

Petr Janata

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Degrees

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|------|---|
| 1996 | Ph.D. University of Oregon, Biology (Neuroscience) |
| 1990 | B.A. Reed College, Interdisciplinary (Biology/Psychology) |

Professional experience

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| 7/13 – present | Professor. Department of Psychology and Center for Mind and Brain, University of California, Davis. Davis, California. |
| 7/08 – 6/13 | Associate Professor. Department of Psychology and Center for Mind and Brain, University of California, Davis. Davis, California. |
| 7/04 – 6/08 | Assistant Professor. Department of Psychology and Center for Mind and Brain, University of California, Davis. Davis, California. |
| 7/00 – 6/04 | Research Assistant Professor. Dept. of Psychological and Brain Sciences, Dartmouth College. Hanover, New Hampshire. |
| 9/00 – 12/00 | Visiting Assistant Professor. Dept. of Psychological and Brain Sciences, Dartmouth College. Hanover, New Hampshire. |
| 1/00 – 6/00 | Research Associate. Dept. of Psychological and Brain Sciences, Dartmouth College. Hanover, New Hampshire. |
| 1/99 – 1/00 | Consultant. Electrical Geodesics, Inc., Eugene, Oregon. |
| 1/97 – 11/99 | Post-doctoral research fellow. Dept. of Organismal Biology and Anatomy. University of Chicago. Chicago, Illinois. |
| 9/96 – 1/97 | Visiting Assistant Professor. Biology Department. Reed College. Portland, Oregon. |
| 7/92 – 9/96 | Graduate research assistant. Institute of Neuroscience, University of Oregon. Eugene, Oregon. |
| 9/91 – 6/92 | Graduate teaching fellow. Dept. of Biology, University of Oregon. Eugene, Oregon. |
| 9/90 – 6/91 | Fulbright Fellow. Institut für Neurophysiologie. University of Vienna, Austria. |

Awards and honors

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| 11/15 | National Academies Keck Futures Initiative (NAKFI) participant. Irvine, CA. |
| 2015 – 2016 | Institute for Social Sciences Fellow. UC Davis. |
| 09/12 | Visiting fellow. Max Planck Institute for Human Development. Berlin, Germany. |

- 2010 Music Has Power Award, Institute of Music and Neurological Function
- 2010 Guggenheim Fellow
- 2010 – 2011 Fulbright Fellow, Prague, Czech Republic
- 9/03 – 10/03 Visiting fellow. Max Planck Institute for Cognitive Neuroscience. Leipzig, Germany.
- 1996 Co-recipient of Ed Arbas Memorial Award for best graduate student paper presented at Western Nerve Net, Eugene, Oregon.
- 1994 McDonnell Summer Institute in Cognitive Neuroscience Fellow
- 1990 – 1991 Fulbright Fellowship to University of Vienna, Vienna, Austria
- 6/89 – 8/89 Coleman Wheeler Fellow. R. S. Dow Neurological Sciences Institute, Good Samaritan Hospital & Medical Center, Portland, Oregon.
- 11/87 – 3/88 DAAD Scholarship. Univ. der Bundeswehr, Munich, Germany.
- 8/87 – 10/87 IAESTE Scholarship. German Cancer Research Institute, Heidelberg, Germany.

Grants

- 2016 – 2018 National Academies Keck Futures Initiative (NAKFI). “Fostering Empathy and Improving Focus Through the Groove Enhancement Machine: Facilitating Sensorimotor Coordination and Cooperation Among Groups of Individuals.” 2 years, \$100,000. PI: Petr Janata
- 2015 – 2017 UC Davis Institute of Social Sciences Interdisciplinary Research Seed Funding Grant. “Music-Evoked Remembering in the Age of Big Data.” 2 years, \$20,000. PI: Petr Janata
- 2015 – 2016 UC President’s Research Catalyst Award. “The University of California Music Experience Research Community Initiative (UC MERCI).” 2 years, \$300,000. PI: Scott Makeig. Role: co-PI
- 2014 – 2015 GRAMMY Foundation. “Music-Evoked Autobiographical Remembering.” 1.5 years, \$20,000. PI: Petr Janata
- 2010 – 2013 NSF Award #1025310. “Modeling Tonal Structure in Music: From Theory to Behavior and Brain Function.” 3 years, \$250,000. PI: Petr Janata
- 2010 Summer Salary Research Grant. UC Davis. “Development of the Musical Engagement Style Survey (MESS).” 2 weeks, \$4,000. PI: Petr Janata
- 2010 Coro Health, LLC. "Evaluation of the effects of personalized music programming on the wellbeing of residents in assisted living and memory care facilities", 6 months, \$38,058. PI: Petr Janata
- 2006 – 2009 Templeton Advanced Research Program. Metanexus Institute. “Music, spirituality, religion, and the human brain.” 3 years, \$998,130. PI: Petr Janata
- 2002 – 2005 NIH Award. R03 DC05146-01. “Mechanisms of sensory/cognitive interactions in audition.” 3 years. \$150,000 direct costs. PI: Petr Janata.
- 1997 – 1999 National Research Service Award (NRSA) # F32 NS10395 from the National Institutes of Health. Title: "Neurophysiology of song learning in awake behaving birds."

Service

External Boards and Committees

- 2011 – 2013 Executive Board, Member-at-large. Society for Music Perception and Cognition
2017 – present
- 2010 – present Medical Advisory Board. Coro Health, LLC.
- 2003 – 2007 Scientific Advisory Board. Accentus, LLC.

