

Frédéric Edouard Theunissen

Curriculum Vitae

Septembre 2010

University of California, Berkeley
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Personal Information

Born : 16 February 1964 in Belgium. US Permanent Resident.
Fluent in French and Spanish.
Married. 2 Children.

Employment

2010-now Professor, Psychology and Neurosciences Institute, UC Berkeley.
2005-2010 Associate Professor. Psychology and Neurosciences Institute. UC
Berkeley
1998-2005 Assistant Professor. Psychology and Neurosciences Institute. UC
Berkeley.

Education and Training

1995-1998 Post-Doctoral Training. Physiology and Psychiatry. Dr. Doupe. UC San
Francisco.
1993-1995. Post-Doctoral Training. MCB Neuroscience. Dr. Miller and Dr. Jacobs.
UC Berkeley.
1993. Ph.D. Biophysics. UC Berkeley.
1985. B. S. Engineering Physics. UC Berkeley.

Honors and Awards.

1999-2002 Searle Scholar.
1999-2001 Sloan Fellow.
1996-1998 NIMH Post-doctoral fellowship.
1995-1998 Sloan fellow post-doctoral fellowship in Theoretical Neuroscience, UC
San Francisco.
1989-90 University fellow (graduate), UC Berkeley .
1983-85 Chancellor fellow (undergraduate), UC Berkeley.

Professional Society Memberships

Acoustical Society of America
International Neurotheological Society
Neuroscience Society

Other Professional Experience

Computer Programmer at Berkeley Solar Group. Simulations of energy expenditures in
residential and commercial buildings. 1985-88.

Research Interests

Auditory physiology. Using songbirds as a model system, my laboratory is researching the neural representation of behaviorally relevant natural sounds at various levels of the ascending auditory system. We are also studying the development of the auditory system and the interaction of the auditory system with the vocal system.

Theoretical Neuroscience in Audition. The goal of this line of research is to derive computational schemes for sound processing that would be beneficial for biological organisms faced with the identification of behaviorally relevant sounds or sound features presented in a background of environmental noise. We then study the link between these optimal computational schemes and major perceptual dimensions in audition. These theoretical predictions are tested against our physiological data.

Computational Neuroscience. My laboratory is currently developing analytical and numerical algorithms in applied systems analysis and information theory. We use these tools to estimate the response properties, the reliability and the redundancy of high-level sensory neurons.

Auditory and Vocal Behavior. My laboratory is also interested in perceptual acoustical behavior in humans (speech and music perception), birds (female choice based on song, song discrimination) and, in collaboration with other research groups, in hyenas and other primates.

Publications.

Peer Reviewed Research Articles (in reverse chronological order)

1. Amin NA, Gill PR, **Theunissen FE**. Role of the zebra finch auditory thalamus in generating complex representations for natural sounds. *J. Neurophys.* 104(2):784-79. 2010.
2. Mathevon, N., Koralek A, Weldele M, Glickman SE, **Theunissen FE**. What the hyena's laugh tells: Sex, age, dominance and individual signature in the giggling call of *Crocuta crocuta*. *BMC Ecology*. 10(1): p. 9. 2010
3. Gastpar MC, Gill PR, Huth AG, and Theunissen FE. Anthropoc correction of information estimates and its application to neural coding. *IEEE Trans of Information Theory*. 56(2):890-900 2010
4. Woolley SM, Hauber ME, Theunissen FE. Developmental experience alters information coding in auditory midbrain and forebrain neurons. *Dev Neurobiol*. 70(4):235-52. 2010
5. Elliott TM and **Theunissen FE**. The modulation transfer function for speech intelligibility. *PLoS Comput Biol*. 3:e1000302. PMID: 19266016. 2009
6. Woolley SM, Gill PR, Fremouw T, **Theunissen FE**. Functional groups in the avian auditory system. *J Neurosci*. 29(9):2780-93. PMID: 19261874. 2009
7. Boumans T, Gobes SM, Poirier C, Theunissen FE, Vandersmissen L, Pintjens W, Verhoye M, Bolhuis JJ, Van der Linden A. Functional MRI of Auditory Responses in the Zebra Finch Forebrain Reveals a Hierarchical Organisation Based on Signal Strength but Not Selectivity. *PLoS ONE*. 3(9): e3184. PMID: 18781203 2008
8. Gill P, Woolley SM, Fremouw T, **Theunissen FE**. What's That Sound? Auditory Area CLM Encodes Stimulus Surprise, Not Intensity or Intensity Changes. *J Neurophysiol*. 99(6):2809-20 PMID: 18287545. 2008
9. Boumans T, **Theunissen FE**, Poirier C, Van Der Linden A. Neural representation of spectral and temporal features of song in the auditory forebrain of zebra finches as revealed by functional MRI. *Eur J Neurosci*. 26(9):2613-26. PMID: 17970728. 2007
10. Hauber ME, Woolley SMN, **Theunissen FE**. Experience-dependence of neural responses to social versus isolate conspecific songs in the forebrain of female Zebra Finches. *Journal of Ornithology*. 148 (Suppl 2):S231–S239. 2007
11. Shaevitz SS, **Theunissen FE**. Functional connectivity between auditory areas field L and CLM and song system nucleus HVC in anesthetized zebra finches. *J Neurophysiol*. 98(5):2747-64. PMID: 17898149. 2007
12. Hauber ME, Cassey P, Woolley SM, **Theunissen FE**. Neurophysiological response selectivity for conspecific songs over synthetic sounds in the auditory forebrain of non-singing female songbirds. *J Comp Physiol A*. 193(7):765-74. 2007
13. Amin N, Doupe AJ, **Theunissen FE**. Development of Selectivity for Natural Sounds in the Songbird Auditory Forebrain. *J Neurophysiol*. 97(5):3517-31. PMID: 17360830. 2007
14. Cohen Y, Theunissen FE, Russ BE, Gill P. The acoustic features of rhesus vocalizations and their representation in the ventrolateral prefrontal cortex. *J Neurophysiol*. 97(2):1470-84. PMID: 17135477. 2007

