

Cognitive Neuroscience of Language

LIN6796-29591

Class Periods: WMF 5th period 11:45 AM - 12:35 PM

Location: MAT108

Academic Term: Spring 2024

Instructor:

Edith Kaan

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Office Hours:

W 1:55-2:45pm and by appointment. In person in TUR 4127. If you would like to meet me over zoom, please contact me for a zoom number.

Course website: on Canvas: <http://elearning.ufl.edu>

Course Description

Overview and critical evaluation of brain imaging techniques and issues in language and brain research, covering speech perception, word recognition, reading, syntax, discourse processing, production, language acquisition, and bilingualism. This is a 3-credit course.

Course Pre-Requisites / Co-Requisites

LIN graduate core course, or equivalent in other disciplines. Please contact the instructor for permission.

Course Objectives

- To learn how brain imaging techniques can be applied to psycholinguistic research, and the potential pitfalls of doing so (reading and discussing original research articles, writing a research proposal)
- To learn to evaluate brain imaging studies of language in terms of their scientific and methodological aspects (reading and discussing original research articles, debate, writing summaries and a literature review)
- To improve oral presentation skills (oral summaries of papers, classroom discussions)

Course Assignments

- **Paper presentations** Students are expected to give an oral summary of 1-3 required discussion papers over the course of the semester, one paper per presenter per session. These summaries are about 15 minutes (powerpoint), followed by a group discussion. The number of presentations over the entire course depends on enrollment.
- **Discussions:** All students are expected to read the discussion papers and to post at least 1 discussion question on the course website before the deadline posted. Students are also expected to actively participate in in-class discussions.
- **Written paper summaries:** Students are expected to pick three papers over the course of the semester related to a specific topic (TBA) and write a summary of 2-4 double-spaced pages long, excluding references. The papers should be peer-reviewed journal articles that report an **original study** related to the topic, and that elaborates upon what has been addressed in class. These papers should **not** be overview papers, unpublished materials, or theses, or any of discussion papers listed on the reading list.
- **Debate:** Students will be required to participate in a debate. Specific details will be provided on Canvas and discussed in class.
- **In class-assignments** (e.g. conference highlights): Throughout the semester we have several in-class assignment. An example is an exercise in which sections of an abstract book from a recent conference

are provided. Students will be asked to form groups and assess the abstracts quantitatively (e.g. what are the questions/areas getting the most attention?), and qualitatively (e.g. which abstracts appear the most interesting to you and why? Are any of them especially relevant to the current unit?) Groups will present and discuss their finding in class.

- **Research paper:** Students are expected to write a literature review and a short research proposal on a selected topic related to cognitive neuroscience of language. The report should be about 15 pages long, double spaced, including references. Over the course of the semester students will be asked to hand in a topic, and outline and the paper itself. Students will receive feedback on the paper and will need to respond to each comment as if they were revising a journal article. The revised version of the paper and the response to the comments need to be handed in at the end of the semester. In addition students are expected to present their ideas in class.

Course Schedule and Readings

See last pages of this syllabus. Readings can be obtained from the UF library website (e-journals). Where indicated, the reading is available through the course website. In some cases, a hardcopy will be made available for you to xerox. Background readings pertain to the lecture and are optional; Discussion readings are required.

Cellphone Policy, Attendance Policy, AI policy, Class Expectations, and Make-Up Policy

- Cell-phone use is not allowed during class unless this is part of the course assignments. If you are using a laptop in class, only use it to take notes and for in-class assignments.
- Students are required to turn in all assignments and tests before the class period they are due. Please contact the instructor in advance if you need to skip a class, or cannot make a deadline.
- Students need to disclose any use of AI in their assignments, and need to indicate their prompts and their critical (content) edits of the AI output. AI output without prompts or critical edits will not be accepted. AI needs to be properly cited (<https://apastyle.apa.org/blog/how-to-cite-chatgpt>).
- Attendance is mandatory. If you are absent, or more than 15 minutes late, for more than two classes, you will get a warning. If absences persist the instructor can prohibit further attendance and assign a failing grade for excessive absences.
- Requirements for class attendance and make-up exams, assignments, and other work in this course are consistent with university policies that can be found at: catalog.ufl.edu/UGRD/academic-regulations/attendance-policies/
- Students are encouraged to employ critical thinking and to rely on data and verifiable sources to interrogate all assigned readings and subject matter in this course as a way of determining whether they agree with their classmates and/or their instructor. No lesson is intended to espouse, promote, advance, inculcate, or compel a particular feeling, perception, viewpoint or belief.

