

Course title: Brain Imaging of Language Functions

Course number: 27-503-01

Lecturer: Prof. Michal Ben-Shachar

First Semester

Hours: 4 h/w – 2 credit points

Class requirements:

- Attendance (over 80% attendance required)
- Active attendance (read and discuss papers) AND class presentation (**20% of final grade**).
- Final exam (exam material includes the contents of the lectures and final list of required reading; **80% of final grade**).

Week	Tuesday	Thursday	Required reading
Week 1: Oct 25, 27	Intro	Cognitive neuropsychology, Modularity	○ Pinker, 1991 ○ Small & Hickok, NBoL Ch1 ○ Dronkers et al., 2004 ○ <i>Henseler et al., 2014*</i>
Week 2: Nov 1, 3	No classes (election day)	Aphasia	○ Forster 1999
Week 3: Nov 8, 10	VLSM	Models of the mental lexicon	○ Mesulam et al., 2021 ○ Baldo et al., 2018 ○ <i>Davis, NBoL Ch44*</i>
Week 4: Nov 15, 17	fMRI I	Class presentations	○ Pinker and Ullman, 2002 ○ Marantz, NBoL Ch13* ○ <i>Leminen et al., 2018*</i>
Week 5: Nov 22, 24	Lexical access	fMRI II	○ Bozic et al., 2013 ○ Carota et al., 2016
Week 6: Nov 29 Dec 1	Morphology	fMRI of morphological processing	○ Shapiro, 1997* ○ Sprouse & Hornstein, Ch14*
Week 7: Dec 6, 8	No classes (ISFN)	Class presentations	○ <i>Hauser, Chomsky & Fitch 2002*</i> ○ Altmann, 1998
Week 8: Dec 13, 15	No classes (Brainy days)	Online sentence processing	○ Matchin et al., 2017 ○ Wilson et al., 2018
Week 9: Dec 20, 22	fMRI of syntactic processing	Hanukkah vacation	○ Hahne and Friederici, 1999 ○ Cohen and Dehaene 2011 ○ Price and Devlin 2011
Week 10: Dec 27, 29	ERP of sentence processing	Class presentations	○ Glezer et al., 2015 ○ Schuster et al., 2021
Week 11: Jan 3, 5	No classes (Yod betevet)	Reading	○ Lerma-Usabiaga et al., 2018 ○ Bouhali et al., 2019

Week 12: Jan 10, 12	Class presentations	Class presentations	○ Frey et al., 2008 ○ Floel et al., 2009
Week 13: Jan 17, 19	Diffusion MRI	Class presentations	○ Ben-Shachar et al, 2007 ○ Hickok and Poeppel, Ch25
Week 14: Jan 24, 26	dMRI of reading pathways	Wrap up and overflow	* - <i>Recommended reading, beyond the scope</i>

Papers for class presentation:

- Baldo JV, Kacinik N, Ludy C, Paulraj S, Moncrief A, Piai V, Curran B, Turken A, Herron T, Dronkers NF. Voxel-based lesion analysis of brain regions underlying reading and writing. *Neuropsychologia*. 2018 Jul 1;115:51-59.
- Bouhali F, Bézagu Z, Dehaene S, Cohen L. A mesial-to-lateral dissociation for orthographic processing in the visual cortex. *Proc Natl Acad Sci U S A*. 2019 Oct 22;116(43):21936-21946.
- Bozic M, Tyler LK, Su L, Wingfield C, Marslen-Wilson WD. Neurobiological systems for lexical representation and analysis in English. *J Cogn Neurosci*. 2013 Oct;25(10):1678-91.
- Carota F, Bozic M, Marslen-Wilson W. Decompositional Representation of Morphological Complexity: Multivariate fMRI Evidence from Italian. *J Cogn Neurosci*. 2016 Dec;28(12):1878-1896.
- Flöel A, de Vries MH, Scholz J, Breitenstein C, Johansen-Berg H. White matter integrity in the vicinity of Broca's area predicts grammar learning success. *Neuroimage*. 2009 Oct 1;47(4):1974-81.
- Frey S, Campbell JS, Pike GB, Petrides M. Dissociating the human language pathways with high angular resolution diffusion fiber tractography. *J Neurosci*. 2008 Nov 5;28(45):11435-44.
- Glezer LS, Kim J, Rule J, Jiang X, Riesenhuber M. Adding words to the brain's visual dictionary: novel word learning selectively sharpens orthographic representations in the VWFA. *J Neurosci*. 2015 Mar 25;35(12):4965-72.
- Lerma-Usabiaga G, Carreiras M, Paz-Alonso PM. Converging evidence for functional and structural segregation within the left ventral occipitotemporal cortex in reading. *Proc Natl Acad Sci U S A*. 2018 Oct 16;115(42):E9981-E9990.
- Matchin W, Hammerly C, Lau E. The role of the IFG and pSTS in syntactic prediction: Evidence from a parametric study of hierarchical structure in fMRI. *Cortex*. 2017 Mar;88:106-123.
- Mesulam MM, Coventry CA, Rader BM, Kuang A, Sridhar J, Martersteck A, Zhang H, Thompson CK, Weintraub S, Rogalski EJ. Modularity and granularity across the language network-A primary progressive aphasia perspective. *Cortex*. 2021 Aug;141:482-496.
- Schuster S, Himmelstoss NA, Hutzler F, Richlan F, Kronbichler M, Hawelka S. Cloze enough? Hemodynamic effects of predictive processing during natural reading. *Neuroimage*. 2021 Mar;228:117687.
- Wilson SM, Bautista A, McCarron A. Convergence of spoken and written language processing in the superior temporal sulcus. *Neuroimage*. 2018 May 1;171:62-74.

Supporting papers and reviews (not for student presentations):

- Neurobiology of language, Book, Editors: Hickok and Small, Chapters 1, 13, 14, 25, 29, 44*.
- Pinker S. (1991). Rules of language. *Science* 253(5019):530-5.
- *Hauser, M.D., Chomsky, N. & Fitch, W.T. (2002). *Science* **298**, 1569–1579.
- Dronkers NF, Wilkins DP, Van Valin RD Jr, Redfern BB, Jaeger JJ. (2004). Lesion analysis of the brain areas involved in language comprehension. *Cognition* 92(1-2):145-77.

- *Henseler I, Regenbrecht F, Obrig H. Lesion correlates of patholinguistic profiles in chronic aphasia: comparisons of syndrome-, modality- and symptom-level assessment. *Brain*. 2014 Mar;137(Pt 3):918-30. * Beyond the scope
- Forster 1999. The Microgenesis of Priming Effects in Lexical Access. B&L.
- *Leminen A, Smolka E, Duñabeitia JA, Pliatsikas C. (2018). Morphological processing in the brain: The good (inflection), the bad (derivation) and the ugly (compounding). *Cortex*. pii: S0010-9452(18)30266-1.
- Altmann 1998. Ambiguity in sentence processing. TICS.
- Ben-Shachar, Dougherty and Wandell 2007. White matter pathways in reading. Current opinions in Neurobiology.
- Hagoort 2008. The fractionation of spoken language understanding by measuring electrical and magnetic brain signals. *Phil. Trans Royal Soc*.
- Shapiro 1997. Tutorial: an introduction to syntax.
- Pinker and Ullman 2002. The past and future of the past tense. TICS.
- Hahne and Friederici (1999). Electrophysiological Evidence for Two Steps in Syntactic Analysis: Early Automatic and late Controlled Processes. *JoCN*.
- Dehaene S, Cohen L. The unique role of the visual word form area in reading. *Trends Cogn Sci*. 2011 Jun;15(6):254-62.
- Price CJ, Devlin JT. The interactive account of ventral occipitotemporal contributions to reading. *Trends Cogn Sci*. 2011 Jun;15(6):246-53.

* Beyond the scope