15. Gill PR, Zhang J, Woolley SMN, Fremouw T and **Theunissen FE**. Sound Representation Methods for Spectro-Temporal Receptive Field Estimation. *J. Computational Neuroscience*. **21**(1):5–20. PMID: 16633939. 2006
16. Woolley SMN, Gill PR, and **Theunissen FE**. Stimulus-Dependent Auditory Tuning Results in Synchronous Population Coding of Vocalizations in the Songbird Midbrain. *J. Neuroscience*. **26**(9):2499-512. PMID: 16510728. 2006
17. Woolley S, Fremouw T, Hsu A and **Theunissen FE**. Tuning for Spectro-temporal Modulations: a Mechanism for Auditory Discrimination of Natural Sounds. *Nature Neuroscience*. **8**(10):1371-9. PMID: 16136039. 2005
18. Hsu A, Woolley S, Fremouw T and **Theunissen FE**. Modulation and phase spectrum of natural sounds enhance neural discrimination performed by single auditory neurons. *J. Neuroscience* **24**(41): 9201-21. PMID: 15483139. 2004
19. Amin N, Grace GA, and **Theunissen FE**. Neural Response to Bird's Own Song and Tutor Song in the Zebra Finch Field L and Caudal Mesopallium. *J. Comp. Physiology A* **190**: 469-489. 2004.
20. Hsu A, Borst A and **Theunissen FE**. Quantifying variability in neural responses and its application for the validation of model predictions. *Network: Comp. Neural Syst* **15**(2):91-109. PMID: 15214701. 2004.
21. Singh N and **Theunissen FE**. Modulation spectra of natural sounds and ethological theories of auditory processing. *JASA* 114:3394-3411. PMID: 14714819. 2003
22. Kimpo RR, Theunissen FE, and Doupe AJ. Propagation of correlated activity through multiple stages of a neural circuit. *J. Neuroscience* 13:5750-61, 2003.
23. Grace JA, Amin NA, Singh NC, **Theunissen FE**. Selectivity for Conspecific Song in the Zebra Finch Auditory Forebrain. *J. Neurophys.* **89** 472-487, 2003
24. **Theunissen FE**, David SV, Singh NC, Hsu A, Vinje WE and Gallant JL. Estimating spatio-temporal receptive fields of auditory and visual neurons from their responses to natural stimuli. *Network: Comp. Neural Syst.***12** 289-316, PMID: 11563531 2001
25. Sen K, Theunissen FE, Doupe AJ. Feature analysis of natural sounds in the songbird auditory forebrain. *J. Neurophys.* **86** 1445-1459, 2001
26. **Theunissen FE**, Sen K and Doupe AJ. Spectral-temporal receptive fields of nonlinear auditory neurons obtained using natural sounds. *J. Neuroscience*, **20**(6):2315-2331, 2000
27. Jacobs GA and Theunissen FE. Extraction of Sensory Parameters from a Neural Map by Primary Sensory Interneurons. *J. Neuroscience* **20**(7): 2934-2943, 2000
28. **Theunissen FE** and Doupe AJ. Temporal and spectral sensitivity of complex auditory neurons in nucleus HVc of male zebra finches. *J. Neuroscience* **18**(10):3786-3802. 1998
29. Haag J, Theunissen FE and Borst A. The intrinsic electrophysiological characteristics of fly lobula plate tangential cells. II Active membrane properties. *J. Computational Neuroscience*. **4**(4), 1997.
30. Clague HW, Theunissen FE and Miller JP. The effects of adaptation on neural coding by primary sensory interneurons in the cricket cercal system. *J. Neurophys.* **77**:207-220, 1997
31. Jacobs GA and Theunissen FE. Functional organization of a neural map in the cricket cercal sensory system. *J. Neuroscience* **16**(2):769-784, 1996.

