Linguistics 172: Language and the Brain

TTH 5-6:20pm, Center Hall 212

Instructor: Wind Cowles
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Hours: Thursday 3-4 and by appointment
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Course Webpage: ling.ucsd.edu/courses/lign172

Course Objectives

At the end of this course, you should be able to:

(1) Critically assess popular media reports on research developments in language and the brain;
(2) Read and understand primary source literature and critically evaluate what you read in the light of previous research;
(3) Compare converging sources of evidence across methodologies in order to arrive at (at least partial) answers to questions of interest in this area;
(4) State the implications of such research for fundamental issues in cognitive science and linguistics.

Additional goals for the course:

(a) Familiarize all majors with basic concepts of neuroscience and with broader issues of mental representation within cognitive science, and
(b) Familiarize non-linguistics majors with basic issues in linguistics

Course Structure, Requirements and Policies

The Readings

The readings will be available via the reserve system at the library. There will be physical copies on reserve in the library itself as well as electronic copies available to download via the eReserves system. The eReserves system is available to any computer on campus without any extra fussing. Off-campus computers can also use eReserves when a proxy is setup. The url for eReserves is:

http://reserves.ucsd.edu/eres/default.aspx

For information about setting up a proxy server in order to access eReserves from off-campus, see http://resnet.ucsd.edu/body_webproxy.html. I will provide more information on the website if people are having trouble – setting up a proxy also allows people to have access to other good resources, and so is worth the investment in time to get it set up!

Many of readings in this class will not be easy going because they will be from primary sources; for certain subjects there is little secondary literature to speak of because the field is in such tremendous flux and expanding so rapidly. Therefore give yourself ample time for the readings; some of it will be technical and is not something that you can just skim through.

The readings should be done by the class *following* when they are assigned. Because the readings will be challenging, the first part of each class will be reserved for questions about any of the readings (or lectures!) from past classes. This is your chance to make sure you've understood what we've been talking about and I highly encourage people to take advantage of this. Of course, if at anytime the reading seems to be too much or too difficult, please let me know, either individually or as a group.

Exams

There will be both a take-home midterm and a take-home final. The midterm will be due at the beginning of class on Tuesday, November 2nd, and the final will be due by 5:30pm on Tuesday, December 7th (the day our final exam is scheduled for). Each exam will count for 50% of your grade. Cheating on either of the exams will result in no credit for the exam in question, and you will be referred to your dean for disciplinary action. This is university policy and there will be no exceptions. PLEASE NOTE: If you hand in an exam that resembles an exam handed in by anyone else in this class or in previous classes like this one, that constitutes cheating. Therefore, all written work must be your own and no one else's. Cheating undermines the value of everyone's education, and you should know that I feel very strongly about this issue and that I will handle all cases of cheating accordingly. I truly hope there will be no cause to discuss this issue any further this quarter, but if there is, I will strictly adhere to the policy outlined in this paragraph without exception.

(Tentative) Syllabus and Readings

Week 0:	Details of the class and overview of major issues

9/23 (TH): Syllabus
High-level debates related to language and the brain

Readings:

- Caplan, D. (1986). 'Issues in neurolinguistics and linguistic aphasiology' In Neurolinguistics and Linguistic Aphasiology: An Introduction. Cambridge, GB: Cambridge University Press, Chapter 1, pp. 3-16.
- Churchland, P.M. (1988). 'The Ontological Problem (the Mind-Body Problem)', Matter and Consciousness, Cambridge, MA: MIT Press, Chapter 2, (only pp. 26-42).

Also recommended:

- Fodor, J. (1981). 'The Mind-Body Problem', Scientific American, January 1981, pp. 114-123.