Evaluation of Grades

| Assignment | Total Points | Percentage of Final Grade |
|---|--------------|---------------------------|
| Paper presentations | 100 each | 20% |
| written summaries (3) | 100 each | 20% |
| Debate | 100 | 10% |
| In class assignments | 100 each | 5% |
| Final written assignment | 100 | 40% |
| Active participation and timely posting of discussion items | 100 | 5% |

Grading Policy

| Percent | Grade | Grade Points |
|--------------|-------|--------------|
| 90.0 - 100.0 | A | 4.00 |
| 87.0 - 89.9 | A- | 3.67 |
| 84.0 - 86.9 | B+ | 3.33 |
| 81.0 – 83.9 | B | 3.00 |
| 78.0 - 80.9 | B- | 2.67 |
| 75.0 - 79.9 | C+ | 2.33 |
| 72.0 – 74.9 | C | 2.00 |
| 69.0 - 71.9 | C- | 1.67 |
| 66.0 - 68.9 | D+ | 1.33 |
| 63.0 - 65.9 | D | 1.00 |
| 60.0 - 62.9 | D- | 0.67 |
| 0 - 59.9 | E | 0.00 |

For UF grading policies for assigning grade points, see:

<https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx>

Students Requiring Accommodation

Students with disabilities requesting accommodations should first register with the Disability Resource Center (<https://disability.ufl.edu/students/get-started/>) by providing appropriate documentation. Once registered, students will receive an accommodation letter which must be presented to the instructor when requesting accommodation. Students with disabilities should follow this procedure as early as possible in the semester.

Course Evaluation

Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at <https://gatorevals.aa.ufl.edu/students/>. Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via <https://ufl.bluera.com/ufl/>. Summaries of course evaluation results are available to students at <https://gatorevals.aa.ufl.edu/public-results/>.

University Honesty Policy

UF students are bound by The Honor Pledge which states, “We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: “On my honor, I have neither given nor received unauthorized aid in doing this assignment.” The Honor Code (<https://sccr.dso.ufl.edu/process/student-conduct-code/>) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to

appropriate personnel. If you have any questions or concerns, please consult with the instructor in this class.

Software Use

All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

Student Privacy

There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please see: <http://registrar.ufl.edu/catalog0910/policies/regulationferpa.html>

Recording

Students are allowed to record video or audio of class lectures. However, the purposes for which these recordings may be used are strictly controlled. The only allowable purposes are (1) for personal educational use, (2) in connection with a complaint to the university, or (3) as evidence in, or in preparation for, a criminal or civil proceeding. All other purposes are prohibited. Specifically, students may not publish recorded lectures without the written consent of the instructor.

A “class lecture” is an educational presentation intended to inform or teach enrolled students about a particular subject, including any instructor-led discussions that form part of the presentation, and delivered by any instructor hired or appointed by the University, or by a guest instructor, as part of a University of Florida course. A class lecture does not include lab sessions, student presentations, clinical presentations such as patient history, academic exercises involving solely student participation, assessments (quizzes, tests, exams), field trips, private conversations between students in the class or between a student and the faculty or lecturer during a class session.

Publication without permission of the instructor is prohibited. To “publish” means to share, transmit, circulate, distribute, or provide access to a recording, regardless of format or medium, to another person (or persons), including but not limited to another student within the same class section. Additionally, a recording, or transcript of a recording, is considered published if it is posted on or uploaded to, in whole or in part, any media platform, including but not limited to social media, book, magazine, newspaper, leaflet, or third party note/tutoring services. A student who publishes a recording without written consent may be subject to a civil cause of action instituted by a person injured by the publication and/or discipline under UF Regulation 4.040 Student Honor Code and Student Conduct Code.