Editorial

Editorial Board Member

Brain Research – Reviewing Editor (2006-2007)

Ad-hoc Reviewer

Journal of Cognitive Neuroscience, Journal of the Acoustical Society of America, Behavioral and Brain Sciences, Music Perception, Psychophysiology, Cognitive Brain Research, PNAS, NeuroImage, Psychological Review, Science, Nature Neuroscience, Biological Psychology, MIT Press, Neuropsychologia, Journal of Neuroscience Methods, Brain, Nature, Journal of Experimental Psychology: Human Perception and Performance, APA Books, National Science Foundation, Perception and Psychophysics, Dana Press, Cortex, International Journal of Psychophysiology, Trends in Cognitive Sciences, Quarterly Journal of Experimental Psychology, BioMedCentral, Cerebral Cortex, UK Economic and Social Research Council, European Journal of Neuroscience, Journal of Neurophysiology, Human Brain Mapping, Memory & Cognition, Cognition, Journal of Neuroscience, Hearing Research, Perception, Emotion, Frontiers in Neuroscience, Brain Topography, Cognitive Processing, Agence Nationale de la Recherche, Biological Psychiatry, Psychiatric Research: Neuroimaging, Music Theory Spectrum, Social Cognitive and Affective Neuroscience, Cognitive Science, Psychonomic Bulletin & Review, Oxford University Press, Psychology of Music, Social Sciences and Humanities Research Council of Canada, Natural Sciences and Engineering Research Council of Canada, Cognitive Psychology, Psychological Methods, Psychology and Aging, Brain and Cognition, Music and Medicine, Aging, Neuropsychology and Cognition, Multivariate Behavioral Research, Sinauer and Associates, John Templeton Foundation, Australian National Health and Medical Research Council, PLOS One, Psychomusicology: Music, Mind and Brain, Current Biology, Journal of Experimental Psychology: General, Empirical Studies of the Arts, Neuropsychological Rehabilitation, Philosophical Transactions B, Cambridge University Press, Cognition and Emotion, Musicae Scientiae, Topics in Cognitive Science, Nature Communications, Journal of Geriatric Psychiatry and Neurology, Journal of Alzheimer's Disease

Professional affiliations (past and present)

Society for Neuroscience, Cognitive Neuroscience Society, Society for Music Perception and Cognition, Acoustical Society of America, American Psychological Association

Research Articles

- Janata, P.**, Peterson, J., Ngan, C., Keum, B., Whiteside, H., & Ran, S. (in press). Psychological and musical factors underlying engagement with unfamiliar music. *Music Perception*.
- Kubit, B., & **Janata, P.** (in press). Listening for memories: attentional focus dissociates functional brain networks engaged by memory-evoking music. *Psychomusicology: Music, Mind, and Brain*. doi:http://dx.doi.org/10.1037/pmu0000210
- Hurley, B. K., Fink, L. K., & **Janata, P.** (in press). Mapping the dynamic allocation of temporal attention in musical patterns. *Journal of Experimental Psychology: Human Perception and Performance*. doi:http://dx.doi.org/10.1037/xhp0000563
- Barrett, F. S., Preller, K. H., Herdener, M., **Janata, P.**, & Vollenweider, F. X. (2017). Serotonin 2A Receptor Signaling Underlies LSD-induced Alteration of the Neural Response to Dynamic Changes in Music. *Cerebral Cortex*, 1-12. doi:10.1093/cercor/bhx257
- Barrett, F.S., & **Janata P.** (2016). Neural responses to nostalgia-evoking music modeled by elements of dynamic musical structure and individual differences in affective traits. *Neuropsychologia* 91:234-246.
- Stupacher, J., M. J. Hove & **Janata, P.** (2016). Audio features underlying perceived groove and sensorimotor synchronization in music. *Music Perception*. 33(5): 571–589.
- Lee, Y.-S., **Janata, P.**, Frost, C., Martinez, Z., & Granger, R. (2015). Melody recognition revisited: influence of melodic Gestalt on the encoding of relational pitch information. *Psychonomic Bulletin & Review*, 22(1), 163-169.
- Hurley, B.K., Martens, P. A., & **Janata, P.** (2014). Spontaneous sensorimotor coupling with multipart music. *Journal of Experimental Psychology: Human Perception and Performance*. 40(4), 1679-1696.
- Fairhurst, M. T., **Janata, P.**, & Keller, P. E. (2014). Leading the follower: An fMRI investigation of dynamic cooperativity and leader-follower strategies in synchronization with an adaptive virtual partner. *Neuroimage*, 84, 688-697.
- Collins, T., Tillmann, B., Barrett, F. S., Delbé, C., & **Janata, P.** (2014). A combined model of sensory and cognitive representations underlying tonal expectations in music: From audio signals to behavior. *Psychological Review*, 121(1), 33-65.
- Barrett, F. S., Robins, R. W., & **Janata, P.** (2013). A Brief Form of the Affective Neuroscience Personality Scales. *Psychological Assessment*, 25(3), 826-843. doi: 10.1037/a0032576
- Fairhurst, M. T., **P. Janata** and P. E. Keller (2013). "Being and Feeling in Sync with an Adaptive Virtual Partner: Brain Mechanisms Underlying Dynamic Cooperativity." *Cerebral Cortex* 23(11): 2592-2600.
- Janata, P.**, & Edwards, W. H. (2013). A Novel Sonification Strategy for Auditory Display of Heart Rate and Oxygen Saturation Changes in Clinical Settings. *Human Factors: The Journal of the Human Factors and Ergonomics Society*, 55(2), 356-372. doi: 10.1177/0018720812455433
- Golubock, J. L., & **Janata, P.** (2013). Keeping timbre in mind: Working memory for complex sounds that can't be verbalized. *Journal of Experimental Psychology: Human Perception and Performance*, 39(2), 399-412.
- Janata, P.** (2012). The effects of widespread and frequent personalized music programming on agitation and depression in assisted living facility residents with Alzheimer type dementia. *Music and Medicine*. 4(1), 8–15.

