

# Sylvain Le Groux

*Music, Mind, Machines*

Visiting Assistant Professor

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## Research Interests

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|--------------------|--|
| Cognitive Sciences | Music Cognition, Psychoacoustics, Psychophysiology, Emotion Research, Intelligent and Creative Systems   |
| Engineering        | Audio Signal Processing, Sound Analysis/Synthesis, Music Information Retrieval, Audio and Music Programming, Machine Learning, Human Computer Interaction, Brain Computer Interface, Affective Computing |
| Music              | Interactive Music Systems, Immersive Environments, Music Composition, Performance and Improvisation  |

## Education

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|-------------|---|
| 2007–2011   | <b>Ph.D. Cognitive and Intelligent Systems</b> , <i>Universitat Pompeu Fabra, Department of Information and Communication Technologies</i> , Barcelona, Spain, <i>Summa Cum Laude</i> .<br>Title: "Situated, Perceptual, Emotive and Cognitive Music Systems: a psychologically grounded approach to interactive music composition" |
| Summer 2008 | <b>Visiting scholar</b> , <i>Stanford University</i> , Center for Computer Research in Music and Acoustics (CCRMA), Stanford, USA.  |
| 2005–2006   | <b>M.A. Music Composition</b> , <i>Universitat Pompeu Fabra/ESMUC</i> , IDEC, Barcelona, Spain.   |
| 2004–2005   | <b>Fulbright Scholar</b> , <i>University of California at Berkeley</i> , Electrical Engineering, Computer Science & Music Departments, Berkeley, CA.  |
| 2001–2002   | <b>D.E.A. (M.S.) in Musical Acoustics, Signal processing and Computer Science</b> , <i>IRCAM/ParisTech</i> , Paris, France, Mention.  |
| 1998–2001   | <b>Double-degree Engineering/Ingenieur</b> , <i>King's College, London and ESME, Paris</i> , awarded with distinction.  |
| 1985–1995   | <b>Flute, Orchestra, Music Theory</b> , <i>Conservatoire National de Region (CNR)</i> , Nantes, France.   |

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## Professional Experience

- 09/2012–present **Visiting Assistant Professor**, *Georgia Institute of Technology*, Center for Music Technology, Atlanta, GA, USA.
- 10/2011–08/2012 **Postdoctoral Researcher, Lecturer and European Union Project Manager**, *Universitat Pompeu Fabra*, Barcelona, Spain.  
FP7 European Union project:
  - BRAINABLE : Autonomy and social inclusion through mixed reality Brain-Computer Interfaces: Connecting the disabled to their physical and social world (FP7 ICT-2009.7.2)
  - CEEDS: The Collective Experience of Empathic Data Systems (FP7 ICT-2009.8.4)
- 2004–present **Interactive Systems Consultant**, *self-employed*.  
Design and development of interactive audiovisual systems for installations and artistic performances.
- 2010 **Technology Transfer**, *Fundacion Orange and Universitat Valencia*, Valencia, Spain.  
Transferred the interactive technology I developed for my doctoral work to "the Pictogram Room", a project that uses Augmented Reality to help people with Autism Spectrum Disorders communicate.
- 2006–2011 **Researcher**, *Pompeu Fabra University*, Barcelona, Spain.  
Participation in several European Union FP7 and national research projects:
  - CEEDS: The Collective Experience of Empathic Data Systems (FP7 ICT-2009.8.4)
  - BRAINABLE : Autonomy and social inclusion through mixed reality Brain-Computer Interfaces: Connecting the disabled to their physical and social world (FP7 ICT-2009.7.2)
  - RGS: The Rehabilitation Gaming System (FP7 ICT)
  - CSN: Convergent Science Network for Biohybrid and Biomimetic Systems (FP7 ICT-2009.8.9)
  - PRESENCIA : Research Encompassing Sensory Enhancement, Neuroscience, Cerebral-Computer Interfaces and Applications (FP6 IST-2004-2.3.4)
  - Fundacio La Marato de TV3 071932
- 2004 **R&D Engineer**, *La Kitchen*, Paris, France.  
Research and development on Iannix, a real-time graphical-based multimedia system.
- 2002–2004 **Researcher**, *Universitat Pompeu Fabra*, Music Technology Group, Barcelona, Spain.  
Participation in the FP5 European Union project Eureka
- June–August 2000 **R&D Engineer**, *European Aeronautic Defence and Space Company*, Paris, France.  
Intern at EADS Defence & Security Networks. Devised computer-based tools for digital filter design in the Research and Development team under the supervision of Fabrice Belveze.