Campus Resources: see tab on the Canvas course website

Overview of the course and readings (subject to change!!! Number of discussion papers may change depending on enrollment)

| Date | Monday Discussion papers (numbered) and required readings | Topic of lecture | Assignments due | Optional background readings |
|---|--|---|--|--|
| (1) Jan 8-10-13 | Syllabus | Introduction to brain and methods of cognitive neuroscience | | |
| (2) Jan 17-19 | (no class M) Boroditsky (2019) Hagoort (2019) | Electrophysiology | | Kaan (2007) |
| (3) Jan 22-24-26 | Kutas and Hillyard (1980) | Hemodynamic and lesion techniques | Sign up for paper presentations | Sabourin (2014) p 1-4 https://www.youtube.com/watch?v=4UOeBM5BwdY |
| (4) Jan 29-31-Feb2 | 1. Lau, Phillips, and Poeppel (2008) | Hemodynamic and lesion techniques; Speech perception | | |
| (5) Feb 5-7-9 | 2. Näätänen, Lehtokoski, and Lennes (1997) 3. Mesgarani et al. (2014) | Speech perception and production | Summary 1 due | Scott (2019) Nature on brain interfaces |
| (6) Feb 12-14-16 | 4. Kuhl et al. (2014) 5. Pulvermüller et al. (2006) 6. Meister et al. (2007) | Word recognition | | Dehaene-Lambertz (2017), Venezia and Hickok (2009) Ganushchak, Christoffels, and Schiller (2011) |
| (7) Feb 19-21-23 | 7. Marinkovich et al. (2003) 8. Leonard et al. (2012) | Meaning | Topic of research paper due | |
| (8) Feb 26-28-Mar1 | 9. Crinion et al. (2006) 10. Lambon Ralph (2007) 11. Huth et al. (2016) | Reading and dyslexia | | Patterson et al. (2007) |
| (9) Mar 4-6-8 | 12. Centanni et al. (2022) | Morphology | Outline of research paper due Summary 2 due Prepare debate | |
| Mar 11-15: SPRING BREAK - NO CLASS | | | | |

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|----------------------|---|---|---|---|
| (11) Mar 18-20-22 | TBA | syntactic composition, dependencies, Broca's area | Debate: Is there a morphological decomposition area in the brain? | |
| (12) Mar 25-27-29 | 13. Malik-Moraleda et al. (2022) 14. Brennan et al. (2016) 15. Ding et al. (2016) | Syntax; Indiv differences, language learning | | Pykkänen (2019) Matchin & Hickok (2020) Matchin chapter in handbook<<>> |
| (13) Apr 1-3-5 | 16. Pratt et al. (2016) 17. Grey (2022) | Social aspects | | Pratt (2011) |
| (14) Apr 8-10-12 | 18. Peeters (2020) 19. Verga & Kotz (2019) | Social aspects | Research paper due | |
| (15) Apr 15-17-19 | 20. Pérez et al. (2019) | | Summary 3 due | Schoot, Hagoort, and Segaert (2016) Li and Jeong (2020) |
| (16) Apr 22-24 | | Wrap-up | Project presentations | |
| Apr 29 | | | Revision of research paper due | |

Reading list

*=Required/discussion paper

- * Boroditsky, L. (2019). Language and the brain. *Science*, 366(6461), 13. <https://doi.org/10.1126/science.aaz6490>.
- * Brennan, J. R., Stabler, E. P., Van Wagenen, S. E., Luh, W.-M., & Hale, J. T. (2016). Abstract linguistic structure correlates with temporal activity during naturalistic comprehension. *Brain and Language*, 157-158, 81-94. <https://doi.org/https://doi.org/10.1016/j.bandl.2016.04.008>
- * Centanni, T. M., Beach, S. D., Ozernov-Palchik, O., May, S., Pantazis, D., & Gabrieli, J. D. E. (2022). Categorical perception and influence of attention on neural consistency in response to speech sounds in adults with dyslexia. *Annals of Dyslexia*, 72(1), 56-78. <https://doi.org/10.1007/s11881-021-00241-1>
- * Crinion, J., Turner, R., Grogan, A., Hanakawa, T., Noppeney, U., Devlin, J. T., Aso, T., Urayama, S., Fukuyama, H., Stockton, K., Usui, K., Green, D. W., & Price, C. J. (2006). Language control in the bilingual brain. *Science*, 312(5779), 1537-1540. <https://doi.org/10.1126/science.1127761>
- Dehaene-Lambertz, G. (2017). The human infant brain: A neural architecture able to learn language. *Psychonomic Bulletin & Review*, 24(1), 48-55. <https://doi.org/10.3758/s13423-016-1156-9>
- * Ding, N., Melloni, L., Zhang, H., Tian, X., & Poeppel, D. (2016). Cortical tracking of hierarchical linguistic structures in connected speech. *Nature Neuroscience*, 19(1), 158-164. <https://doi.org/10.1038/nn.4186>