- Janata, P.**, Tomic, S. T., & Haberman, J. M. (2012). Sensorimotor coupling in music and the psychology of the groove. *Journal of Experimental Psychology: General*, *141*(1), 54–75. doi: 10.1037/a0024208
- Johnson, J. K., Chang, C. C., Brambati, S. M., Migliaccio, R., Gorno-Tempini, M. L., Miller, B. L., **Janata, P.** (2011). Music recognition in frontotemporal lobar degeneration and Alzheimer disease. *Cognitive and Behavioral Neurology*, *24*(2), 85–92.
- Lee, Y.-S., **Janata, P.**, Frost, C., Hanke, M., & Granger, R. (2011). Investigation of melodic contour processing in the brain using multivariate pattern-based fMRI. [doi: 10.1016/j.neuroimage.2011.02.006]. *Neuroimage*, *57*(1), 293-300.
- Navarro Cebrian, A., & **Janata, P.** (2010). Electrophysiological correlates of accurate mental image formation in auditory perception and imagery tasks. *Brain Research*, *1342*, 39-54.
- Barrett, F. S., Grimm, K. J., Robins, R. W., Wildschut, T., Sedikides, C., & **Janata, P.** (2010). Music-evoked nostalgia: Affect, memory, and personality. *Emotion*, *10*(3), 390-403.
- Navarro Cebrian, A., & **Janata, P.** (2010). Influences of multiple memory systems on auditory mental image acuity. *Journal of the Acoustical Society of America*, *127*(5), 3189-3202.
- Janata, P.** (2009). The neural architecture of music-evoked autobiographical memories. *Cerebral Cortex*. *19*, 2579-2594.
- Tomic, S. T., & **Janata, P.** (2008). Beyond the beat: modeling metric structure in music and performance. *Journal of the Acoustical Society of America*. *124*(6): 4024–4041.
- Tillmann, B., **Janata, P.**, Birk, J. L., & Bharucha, J. J. (2008). Tonal centers and expectancy: facilitation or inhibition of chords at the top of the harmonic hierarchy? *Journal of Experimental Psychology: Human Perception and Performance*. *34*(4): 1031-1043.
- Janata, P.**, Tomic, S. T., & Rakowski, S. K. (2007). Characterization of music-evoked autobiographical memories. *Memory*, *15*(8), 845–860.
- Tomic, S. T., & **Janata, P.** (2007). Ensemble: A web-based system for psychology survey and experiment management. *Behavior Research Methods*, *39*(3), 635–650.
- Janata, P.**, & Paroo, K. (2006). Acuity of auditory images in pitch and time. *Perception & Psychophysics*. *68*(5): 829–844.
- Handy, T.C., Miller, M.B., Schott, B., Shroff, N.M., **Janata, P.**, Van Horn, J. D., Inati, S., Grafton, S.T., & Gazzaniga, M.S. (2004). Visual imagery and memory: Do retrieval strategies affect what the mind's eye sees? *European Journal of Cognitive Psychology*. *16*(5): 631–652.
- Moran, J. M., Wig, G. S., Adams, R. B., **Janata, P.**, & Kelley, W. M. (2004). Neural correlates of humor detection and appreciation. *Neuroimage*, *21*, 1055–1060.
- Janata, P.**, & Grafton, S. T. (2003). Swinging in the brain: shared neural substrates for behaviors related to sequencing and music. *Nature Neuroscience*, *6*(7), 682-687.
- Tillmann, B., **Janata, P.**, Birk, J., & Bharucha, J. J. (2003). The costs and benefits of tonal centers for chord processing. *Journal of Experimental Psychology: Human Perception and Performance*, *29*(2), 470-482.
- Janata, P.**, Birk, J. L., Tillmann, B., & Bharucha, J. J. (2003). Online detection of tonal pop-out in modulating contexts. *Music Perception*, *20*(3), 283-305.
- Tillmann, B., **Janata, P.**, & Bharucha, J. J. (2003). Activation of the inferior frontal cortex in musical priming. *Cognitive Brain Research*, *16*, 145-161.

- Janata, P.**, Birk, J. L., Van Horn, J.D., Leman, M., Tillmann, B., & Bharucha, J. J. (2002). The cortical topography of tonal structures underlying Western music. *Science*. 298:2167–2170.
- Janata, P.**, Tillmann, B., and Bharucha, J. J. (2002). Listening to polyphonic music recruits domain-general attention and working memory circuits. *Cognitive, Affective, and Behavioral Neuroscience*. 2(2). 121–140.
- Adams, R. B., & **Janata, P.** (2002). A comparison of neural circuits underlying auditory and visual object categorization. *NeuroImage*, 16, 361-377.
- Janata, P.** (2001b). Quantitative assessment of vocal development in the zebra finch using self-organizing neural networks. *Journal of the Acoustical Society of America*. 110(5): 2593-2603.
- Kikas, T., **Janata, P.**, Ishida, H., and Janata, J. (2001). Chemical plume tracking. 2. Multiple-frequency modulation. *Analytical Chemistry* 73(15), 3669 -3673.
- Janata, P.** (2001a) Brain electrical activity evoked by mental formation of auditory expectations and images. *Brain Topography*. 13(3): 169-193.
- Janata, P.** & Margoliash, D. (1999) Gradual emergence of song-selectivity in sensorimotor structures of the male zebra finch song-system. *Journal of Neuroscience* 19(12): 5108-5118.
- Janata, P.** (1995) ERP measures assay the degree of expectancy violation of harmonic contexts in music. *Journal of Cognitive Neuroscience* 7(2): 153-164.
- Janata, P.** & Petsche, H. (1993) Spectral analysis of the EEG as a tool for evaluating expectancy violations of musical contexts. *Music Perception* 10: 281-304.
- Potje-Kamloth, K.; **Janata, P.**; Janata, J.; Josowicz, M. Electrochemical encapsulation for sensors. (1989) *Sensors and Actuators*. 18:613-623.
- Janata, P.** & Reisberg, D. (1988) Response-time measures as a means of exploring tonal hierarchies. *Music Perception*. 6(2): 163-174.

Book chapters

- Janata, P.** (2015). Neural basis of music perception. In G. Celesia & G. Hickok (Eds.), *Human Auditory System* (Vol. 129): Elsevier.
- Janata, P.** (2014) The cognitive neuroscience of music. In: Oxford Handbook of Cognitive Neuroscience. New York: Oxford University Press.
- Janata, P.**, & Parsons, L. (2013). Neural mechanisms of music, singing and dancing. In M. A. Arbib (Ed.), *Language, Music, and the Brain: A Mysterious Relationship* (Vol. 10). Cambridge, MA: MIT Press.
- Janata, P.** (2012). Acuity of mental representations of pitch. *Annals of the New York Academy of Sciences*, 1252(1), 214-221. doi: 10.1111/j.1749-6632.2011.06441.x
- Janata, P.** (2009). Music and the Self. In R. Haas & V. Brandes (Eds.), *Music That Works*. Wien: Springer.
- Janata, P.** (2007). Navigating tonal space. In E. Selfridge-Field (Ed.), *Tonal Theory for the Digital Age* (Computing in Musicology: Vol. 15, pp. 39–50).
- Janata, P.** (2005). Brain networks that track musical structure. *Annals of the New York Academy of Sciences*, 1060(1), 111-124.
- Tillmann, B., **Janata, P.**, & Bharucha, J. J. (2003). Activation of the inferior frontal cortex in musical priming. In *Neurosciences and Music* (Vol. 999, pp. 209-211).

Janata, P. (2001c). Neurophysiological mechanisms underlying auditory image formation in music. In R. I. Godøy & H. Jørgensen (Eds.), *Elements of Musical Imagery*. Lisse: Swets & Zeitlinger Publishers. pp. 27-42.