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## Teaching Experience

- 09/2012–present **Assistant Professor**, *Georgia Tech*, M.S. Music Technology.
  - MUSI 6001 - Music Perception and Cognition
  - MUSI 6202 - Digital Audio Processing for Music
  - MUSI 6002 - Interactive Music
  - MUSI 7100 - Music Technology Research Lab
- 2011–present **External Examiner**, *Middlesex University, UK / SAE Madrid and Barcelona*, B.A./B.Sc. Hons in Audio Production.
- 2010–present **Lecturer**, *Pompeu Fabra University*, M.Sc. Cognitive Systems and Interactive Media.
  - CSIM 30853 - Advanced Interface Design

- 2011–2012 **Invited Lecturer**, *Pompeu Fabra University*, M.Sc. Cognitive Systems and Interactive Media.  
 ○ CSIM 30852 - Sound Communication
- 2011–2012 **Invited Lecturer**, *IDEA, Pompeu Fabra University*, Master in Music Therapy.  
 ○ Module 6: Psychology and Neurosciences
- 2011–2012 **Thesis co-supervisor**, *Pompeu Fabra University*, Ph.D. Cognitive and Intelligent Systems.  
 "A Perturbational Approach to the Study of Consciousness Deficits Using Binaural Beats"
- 2009–2012 **Thesis Supervisor**, *Pompeu Fabra University*, M.Sc. Cognitive Systems and Interactive Media.  
 ○ "Pitch Sequence Modeling and Musical Expectation"  
 ○ "Expression of Emotion in Virtual Environments Using Graphics"  
 ○ "Perceptual Determinants of Musical Emotion"  
 ○ "Neurofeedback Music System"  
 ○ "A New Generation of Music Therapy Systems"
- 2009 **Teaching Assistant**, *Pompeu Fabra University*, M.Sc. Cognitive Systems and Interactive Media.  
 ○ CSIM 30863 - Systems Design, Integration and Control
- 2008–2009 **Thesis Supervisor**, *Pompeu Fabra University*, B.Sc. in Computer Science.  
 Title of the thesis: "Sonification Tools for Interactive Virtual Environments"
- 2005–2006 **Lecturer**, *Ramon Llull - La Salle University*, M.Sc. in Sound Production and Digital Audio.  
 ○ Digital Audio: storage, protection and quality  
 ○ Interactive Music and Audio with Pure Data
- 2004 **Teaching Assistant**, *Pompeu Fabra University*, B.Sc. Computer Science.  
 ○ 21417 - Data Structures and algorithms in C  
 ○ 21414 - Introduction to Object Oriented Programming and Java
- 1997–2000 **Teacher**, *self-employed*.  
 Mathematics, Physics and Chemistry instructor.

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## Honors and Awards

- 2012 **Fellow of the Consortium for Advanced Studies in Barcelona**.
- 2011 **Best Hack**, *Music hack day*, Barcelona, Spain.
- 2010 **SwissNex grant**, *SwissNex*, San Francisco, CA, USA.  
 To support the "Braindate" project
- Summer 2008 **BE-DGR Generalitat de Catalunya scholarship**, to *Stanford University*, Stanford, CA, USA.
- 2006–2011 **Doctoral Scholarship**, *Universitat Pompeu Fabra*, SPECS, Spain.
- 2004–2005 **Fulbright Scholarship, Georges Lurcy award**, to *University of California at Berkeley*, CA, USA.
- Summer 2005 **Summer workshop fellowship**, *Stanford University*, CA, USA.  
 Teaching assistantship for the Physical Interaction Design workshop
- 2000–2001 **N+i Fellowship**, to *King's College*, London, UK.  
 Full tuition and travel grant for the obtention of double-degree Engineering/Ingenieur

1992 **Creative writing award.**  
Regional (Pays de La Loire) winner of the national Junior High School creative writing contest.