32. **Theunissen FE**, Roddey JC, Stufflebeam S, Clague H and Miller JP. Information theoretic analysis of dynamical encoding by four identified primary sensory interneurons in the cricket cercal system. *J. Neurophys.* **75**(4): 1345-1364, 1996
33. **Theunissen FE** and Miller JP. Temporal encoding in nervous systems: a rigorous definition. *J. Computational Neuroscience.* **2**:149-162, 1995.
34. **Theunissen FE** and Miller JP. Representation of sensory information in the cricket cercal sensory system. II. Information theoretic calculation of system accuracy and optimal tuning curve width of four primary interneurons. *J Neurophys.* **66**(5):1690-1703, 1991
35. Miller JP, Jacobs GA and Theunissen FE. Representation of sensory information in the cricket cercal sensory system. I. Response properties of the primary interneurons. *J Neurophys.* **66**(5):1680-1689, 1991.

Book chapters

1. **Elliott T and Theunissen FE**. The Avian Auditory Pallium in *Auditory Cortex*. J. Winer and C. Schreiner Eds. Springer-Verlag. 2011.
2. **Theunissen FE**, Amin S, Shaevitz S, Woolley SMN, Fremouw T and Hauber M. Song selectivity and the songbird brain. In *Neuroscience of Birdsong*. Philip Zeigler P and Marler P Eds. Cambridge University Press. 2008
3. **Theunissen FE**, Amin S, Shaevitz S, Woolley SMN, Fremouw T and Hauber M. Song selectivity in the song system and in the auditory forebrain. In *Behavioral Neurobiology of Birdsong* .Editor P. Zeigler and P. Marler. *Ann NY Acad Sci.* **1016**: 222-245. 2004
4. **Theunissen FE**, Woolley SMN, Hsu A and Fremouw T. Methods for the analysis of auditory processing in the brain. In *Behavioral Neurobiology of Birdsong* . Editor P. Zeigler and P. Marler. *Ann NY Acad Sci.* **1016**: 187-207 2004.
5. **Theunissen FE**, Eeckman FH and Miller JP. A modified Hodgkin and Huxley spiking model with continuous spiking output. In *Computation and Neural Systems*. Editor Frank Eeckman. Kluwer Academic Publishers. 1993
6. **Theunissen FE**, Eeckman FH and Miller JP. Linearization by noise and/or additional shunting current of a modified FitzHugh Nagumo spiking model. In *Neural Systems: Analysis and Modeling*. Editor F. Eeckman. Kluwer Academic Publishers 1992.
7. Eeckman FH, Theunissen FE, and Miller JP. NeMoSys: An approach to Realistic Neural Simulation. In *Neural Systems: Analysis and Modeling*. Editor F. Eeckman. Kluwer Academic Publishers 1992.

Peer-reviewed review articles or commentaries

1. **Theunissen FE** and Shaevitz S. Auditory processing of vocal sounds in birds. *Curr Opin Neurobiol.* **16**(4):400-7. 2006
2. **Theunissen FE**. Use it or loose it. Focus on:"Sequential learning from multiple tutors and serial retuning of auditory neurons in a brain area important to birdsong learning". *J. Neurophys.* **92**(5):2642-3. 2004
3. **Theunissen FE**. From synchrony to sparseness. *Trends Neurosci* **26** 61-64, 2003

4. Borst A and Theunissen FE. Information theory and neural coding. *Nature Neuroscience*. **2**(11):947-957, 1999

Software

1. Zhang J, Gill, P. Gallant J and Theunissen FE. STRFPAK (Version 5.3). Software for estimating Spatio-Temporal Receptive Fields of sensory neurons. University of California, Berkeley. Copyright 2003-09. Available at Strfpak.berkeley.edu
2. Theunissen FE, Tromp J, Eeckman FH, Miller JP. NeMoSys (Version 5.3). A Neuro-Modeling-System. University of California, Berkeley. Copyright. 1992.

Bold: first (or second and equal contribution) or corresponding author