Book reviews, commentaries, and opinion pieces

Janata, P. (2009). Music and the personal journey. *Wake County Physician*, 14(4), 34.

Janata, P. (2009). An entrancing tale of cross-disciplinary bridge building and burning in ethnopsychophysiomusicology. *Empirical Musicology Review*, 4(2), 78–81.

Keller, P. E., & **Janata, P.** (2009). Marc Leman, Embodied Music Cognition and Mediation Technology. *Music Perception*, 26(3), 289–292.

Janata, P. (2007). When music stops making sense: Lessons from an injured brain [Electronic Version]. *Cerebrum: The Dana Forum on Brain Science* from <http://www.dana.org/news/cerebrum/detail.aspx?id=8964>.

Janata, P. (2007). "The highs and lows of being tone deaf." *Nature Neuroscience* 10(7): 810–812.

Janata, P. (2006). Commentary on "The Processing of Pitch and Scale: An ERP Study of Musicians Trained Outside of the Western Musical System" by Bischoff Renninger, Wilson, and Donchin. *Empirical Musicology Review*, 1(4), 198–200.

Janata, P. (2006). Sweet anticipation: Music and the psychology of expectation. *Nature*, 443(7107), 29-30.

Janata, P. (2004). When music tells a story. *Nat Neurosci*, 7(3), 203-204.

Janata, P. (2003). Jazzing up neuroscience. Review of *The Cognitive Neuroscience of Music*, eds. I. Peretz & R. Zatorre. *Nature*. 426:386.

Refereed conference proceedings

Janata, P. & Childs, E. (2004). MarketBuzz: sonification of real-time financial data. Proceedings of ICAD 04-Tenth Meeting of the International Conference on Auditory Display.

Potje-Kamloth, K.; **Janata, P.**; Josowicz, M. (1989) Carbon fiber microelectrodes. Proceedings of ElectroFinnAnalysis Conference. Plenum Press.

Conference Abstracts

Fink, L.K.; Hurley, B.K.; Geng, J.J.; Janata, P. (2017) Predicting temporal attention and pupillary responses to auditory rhythms using a linear oscillator model. European Conference on Eye Movements. Wuppertal, Germany.

Hurley, B.K.; Fink, L.K.; Janata, P. (2017) A resonator model predicts temporal orienting in rhythmic music. Soc. Cognitive Neuroscience Abstracts. San Francisco, CA.

Hurley, B.K.; Fink, L.K.; Janata, P. (2016) Predicting temporal attention in music with a damped oscillator model. International Conference on Music Perception and Cognition. San Francisco, CA.

Fink, L.; Hurley, B.; Geng, J.; Janata, P. (2016) Pupillary responses to auditory stimuli index attention and sensorimotor coupling. International Conference on Music Perception and Cognition. San Francisco, CA.

Janata, P. & Rothfuss, M. (2015) Differences in music-evoked and traditionally cued autobiographical memories across the lifespan. Alpine Brain Imaging Meeting. Champéry, Switzerland.

- Rector, J.; Leitman, D.; Janata, P. (2015) Perception of emotion in frequency-modulated tones. Society for Music Perception and Cognition. Nashville, TN.
- Hurley, B.K. & Janata, P. (2015) Temporal attention in multipart music. Society for Music Perception and Cognition. Nashville, TN.
- Janata, P. & Rothfuss, M. (2015) Differences in music-evoked and traditionally cued autobiographical memories across the lifespan. Society for Music Perception and Cognition. Nashville, TN.
- Kubit, B. & Janata, P. (2015) Attentional focus dissociates functional brain networks engaged by music-evoked autobiographical memories. Soc. Cognitive Neuroscience Abstracts
- Janata, P. & Kubit, B. (2015). Attentional focus dissociates functional brain networks engaged by memory-evoking music. Alpine Brain Imaging Meeting. Champéry, Switzerland.
- Kolarik, B.; Janata, P.; Ekstrom, A. (2014). Investigating remote memory for context using virtual reality. Interdisciplinary Graduate and Professional Student Symposium. University of California, Davis.
- Barrett, F.S. & Janata, P. (2014). We respond emotionally to music that we like. *Inaugural Meeting of the Society for Affective Science*, Bethesda, MD.
- Lee, Y.S., Janata, P., Frost, C., Martinez, Z., Hull, J., & Granger, R. (2013) Melody recognition revisited: Influence of Melodic Gestalt on the encoding of relational pitch information. Society for Neuroscience, San Diego, CA.
- Janata, P. & Peterson, J. (2013). On the determinants of listening time for novel musical excerpts. Society for Music Perception and Cognition. Toronto, CA.
- Hurley, B.K. & Janata, P. (2013). Spontaneous Sensorimotor Coupling and the Musical Auditory Scene. Society for Music Perception and Cognition. Toronto, CA.
- Janata, P.; Bolgar, J.; Rosen, B.; Leitman, D. (2013) Sounds of sadness, sounds of joy: abstracting emotions from frequency modulated tones. Alpine Brain Imaging Meeting. Champéry, Switzerland.
- Collins, T. & Janata, P. (2012). Categorizing tonal representations of audio to model high-level music cognition. Digital Music Research Network (DMRN+7). Queen Mary University of London, UK.
- Collins, T.; Tillmann, B.; Delbe, C.; Barrett, F.S.; Janata, P. (2012) "Modeling reaction times in tonal priming experiments" ICMPC-ESCOM 2-2012.
- Fairhurst, M.T.; Janata, P.; Keller, P.E. (2012) Leaders and followers: an fMRI study of dynamic cooperation with an adaptive virtual partner. Organization for Human Brain Mapping.
- Janata, P.; Barrett, F.S. (2012) Analysis of dynamic musical experiences on multiple timescales. Alpine Brain Imaging Meeting, Champéry, Switzerland.
- Lee, Y-S.; Janata, P.; Frost, C.; Hanke, M.; Granger, R. (2011) Investigation of melodic contour processing in the brain using multivariate pattern-based fMRI. Soc. Cognitive Neuroscience Abstracts.
- Fairhurst, M.T.; Stelzer, J.; Janata, P.; Repp, B.H.; Keller, P.E. (2011) Exploring agency and self-other processing: an fMRI study of dynamic cooperation using an adaptively paced finger tapping task with variable auditory feedback. Neurosciences and Music IV, Edinburgh, United Kingdom.
- Janata, P. (2011) A comparison of functional brain networks during rest and musical target detection. Alpine Brain Imaging Meeting (ABIM11).