Week 1:	Overview of the brain Methods used to study how the brain works

9/28 (T): Basic Neuroanatomy

Readings:

- Churchland, P. (1996) How do neurons work?' In Neurophilosophy, MIT Press, pp. 48-69.
- Kelly, J.(1985). 'Principles of the Functional and Anatomical Organization of the Nervous System.' In E. Kandel and J. Schwartz, (eds.), Principles of Neural Science. New York, NY:Elsevier North Holland, Chapter 19, pp. 209-221.
- Kalat, J. (2004) 'The Cerebral Cortex.' In Biological Psychology. Pacific Grove, Brooks/Cole, Module 4.3, pp 94-103.

9/31 (TH): Lateralization of function
Methodologies used to study brain function

Readings:

- Caplan, D. (1986). 'Approaches to neurolinguistics and linguistic aphasiology' and 'Cerebral dominance and specialization for language.' Neurolinguistics and Linguistic Aphasiology: An Introduction. Cambridge, GB: Cambridge University Press, Chapters 2 and 18, pp. 17-39, 345-368.

- Kutas and van Petten (1995) 'Psycholinguistics Electrified: Event-related brain potential investigations.' In Gernsbacher, M.A. (Ed) Handbook of Psycholinguistics. Pp. 83-92 are required, although you are encouraged to read 92-102

  Also Recommended:
- Fabbro, F. (1999) 'Methods for studying the organization of language in the brain. In The Neurolinguistics of Bilingualism. Chapter 7, pp. 59-67.

Week 2: What is learned from when language goes wrong

10/5 (T): Aphasias

Readings:
- Damasio, A.R. (1992). 'Aphasia' New England Journal of Medicine 326(8), pp. 531-539.
- Hillis, A.H. & Caramazza, A. (1991) 'Category-Specific Naming and Comprehension Impairment: A double dissociation.' Brain, 114, pp. 2081-2094.

10/7 (TH): Dyslexia and Inherited Speech/Language Disorder

Readings:
- Démonet, J-F & Chaix, Y. (2004) 'Developmental dyslexia' Lancet, 363(9419), May, pp. 1451-1460.
- Vargha-Khadem, F., Watkins, K.E., Alcock, K., Fletcher, P., and Passingham, R. (1995). 'Praxic and nonverbal cognitive deficits in a large family with a genetically transmitted speech and language disorder.' Proceedings of the National Academy of Sciences 92 (3): pp. 930-933.
- Watkins et al. (2002) 'MRI analysis of an inherited speech and language disorder: structural brain abnormalities' Brain, 125(3), pp. 465-478.

Weeks 3 & 4:	Language representation in the brain Language (and brain) evolution

10/12 (T): The Organization of Language in the Brain

Readings:
- Ojemann, G. (1991). 'Cortical Organization of Language.' Journal of Neuroscience 11, pp. 2281-2287.
- Lüders, H., Lesser, R., Hahn, J., Dinner, D., Morris, H., Wyllie, E., and Godoy, J. (1991). 'Basal temporal language area.' *Brain* **114**, pp. 743-754.
- Krauss, G.L., Fisher, R., Plate, C., Hart, J., Uematsu, S., Gordon, B., and Lesser, R.P. (1996). 'Cognitive effects of resecting basal temporal language areas.' Epilepsia 37 (5), pp. 476-83.
- Boatman, D. (2004) 'Cortical bases of speech perception: evidence from functional lesion studies.' Cognition, 92, 47-65.

Also recommended:
- Ojemann, G. (2003) The neurobiology of language and verbal memory: Observations from awake neurosurgery. International Journal of Psychophysiology, 48, pp. 141-146.

10/14: (TH): Bilingualism and the Brain

Readings:

- Dehaene, S., Dupoux, E., Mehler, J., Cohen, L., Paulesu, E., Perani, D., van de Moortele, P.-F., Lehéricy, S., and Le Bihan, D. (1997). 'Anatomical variability in the cortical representation of first and second language.' NeuroReport 8, pp. 3809-3815.
- Perani, D., Paulesu, E., Sebastian Galles, N., Dupoux, E., Dehaene, S., Bettinardi, V., Cappa, S.F., Fazio, F., and Mehler, J. (1998). 'The bilingual brain: Proficiency and age of acquisition of the second language.' *Brain* **121**, pp. 1841-1852.
- Vingerhoets, G.Van Borsel, J., Tesink, C., ven den Noort, M., Deblaere, K., Seurinck, R., Vandemaele, P., & Achten, E. (2003) Multilingualism: an fMRI study. *NeuroImage*, 20, 2181-2196.