- Ganushchak, L., Christoffels, I., & Schiller, N. (2011). The Use of Electroencephalography in Language Production Research: A Review. *Frontiers in Psychology*, 2(208).
<https://doi.org/10.3389/fpsyg.2011.00208>.
- *Grey, S. (2022). Variability in native and nonnative language: An ERP study of semantic and grammar processing. *Studies in Second Language Acquisition*, 45(1), 137-166.
<https://doi.org/10.1017/S0272263122000055>
- * Hagoort, P. (2019). The neurobiology of language beyond single-word processing. *Science*, 366(6461), 55. <https://doi.org/10.1126/science.aax0289>
- *Huth, A. G., de Heer, W. A., Griffiths, T. L., Theunissen, F. E., & Gallant, J. L. (2016). Natural speech reveals the semantic maps that tile human cerebral cortex. *Nature*, 532(7600), 453-458.
<https://doi.org/10.1038/nature17637>
- Kaan, E. (2007). Event-Related Potentials and Language Processing: A Brief Overview. *Language and Linguistics Compass*, 1(6), 571-591. <https://doi.org/10.1111/j.1749-818X.2007.00037.x>
- * Kutas, M., & Hillyard, S. A. (1980). Reading senseless sentences: brain potentials reflect semantic incongruity. *Science*, 207, 203-205.
- *Lambon Ralph, M. A., Lowe, C., & Rogers, T. T. (2007). Neural basis of category-specific semantic deficits for living things: evidence from semantic dementia, HSVE and a neural network model. *Brain*, 130(4), 1127-1137. <https://doi.org/10.1093/brain/awm025>
- * Lau, E. F., Phillips, C., & Poeppel, D. (2008). A cortical network for semantics: (de)constructing the N400. *Nature Reviews Neuroscience*, 9(12), 920-933. <https://doi.org/10.1038/nrn2532>.
- *Leonard, M., K., Naja Ferjan, R., Christina, T., Katherine, E. T., Marla, H., Rachel, I. M., & Eric, H. (2012). Signed words in the congenitally deaf evoke typical late lexicosemantic responses with no early visual responses in left superior temporal cortex. *The Journal of Neuroscience*, 32(28), 9700.
<https://doi.org/10.1523/JNEUROSCI.1002-12.2012>
- Li, P., and Jeong, H. (2020). The social brain of language: grounding second language learning in social interaction. *npj Science of Learning*, 5(1), 8. <https://doi.org/10.1038/s41539-020-0068-7>
- *Malik-Moraleda, S., Ayyash, D., Gallée, J., Affourtit, J., Hoffmann, M., Mineroff, Z., Jouravlev, O., & Fedorenko, E. (2022). An investigation across 45 languages and 12 language families reveals a universal language network. *Nature Neuroscience*, 25(8), 1014-1019.
<https://doi.org/10.1038/s41593-022-01114-5>
- Matchin, W., and Hickok, G. (2020). The Cortical Organization of Syntax. *Cerebral Cortex*, 30(3), 1481-1498. <https://doi.org/10.1093/cercor/bhz180>
- *Marinkovic, K., Dhond, R. P., Dale, A. M., Glessner, M., Carr, V., & Halgren, E. (2003). Spatiotemporal Dynamics of Modality-Specific and Supramodal Word Processing. *Neuron*, 38(3), 487-497.
<https://doi.org/https://doi.org/10.1016/S0896-62>
- * Meister, I. G., Wilson, S. M., Deblieck, C., Wu, A. D., & Iacoboni, M. (2007). The Essential Role of Premotor Cortex in Speech Perception. *Current biology : CB*, 17(19), 1692-1696.
<https://doi.org/10.1016/j.cub.2007.08.064>
- * Mesgarani, N., Cheung, C., Johnson, K., & Chang, E. F. (2014). Phonetic Feature Encoding in Human Superior Temporal Gyrus. *Science*, 343(6174), 1006. <https://doi.org/10.1126/science.1245994>.
- * Näätänen, R., Lehtokoski, A., & Lennes, M. (1997). Language-specific phoneme representations revealed by electric and magnetic brain responses. *Nature*, 385, 432-434.
<https://doi.org/10.1038/385432a0>.
- Patterson, K., Nestor, P. J., & Rogers, T. T. (2007). Where do you know what you know? The representation of semantic knowledge in the human brain. *Nature Reviews Neuroscience*, 8(12), 976-987. <https://doi.org/10.1038/nrn2277>