- Fairhurst, M.T.; Stelzer, J.; Janata, P.; Repp, B.H.; Keller, P.E. (2010) Neural correlates of dynamic cooperativity: an fMRI investigation of synchronized finger tapping with an adaptive “virtual partner” to explore leader-follower relationships. Soc. Neurosci. Abstracts
- Fairhurst, M.T.; Janata, P.; Repp, B.H.; Stelzer, J.; Keller, P.E. (2010) fMRI investigation of dynamic cooperativity: synchronized finger tapping with an adaptive “virtual partner.” ICMPC11
- Martens, P.; Janata, P.; Tomic, S.T. (2009) Analytical and computational modeling of musical groove. Society for Music Perception and Cognition.
- Martens, P.; Tomic, S.T.; Janata, P. (2009) Aural vs. visual cues in communicating tactus. Society for Music Perception and Cognition.
- Janata, P. & Tomic, S.T. (2009) A damped oscillator model for relating the temporal structures of bimanual tapping responses and complex musical stimuli. Society for Music Perception and Cognition.
- Janata, P. (2009) Coordination of brain activity across multiple timescales by excerpts of popular music. Soc. Cognitive Neuroscience Abstracts.
- Janata, P.; Vines, B.; Tomic, S.T. (2009) Estimating perceived rhythmic complexity with symbolic and non-symbolic models. WEST Conference. Santa Barbara.
- Barrett, F.S. & Janata, P. (2009) Neural correlates of music-evoked nostalgia. Soc. Cognitive Neuroscience Abstracts.
- Barrett, F.S.; Grimm, K.J.; Wildschut, T.; Sedikides, C.; Janata, P. (2008) Music-evoked nostalgia: Affect, Memory, Personality. Bay Area Memory Meeting V.
- Vines, B.W. & Janata, P. (2008) Moving to music: the influence of familiarity, enjoyment, and groove on spontaneous dance. ICMPC10.
- Grieser, J.; Janata, P.; Koelsch, S. (2008) Can musical sounds prime semantic associations? Soc. Cognitive Neuroscience Abstracts.
- Janata, P. (2008) Following the music to the memories. Soc. Cognitive Neuroscience Abstracts.
- Grieser, J.; Koelsch, S.; Janata, P. (2007) Communicative sound: Do out-of-context musical sounds convey meaning? Evolution of Emotional Communication 2007. Hannover, Germany
- Janata, P.; Tomic, S.; Haberman, J. (2007) Getting in “the groove” while tapping. Society for Music Perception and Cognition.
- Heller, A.S.; Janata, P.; Ranganath, C. (2007) Neural correlates of learning cross-modal associations. Soc. Cognitive Neuroscience Abstracts.
- Janata, P. & Tomic, S.T. (2006) Brain networks underlying the retrieval and experience of music-evoked autobiographical memories. Soc. Neurosci. Abstracts.
- Janata, P. (2006) Identifying stable brain states with independent components analysis (ICA). Soc. Cognitive Neuroscience Abstracts.
- Janata, P. & Tomic, S. (2005) The implications of baseline correction practices in the analysis of event-related potential (ERP) topographies. Organization for Human Brain Mapping 2005 Abstracts.
- Janata, P. & Margoliash, D. (2002) Neurophysiological correlates of vocal development in the zebra finch. 16th Annual Symposium of the Center for Study of Gene Structure & Function, Hunter College.

- Janata, P.; Birk, J.L.; Van Horn, J.D.; Leman, M.; Tillmann, B. & Bharucha, J.J. (2002). Cortical loci of cognitive structures underlying western tonal music. Soc. Neurosci. Abstracts.
- Tillmann, B.; Janata, P. & Bharucha, J.J. (2002) Activation of inferior frontal cortex in musical priming. Soc. Cognitive Neuroscience Abstracts.
- Janata, P.; Tillmann, B. & Bharucha, J.J. (2002) Neural circuits underlying attentive listening to music. Soc. Cognitive Neuroscience Abstracts.
- Janata, P. & Adams, R.B. (2001) An fMRI comparison of neural circuits underlying auditory and visual object categorization. Soc. Neurosci. Abstracts.
- Janata, P.; Tillmann, B. & Bharucha, J.J. (2001) Neural circuits underlying attentive listening to music. Soc. Music Perception & Cognition.
- Bharucha, J.J.; Tillmann, B. & Janata, P. (2001) Culture and the brain: An fMRI study of the perception of music and speech by Western and Indian listeners. Soc. Music Perception & Cognition.
- Tillmann, B.; Janata, P. & Bharucha, J.J. (2001) The costs and benefits of tonal centers on chord processing. Soc. Music Perception & Cognition.
- Handy, T.C.; Schott, B.; Miller, M.B.; Janata, P.; Shroff, N.M.; Düzel, E.; Yonelinas, A.P.; Grafton, S.T. & Gazzaniga, M.S. (2001). Visuocortical activation during mental imagery varies with the source of the image in memory. Soc. Cognitive Neuroscience Abstracts.
- Janata, P.; Tillmann, B. & Bharucha, J.J. (2000) Neural circuits for auditory selective attention in complex natural scenes. Soc. Neurosci. Abstracts.
- Janata, P. (1999) Neurophysiological measures of mental images generated in musical contexts. Neural Information Processing Systems (NIPS) 13.
- Janata, P. (1999) Neurophysiological mechanisms underlying auditory image formation in music. CMI-99: VI International Conference on Systematic and Comparative Musicology. Oslo.
- Janata, P. & Margoliash, D. (1998) Song-selective auditory responses in NIf: extending the sensorimotor integration hierarchy. Soc. Neurosci. Abst., pg. 190.
- Janata, P. (1998) Polarity inversion of scalp potential topography during perceptive and imaginative processing of auditory stimuli: Activation signatures of different cortical projections? Cognitive Neuroscience Abstracts
- Janata, P. (1996) Electrophysiological imaging of imagined musical events. Soc. Cognitive Neuroscience Abstracts 3:122.
- Janata, P. & Takahashi, T.T. (1995) Neural responses to spatio-temporal pitch contexts in the barn owl. Soc. Neurosci. Abst. 21:673.
- Janata, P. & Winn, T. (1995) Event-related brain potentials in response to imagined auditory events. Soc. Music Perception & Cognition Abstr. pg. 20.
- Janata, P.; Keller, C.H.; Takahashi, T.T. (1994) Pitch coding in the barn owl's inferior colliculus: Responses to complex harmonic sounds. Soc. Neurosci. Abstr. 20:319.
- Janata, P. (1994) Differential processing of musical expectancies as assayed by measures of brain-electrical activity. Soc. Cognitive Neuroscience Abstracts 1: pg.21
- Takahashi, T.T.; Keller, C.H. & Janata, P. (1993) Resolving multiple sound sources in the owl's midbrain. Soc. Neurosci. Abst. 19:531.