Also Recommended

- Roux, F-E., Lubrano, V., Lauwers-Cances,V., Trémoulet, M. Mascott, C.R., & Démonet, J-F. (2004) 'Intra-operative mapping of cortical areas involved in reading in mono- and bilingual patients.' *Brain*, 127, 1796-1810.

10/19 (T): Language in a different modality: The Neural Representation of ASL

Readings:

- Haglund, M.M., Ojemann, G.A., Lettich, E., Bellugi, U. and Corina, D. (1992). 'Dissociation of Cortical and Single Unit Activity in Spoken and Signed Languages.' *Brain and Language* **44** (1), pp. 19-27.
- Corina, D.P., Vaid, J., and Bellugi, U. (1992). 'The linguistic basis of left hemisphere specialization.' *Science* **255**, pp. 1258-1260.
- Neville, H.J., Bavelier, D., Corina, D., Rauschecker, J., Karni, A., Lalwani, A., Braun, A., Clark, V., Jezzard, P., and Turner, R. (1998). 'Cerebral organization for language in deaf and hearing subjects: Biological constraints and effects of experience.' *Proceedings of the National Academy of Sciences of the United States of America* **95** (3), pp. 922-929.
- Bavelier, D. Corina, D., Jezzard, P., Clark, V., Karni, A., Lalwani, A., Rauschecker, J.P., Braun, A., Turner, R., Neville, H.J. (1998). 'Hemispheric specialization for English and ASL: Left invariance—right variability.' *Neuroreport* **9** (7), pp. 1537-1542.
- Gordon (2004) Neurology of Sign Language.' Brain and Development

10/21 (TH): Origins and Evolution of Language

Readings:

- Deacon, T.W. (1990). 'Brain-Language Coevolution.' In J.A. Hawkins and M. Gell-Mann (eds.), *The Evolution of Human Languages: SFI Studies in the Sciences of Complexity*, Proceedings Vol. X. Redwood City, CA: Addison Wesley, pp. 49-83.

Weeks 5-9: How does the brain process language in real time?

10/26 (T): Bigger issues revisited
Single word processing: Evidence from fMRI and ERPs

Readings:

- Petersen, S., Fox, P., Snyder, A., and Raichle, M. (1990). 'Activation of Extrastriate and Frontal Cortical Areas by Visual Words and Word-Like Stimuli.' *Science* **249**, pp. 1041-1043.

- McCarthy, G., Blamire, A.M., Rothman, D.L., Gruetter, R., and Shulman, R.G. (1993). 'Echoplanar magnetic resonance imaging studies of frontal cortex activation during word generation in humans.' *Proceedings of the National Academy of Sciences* **90**, pp. 4952-4956.
- TBA

10/28 (TH): PET and fMRI Studies of Sentence Processing

Readings:
- Stromswold K., Caplan D., Alpert N., and Rauch S. (1996). 'Localization of syntactic comprehension by positron emission tomography.' *Brain and Language* **52** (3), pp. 452-473.
- TBA

11/2 (T): MIDTERM EXAMS DUE
ERP studies of semantic processing, part 1 (Semantic anomalies)

Readings:
- Kutas and van Petten (1995) 'Psycholinguistics Electrified: Event-related brain potential investigations.' In Gernsbacher, M.A. (Ed) Handbook of Psycholinguistics. pp. 102-110.
- Kutas, M. and Hillyard, S. (1980). 'Event-related brain potentials to semantically inappropriate and surprisingly large words.' *Biological Psychology* **11**, pp. 99-116.
- Fischler, I., Bloom, P.A., Childers, D.G., Roucos, S.E., and Perry, N.W. Jr. (1983). 'Brain potentials related to stages of sentence verification.' *Psychophysiology* **20(4)**, pp. 400-409.