- *Peeters, D. (2020). Bilingual switching between languages and listeners: Insights from immersive virtual reality. *Cognition*, *195*, 104107.
<https://doi.org/https://doi.org/10.1016/j.cognition.2019.104107>
- *Pérez, A., Dumas, G., Karadag, M., & Duñabeitia, J. A. (2019). Differential brain-to-brain entrainment while speaking and listening in native and foreign languages. *Cortex*, *111*, 303-315.
<https://doi.org/https://doi.org/10.1016/j.cortex.2018.11.026>
- *Prat, C. S., Yamasaki, B. L., Kluender, R. A., & Stocco, A. (2016). Resting-state qEEG predicts rate of second language learning in adults. *Brain and Language*, *157-158*, 44-50.
<https://doi.org/https://doi.org/10.1016/j.bandl.2016.04.007>
- Prat, C. S. (2011). The Brain Basis of Individual Differences in Language Comprehension Abilities [https://doi.org/10.1111/j.1749-818X.2011.00303.x]. *Language and Linguistics Compass*, *5*(9), 635-649. <https://doi.org/https://doi.org/10.1111/j.1749-818X.2011.00303.x>
- * Pulvermüller, F., Huss, M., Kherif, F., Moscoso del Prado Martin, F., Hauk, O., & Shtyrov, Y. (2006). Motor cortex maps articulatory features of speech sounds. *Proceedings of the National Academy of Sciences*, *103*(20), 7865-7870. <https://doi.org/10.1073/pnas.0509989103>.
- Pylkkänen, L. (2019). The neural basis of combinatory syntax and semantics. *Science*, *366*(6461), 62.
<https://doi.org/10.1126/science.aax0050>.
- Sabourin, L. (2014). fMRI Research on the Bilingual Brain. *Annual Review of Applied Linguistics*, *34*, 1-14.
<https://doi.org/10.1017/S0267190514000038>
- Schoot, L., Hagoort, P., & Segaert, K. (2016). What can we learn from a two-brain approach to verbal interaction? *Neuroscience & Biobehavioral Reviews*, *68*, 454-459.
<https://doi.org/https://doi.org/10.1016/j.neubiorev.2016.06.009>.
- Scott, S. K. (2019). From speech and talkers to the social world: The neural processing of human spoken language. *Science*, *366*(6461), 58. <https://doi.org/10.1126/science.aax0288>
- *Verga, L., & Kotz, S. A. (2019). Spatial attention underpins social word learning in the right fronto-parietal network. *NeuroImage*, *195*, 165-173.
<https://doi.org/10.1016/j.neuroimage.2019.03.071>
- Venezia, J. H., & Hickok, G. (2009). Mirror Neurons, the motor system and language: From the Motor Theory to embodied cognition and beyond. *Language and Linguistics Compass*, *3*(6), 1403-1416.
<https://doi.org/10.1111/j.1749-818X.2009.00169.x>