Keller, C.H.; Takahashi, T.T. & Janata, P. (1993) A precedence effect in the owl's auditory space map? Soc. Neurosci. Abst. 19:531.

Invited Colloquia, Symposia, Workshops

May 2018 – Invited speaker. Music and the Brain, Stanford University, Palo Alto, CA. “Psychological mechanisms of engaged listening and spontaneous motor interaction in music.”

November 2017 – Invited speaker. LASER: Conversations in Art and Science, UC Davis, Davis, CA. “Musical neurobiographies.”

January 2017 – Invited speaker. Mind Research Network. Albuquerque, NM. “Brain mapping of music-evoked memories.”

October 2016 – Invited speaker. California Music Therapy Association. Stockton, CA. “Music, Memories, and the Brain.”

September 2016 – Invited speaker. University of Maryland. College Park, MD. “Music on the Mind: From Models to Memories.”

April 2016 – Invited speaker. Vanderbilt University. Nashville, TN. “Music, Memory, and the Brain.”

March 2016 – Invited speaker. Grand Teton Music Festival. Jackson, WY. “Music, Memories, and the Brain.”

November 2015 – Invited speaker. Max Planck Institute for Empirical Aesthetics. Frankfurt, Germany. “Understanding Aesthetic Experience: the Centrality of the Individual.”

May 2015 – Invited speaker. Implicit Being: A Colloquium on Music and the Brain. Louis Armstrong Center for Music and Medicine. Mount Sinai Beth Israel Medical Center. NYC, NY. “Psychological and Neural Aspects of ‘Being in the Groove’.”

February 2015 – Invited speaker. Association for Research in Otolaryngology (ARO) MidWinter Meeting. Baltimore, MD. “Correlates of musical structure and behavioral experience in the prefrontal cortex of *Homo sapiens*.”

January 2015 – Invited speaker. Alpine Brain Imaging Meeting. Champéry, Switzerland. “First Turns Toward the Cognitive Neuroscience of Skiing Moguls.”

November 2014 – Invited panelist. 2014 International Conference on Innovation Studies. Taipei, Taiwan.

November 2014 – Invited speaker. National Chengchi University, Taipei, Taiwan. “Music, Memories, and the Brain.”

October 2014 – Invited speaker. Spiritual Care Symposium. Mercy General Hospital, Sacramento, CA. “Music, Memories, and the Brain.”

May 2014 – Invited speaker. CHASE Summer School. UC Merced, CA. “Modeling Tonal Structure in Music and the Brain’s Experience of it.”

April 2014 – Invited speaker. University of California, Merced, CA. “Sensorimotor coupling in music and being ‘in the groove’.”

April 2014 – Invited speaker. University of Arkansas, Fayetteville, AR. “Sensorimotor coupling in music and being ‘in the groove’.”

February 2014 – Invited speaker. Music, transcendence, and spirituality. Stanford University, Palo Alto, CA. “In search of neural correlates of spiritual experiences with music.”

February 2014 – Invited speaker. Public lecture. Tahoe Environmental Research Center, Incline Village, NV. “Music, Memory, and the Brain.”

January 2014 – Invited speaker. Music Mind Meaning Conference 2014. Peabody Institute of the Johns Hopkins University. Baltimore, MD. “Mapping Music to Meaningful Memories.”

January 2014 – Invited speaker. Public Lecture. First Presbyterian Church, Savannah, GA. “Nurturing the Sense of Meaning in Life Through Music-Evoked Remembering.”

January 2014 – Invited speaker. Grand Rounds. Memorial Health University Medical Center, Savannah, GA. “Music, Memories, and the Brain”

January 2014 – Invited speaker. St. Joseph’s/Candler Hospital. Savannah, GA. “Music-Evoked Spiritual Experiences and the Brain.”

October 2013 – Invited speaker. Music, Mind and Medicine: Creativity and Consciousness in Clinical Care. Western Michigan University. Kalamazoo, MI. “Strong musical experiences and the brain.”

September 2013 – Invited participant. Fetzer Institute. Kalamazoo, MI. Workshop titled, “Spirituality: The Art of Compassionate Presence.”

May 2013 – Invited speaker. Psychology in Action. UC Los Angeles. “Music, Memories, and Your Brain.”

May 2013 – Invited speaker. Graduate seminar on “The Musical Brain.” UC San Diego. “Sensorimotor coupling in music and being ‘in the groove’.”

March 2013 – Invited speaker. Musical Rhythm Workshop. NYU Abu Dhabi, United Arab Emirates. “Sensorimotor coupling in music and being ‘in the groove’.”

February 2013 – Invited lecture. Centre for Research in Music Media and Technology (CIRMMT), McGill University, Montreal, Canada. “Music, Memories, and the Brain.”

February 2013 – Invited speaker. On Music and Brains: the Surprising Link. Jerusalem, Israel. “Relating Tonal Structure to Brain Function.”

January 2013 – Invited lecture. Cognitive Science Program. Northwestern University, Evanston, IL. “Sensorimotor coupling in music and being ‘in the groove’.”

January 2013 – Invited speaker. Alpine Brain Imaging Meeting, Champéry, Switzerland. “Sensorimotor coupling in music and being ‘in the groove’.”

November 2012 – Invited lecture. Marin Baroque. Pre-concert lecture. San Anselmo, CA. “Music, Memories, and Your Brain.”

September 2012 – Invited lecture. Max Planck Institute for Lifespan Psychology, Berlin, Germany. “Sensorimotor coupling in music and being ‘in the groove’.”

August 2012 – Invited lecture. Music, the Brain, Medicine, and Wellness : A Scientific Dialogue. Santa Fe Chamber Music Festival, Santa Fe, New Mexico. “Mapping Music to Memories.”