11/4 (TH): ERP studies of semantic processing, part 2
(Word Expectancy, Semantic Association
Word Position, Frequency, and Class Membership)

Readings:
- Kutas, M. and Hillyard, S. (1984). 'Brain potentials during reading reflect word expectancy and semantic association.' *Nature* **307**, pp. 161-163.
- Kutas, M., Lindamood, T., and Hillyard, S. (1984). 'Word Expectancy and Event-Related Brain Potentials During Sentence Processing.' In S. Kornblum and J. Requin (eds.), *Preparatory States and Processes*, Chapter 11, pp. 217-237.
- Osterhout, L., Bersick, M., and McKinnon, R. (1997). 'Brain potentials elicited by words: Word length and frequency predict the latency of an early negativity.' *Biological Psychology* **46**, pp. 143-168.

11/9 (T): A little more about the N400, Discourse contexts

Readings:
- Brown, C. and Hagoort, P. (1993). 'The Processing Nature of the N400: Evidence from Masked Priming.' *Journal of Cognitive Neuroscience* **5** (1), pp. 34-44.
- Nobre, A.C., Allison, T., and McCarthy, G. (1994). 'Word recognition in the human inferior temporal lobe.' *Nature* **372**, pp. 260-263.
- Van Berkum, J., Zwisterlood, P. Hagoort, P., & Brown, C. (2003) When and how do listeners relate a sentence to the wider discourse? Evidence from the N400 effect. *Cognitive Brain Research*, 17, pp. 701-718.

11/11 (TH): NO CLASS

11/16 (T): What about syntax? ERP Studies of Syntactic Violations

Readings:

- Osterhout, L. and Holcomb, P. (1992). 'Event-related brain potentials elicited by syntactic anomaly.' *Journal of Memory and Language* **31** (6), pp. 785-806.
- Neville, H., Nicol, J., Barss, A., Forster, K., and Garrett, M. (1991). 'Syntactically based sentence processing classes: Evidence from event-related brain potentials.' *Journal of Cognitive Neuroscience* **3** (2), pp. 151-165.

11/18 (TH): More about syntactic processing: ERP studies of syntactic difficulty

Readings:

- Kaan, E., Harris, A., Gibson, E., Holcomb, P. (2000) 'The P600 as an index of syntactic integration difficulty. *Language and Cognitive Processes*, 15(2), pp. 159-201.

11/23 (T): Linguistic dependencies and working memory

Readings:

- Garnsey, S., Tanenhaus, M., and Chapman, R. (1989). 'Evoked Potentials and the Study of Sentence Comprehension', *Journal of Psycholinguistic Research* **18**, pp. 51-60.
- Kluender, R. and Kutas, M. (1993). 'Bridging the Gap: Evidence from ERPs on the Processing of Unbounded Dependencies', *Journal of Cognitive Neuroscience* **5** (2), pp. 196-214.
- Münte, T.F., Schiltz, K., and Kutas, M. (1998) 'When temporal terms belie conceptual order.' *Nature* **395** (6697), pp. 71-73.

11/25 (TH): NO CLASS

Week 10: Putting it all together

11/30 (T): When and where united? Proposals for syntactic processing

Readings:

- Friederici, A. & Kotz, S. (2003) 'The brain basis of syntactic processes: functional imagine and lesion studies. *NeuroImage*, 20, S8-S17
- Hagoort, P. (2003) 'How the brain solves the binding problem for language: a neurocomputational model of syntactic processing.' *NeuroImage*, 20, S18-S29.

12/2 (TH): Wrap-up & review