have special requirements or any issues with accessibility, please contact me so we can coordinate with the Student Disability Services (SDS). Visit the [SDS website](#) for more information.

### Submission guideline

Submissions should be made via **Canvas**. See Canvas for specific guidelines. Other specific guidelines can be found in the external course website: <https://tinyurl.com/exp-comp-methods-ling-research>.

### Late work and extension request

Students come in with different levels of experience in programming languages, and people learn at different speeds. If you need extra time to work on your assignments, please communicate with the instructor **at least 24 hours before the assignment is due**. Late submissions will result in a one-letter-grade deduction for each day, unless communicated in advance.

Should you request an extension, please email the instructor with the header: “**COGS20003: A# Extension (LASTNAME, FIRSTNAME)**”. For example, if I’m requesting an extension for Assignment 2, then the header will be: “COGS20003: A2 Extension (Kim, Sanghee).”

1. If you request an extension for Assignments 1, 2, or 3, they can be extended until the week after Assignment 3 is due (**April 24**).
2. You can also request an extension for Assignments 4, 5, or 6 until the week after Assignment 6 is due (**May 22**).

Assignments for which an extension is not requested will not be eligible for an extension. For example, if you request an extension for Assignment 2, this does not mean you have automatically requested an extension for Assignments 1 and 3.

### Academic integrity

Familiarize yourself with the Academic Policies provided in the [The University of Chicago’s Student Manual](#). The University’s [Academic Honesty & Plagiarism policy](#) is active here:

*It is contrary to justice, academic integrity, and to the spirit of intellectual inquiry to submit another’s statements or ideas as one’s own work. To do so is plagiarism or cheating, offenses punishable under the University’s disciplinary system. Because these offenses undercut the distinctive moral and intellectual character of the University, we take them very seriously.*

*Proper acknowledgment of another's ideas, whether by direct quotation or paraphrase, is expected. In particular, if any written or electronic source is consulted and material is used from that source, directly or indirectly, the source should be identified by author, title, and page number, or by website and date accessed. Any doubts about what constitutes "use" should be addressed to the instructor.*

Correctly attribute any materials and ideas taken from the work of others by properly citing them. In this course, we will be developing skills and knowledge that are important to discover and practice on your own. Because the use of AI tools inhibits the development of these skills and knowledge, students are not allowed to use any AI tools, such as ChatGPT, in this course. Using AI tools, particularly for creating content for assignments, violates the University's academic integrity policy. I do not anticipate any problems with academic integrity, but should there be academic violations, I will forward the materials to the College for further review and action.

## References

- [1] Emily M Bender. *Linguistic fundamentals for natural language processing: 100 essentials from morphology and syntax*. Morgan & Claypool Publishers, 2013.
- [2] Emily M Bender and Alex Lascarides. *Linguistic fundamentals for natural language processing II: 100 essentials from semantics and pragmatics*. Morgan & Claypool Publishers, 2022.
- [3] Lelia Glass et al. *Language and computers*. Language Science Press, 2024.
- [4] Daniel Navarro. *Learning statistics with R*. 2013. URL: <https://learningstatisticswithr.com/lsr-0.6.pdf>.
- [5] Robert J Podesva and Devyani Sharma. *Research methods in linguistics*. Cambridge University Press, 2014.
- [6] Julie Sedivy. *Language in mind: An introduction to psycholinguistics*. Sinauer Associates, Incorporated, 2020.