June 2012 – Invited lecture. Producing Time. International symposium organized by IRCAM, Paris, France. “Tonality Tracking: Coupling the Temporal Structure of Harmonic Motion in Music with Brain Activity.”

June 2012 – Invited speaker. BLUEMiND2, Nags Head, NC. Discussant on the theme of, “Where Nostalgia is Born.”

June 2012 – Invited panelist. World Science Festival, New York City, NY. “Reawakening the Brain Through Music”

April 2012 – Invited speaker. UC Berkeley Ear Club. Berkeley, CA. “On the many factors that influence mental representations of pitch.”

March 2012 – Keynote lecture. Science Festival. Universidad Sagrada Corazon, San Juan, Puerto Rico. “Music and the Brain.”

March 2012 – Invited speaker. Monte Verita Workshop on Music in Neuroscience. Ascona, Switzerland. “Mapping Music to Memories in the Human Brain.”

March 2012 – Keynote address. Growing in Faith Through the Lens of Science. First Lutheran Church, Lincoln, NE. “How the Brain Supports Strong Experiences with Music.”

January 2012 – Invited speaker. SPSP Pre-conference on Religion and Spirituality. San Diego, CA. “Neural Substrates of Strong Experiences with Music.”

December 2011 – Invited speaker. Music and Neuroscience Workshop. Google, Mountain View, CA. “Music, Probability, and the Brain.”

September 2011 – Keynote speaker. Neuroscience Program Retreat. University of Colorado Anschutz Medical Campus. “Music, Memories, and the Brain.”

June 2011 – Invited symposium speaker. The Neurosciences and Music IV. Edinburgh, Scotland. “Acuity of Mental Representations of Pitch.”

May 2011 – Invited speaker. International Music Therapy Research Conference. Wilfrid Laurier University, Waterloo, ON, Canada. “Music, the self, and the brain.”

April 2011 – Featured speaker. Music and the Brain Workshop, Rackham Graduate School, University of Michigan. “How the brain supports strong experiences with music.”

April 2011 – Invited lecture. Department of Psychology, Uppsala Universitet, Uppsala, Sweden. “Music, Memories, and the Brain.”

March 2011 – Invited seminar. Neurologická klinika 1. LF UC a VFN v Praze, Czech Republic, “Hudba, Vzpominky, a Mozek.”

November 2010 – Invited lecture. Mozart & Science 2010, Krems a.d. Donau, Austria. “Music, Memories, and the Brain.”

September 2010 – Invited lecture. Institute of Informatics, Czech Academy of Sciences, Prague, Czech Republic. “Hudba, Statistika, a Mozek.”

May 2010 – Invited lecture. Universidad de Granada, Granada, Spain. “Music, Memories, and the Brain.”

March 2010 – Invited lecture. SiCa Center for Arts, Science and Technology, Stanford University, Palo Alto, CA. “Music, Memories, and the Brain.”

February 2010 – Invited lecture. Sonoma Choral Society, Santa Rosa, CA. “Music, Memories, and the Brain.”

January 2010 – Invited lecture. Library of Congress, Washington D.C. “Music, Memories, and the Brain.”

December 2009 – OMNI. UC Davis, Davis, CA. “Music, Memory, and the Brain.”

November 2009 – Invited speaker. McMaster Institute for Music and the Mind Annual Workshop. McMaster University, Hamilton, Ontario. “Music, Memories, and the Brain.”

November 2009 – Invited speaker. Neuroscience and Music Institute. American Music Therapy Association conference. San Diego, CA. “Music, Memories, and the Brain.”

- November 2009 – Featured speaker. Healing rhythms: a research conference and workshop on music, movement and meditation. Indiana State University, Terre Haute, IN. “Music, Spirituality, and the Brain.”
- November 2009 – Colloquium speaker. Statistics Department, UC Davis, Davis, CA. “Music, Probability, and the Brain.”
- March 2009 – Invited symposium speaker. Sound & Science, UCLA, Los Angeles, CA. “Brain networks for tracking musical structure.”
- November 2008 – Invited symposium speaker. 156th Meeting of the Acoustical Society of America, Miami, FL. “Dynamics of tonality.”
- November 2008 – Invited speaker. Universite Claude Bernard Lyon I, Lyon, France. “Neuroimaging studies of music-evoked autobiographical memories and emotions.”
- October 2008 – Invited speaker. Neuroscience & Spiritual Practices: Transforming the Embodied Mind. Claremont School of Theology, Claremont, CA.
- September 2008 – Invited speaker. California Institute of Integral Studies. San Francisco, CA. “Entrainment: Music and the Brain.”
- September 2008 – Invited participant. Music: Its Evolution, Cognitive Basis, and Spiritual Dimensions. Cambridge, UK. “A theory of the neural processes underlying music-related spiritual experiences.”
- July 2008 – Invited speaker. Max Planck Institute for Human Cognitive and Brain Sciences. Leipzig, Germany. “Neuroimaging studies of music-evoked autobiographical memories and emotions.”
- July 2008 – Invited speaker. Education Through Music Annual Colloquium, Chicago, IL. “Four lectures about music and the brain.”
- June 2008 – Invited Presentation, Reed College Reunion Weekend, Portland, OR. “Music, memories, and the brain.”
- May 2008 – Invited Address. APS 20th Annual Convention, Chicago, IL. “Music-Evoked Autobiographical Memories.”
- May 2008 – Invited symposium speaker. Music and the Brain. Stanford University, Palo Alto, CA. “Neural substrates of music-evoked autobiographical memories.”
- March 2008 – Invited conversation with Moby. Rubin Museum of Art, New York, NY. “The Groove Factor.”
- March 2008 – Center for Complex Systems and Brain Sciences. Florida Atlantic University, Boca Raton, FL. “Neural Substrates of Music-Evoked Autobiographical Memories.”
- February 2008 – Invited speaker. Learning & the Brain Conference. San Francisco Airport Marriot. “Music, Memory, and Attention.”
- November 2007 – Invited event faculty/speaker. Arts on Earth/Arts and Minds. University of Michigan, Ann Arbor, MI. “Arts and the Brain.”
- October 2007 – Honors College. Arizona State University, Tempe, AZ. “Imaging music-evoked autobiographical memories.”
- June 2007 – Keynote speaker. Transdisciplinarity and the Unity of Knowledge. Metanexus Institute Conference. Philadelphia, PA. “Music, Spirituality, and the Brain”
- May 2007 – Invited symposium speaker. Music, Rhythm, and the Brain. Stanford University, Palo Alto, CA. “The challenges of quantifying musical experience.”

- April 2007 – Institute of Cognitive and Brain Science, UC Berkeley, Berkeley, CA. “Brain networks underlying the retrieval and experience of music-evoked autobiographical memories.”
- April 2007 – Center for the Study of Language and Information. Stanford University, Palo Alto, CA. “Music and autobiographical memories.”
- January 2007 – Journées fondatrices du groupe Perception Sonore. Lyon, France. “Timbre and Semantics.”
- January 2007 – Alpine Brain Imaging Meeting, Champéry, Switzerland. “Brain networks underlying the retrieval and experience of music-evoked autobiographical memories.”
- October 2006 – Invited symposium speaker. Mozart & Science. Baden, Austria. “Music and the self.”
- September 2006 – Invited symposium speaker. Music & Mind: Cognition, Composition & Performance. Univ. of British Columbia, Vancouver, Canada. “Music, autobiographical memories, and the medial prefrontal cortex.”
- September 2006 – Invited symposium speaker. Dellfest, Reed College, Portland, OR. “Music, memories, and the brain.”
- May 2006 – Department of Psychology, Univ. of Oregon, Eugene, OR. “Music, autobiographical memories, and the medial prefrontal cortex.”
- December 2005 – The Cajal Club, UC Davis, Davis, CA. “Cortical organization of music.”
- October 2005 – Department of Psychology, UC Berkeley, Berkeley, CA. “Attention, expectancy, and imagery in audition.”
- September 2005 – UC Davis Imaging Research Center Opening, Sacramento, CA. “Music and the self.”
- July 2005 – Invited symposium speaker. UC Davis Alumni College. Davis, California. “Music and Cognition.”
- May 2005 – Invited symposium speaker. Neurosciences and Music II. Leipzig, Germany. “Cortical networks that track musical structure.”
- February 2005 – Invited panelist. College Band Directors National Association biennial meeting. New York City, NY. “The neuroscience of music.”
- February 2005 – Invited symposium speaker. The Sacred Center, Berkeley, California. “How the brain experiences music.”
- January 2004 – Invited symposium speaker. Ballett Frankfurt, Frankfurt, Germany. “Why does music make us want to dance?”
- December 2003 – Department of Psychology, University of Washington, Seattle, WA. “Probing the structure of mental representations with music and neuroimaging.”
- November 2003 – Center for Mind and Brain, and Department of Psychology, UC Davis, Davis, CA. “Probing the structure of mental representations with music and neuroimaging.”
- November 2003 – Department of Biology, The City College of CUNY, New York, NY. “Probing the structure of mental representations with music and neuroimaging.”
- October 2003 – Invited symposium speaker. Vienna Symposium on Clinical Psychoacoustics and Neuroimaging. Vienna, Austria. “Cortical representations of musical contexts.”
- October 2003 – Invited symposium speaker. Innovations in Education: The Art and Science Partnership. Qatar Foundation, Doha, Qatar. “Music and Neuroscience.”

- October 2003 – Max Planck Institute for Cognitive Neuroscience, Leipzig, Germany. “Cortical representations of musical contexts.”
- June 2003 – Invited symposium speaker. Department of Psychology, Harvard University, Boston, MA. “Culture, music and the brain.”
- May 2003 – Department of Neuroscience, Georgetown University, Washington, D.C. “Probing the structure of mental representations with music and neuroimaging.”
- May 2003 – Department of Neurosciences, UC San Diego, San Diego, CA. “Probing the structure of mental representations with music and neuroimaging.”
- December 2002 – NIPS*02 Computational Neuroimaging: Foundations, Concepts & Methods. Whistler, British Columbia. "The cortical topography of tonal structures underlying Western music."
- November 2002 – Department of Psychology, Georgia Institute of Technology, Atlanta, GA. “The functional neuroanatomy of musical contexts and mental image formation.”
- March 2001 – Invited symposium speaker. Eastman School of Music, Rochester, NY. "Attention, expectancy, and mental image formation in musical contexts."
- March 2001 – Department of Cognitive Sciences, UC Irvine, Irvine, CA. "Attention, expectancy, and mental image formation in musical contexts."
- December 1999 – NIPS*99 Neural Mechanisms of Music Processing Workshop. Breckenridge, Colorado. "Neurophysiological measures of mental images generated in musical contexts."
- July 1999 – Invited symposium speaker: VII International Conference on Cognitive Neuroscience, Budapest, Hungary. "ERP measures of mental images generated in musical contexts."
- June 1999 – Session Chair. Cognitive and Neurological Bases of Musical Imagery. CMI-99: VI International Conference on Systematic and Comparative Musicology. Oslo.
- June 1997 – Department of Psychology, University of Potsdam, Potsdam, Germany. "Probing human cognition with music and measures of brain electrical activity."
- June 1997 – Invited symposium speaker: Foundations of Music Research in Brain Science, University of Ghent, Ghent, Belgium. "Understanding the activation of human cortex by auditory images: a perspective derived from recording the brain electrical activity of musicians performing musical imagery tasks."
- October 1996 – Oregon State Hospital, Salem. "Studies of brain responses to wrong chords and imagined notes."
- May 1996 – Invited symposium speaker: VI International Conference on Cognitive Neuroscience, Asilomar, California. "Electrophysiological imaging of musical imagery"
- September 1994 – Psychology Department, Reed College, Portland, Oregon. "Electrophysiological correlates of top-down and bottom-up processes in music perception."
- June 1994 – Invited symposium speaker: Herbert von Karajan Symposium, Vienna, Austria. "Probing human cognition with music and measures of brain electrical activity."
- November 1991 – Psychology Department, Reed College, Portland, Oregon. "Assaying expectancy violations in music using measures of brain electrical activity."
- February 1988 – Department of Physiology, University of Erlangen, Erlangen, Germany. "Experiences with carbon-fiber microelectrodes."

Patents

Filed provisional

U.C. Case No.: UC-2012-540-1. “Sonification systems and methods for auditory display of heart rate and oxygen saturation changes in clinical settings.”

U.C. Case No.: UC-2013-945-0. “Music-evoked autobiographical memory (MEAM) Central: A Novel Social Website.”

Granted

U.S. Patent No. 5,667,470 “Apparatus and method for using listener feedback to determine the nature of sound stimuli presented to the listener.”