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## Academic Service

Reviewer Fulbright Commission France  
Committee MSc in Cognitive Systems and Interactive Media, and B.Sc. in Computer Science at Universitat Pompeu Fabra  
Program Committee Conference on New Interfaces for Musical Expression (NIME), Sound and Music Computing Conference (SMC)  
Reviewer Journal of Virtual Reality  
International Computer Music Conference (ICMC)  
IEEE transactions on audio, speech, and language processing  
Member The New York Academy of Science  
Association for Computing Machinery  
International Computer Music Association

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## Language Skills

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|------------|-------------------------|---|
| French     | <b>Native</b>           |   |
| English    | <b>Fluent</b>           | <i>TOEIC score: 890. Lived 1 year in England and 2 years in the US.</i> |
| Spanish    | <b>Fluent</b>           | <i>7 years living in Spain</i>  |
| Catalan    | <b>Notions</b>          |   |
| Portuguese | <b>Notions</b>          |   |
| Italian    | <b>Notions</b>          |   |
| Latin      | <b>5 years of study</b> |   |

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## Technical Skills

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| OS:          | OS 9/X, Linux, Windows, VMS   | Audio:      | Max/MSP, PD, Logic, Ableton Live                                |
| Programming: | C++, Python, JAVA, MATLAB, Lisp   | Scripting:  | Unix Shell  |
| Statistics:  | SPSS, R   | Typography: | LaTeX, LyX, LilyPond, Sibelius                                  |
| Web:         | HTML 5, CSS, Javascript   | Database:   | MySQL   |
| Game Engine: | Unity   | Standards:  | OSC, MIDI, SDIF   |
| Libraries:   | poco, gsl, flex, liblo, openframeworks, qt, glut, opengl, stk, opencv,... | Hardware:   | Arduino, Atmel AVR, DMX, Enobio, Gtec mobilab, Emotiv, Neurosky |

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## Interests

Music Algorithmic composition. Intermedia performance. Improvised Music. Contemporary Jazz. Electro. French chanson. World Music. I perform on Guitar, Flute and Laptop.

Sports Running, Windsurfing, Longboarding, Skiing

Other Literature, Cinema and Interactive Media

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## Selected Installations and Performances

### Intermedia

- The Emotion Machine @Fabrica Fabra i Coats, Barcelona, 2012
- In SMuSe @Ernst Strungmann Forum, Frankfurt, 2011
- Brain Date @SwissNex, San Francisco, 2010  
<http://www.swissnexsanfrancisco.org/Ourwork/events/braindate>
- Robot Arena with SPECS @Sonar, Barcelona, 2010  
<http://2010.sonar.es/en/sonarmatica/specs34.html>
- Brain Orchestra with J. Manzolli, SPECS and G-tec @FET, Prague, 2009  
<http://news.bbc.co.uk/2/hi/science/nature/8016869.stm>
- Re(per)curso with J. Manzolli and SPECS @Museum of Modern Art, @Ars Futura, Barcelona, 2009
- Oracle with SPECS@Barcelona Biomedical Research Park, Barcelona, 2008  
<http://www.iua.upf.edu/syntheticOracle/>

### Guitar [+ Electronics]

- Instrumenta with Karlheinz Essl, Hugo Solis and Mauricio Valdes @Festival Instrumenta Contemporanea, Oaxaca, Mexico, 2008
- Metronom with Ensamble Crumble and the Reactable @Metronom, Barcelona, 2006  
<http://hugosolis.net/content/ensamble-crumble>
- La Musique des Cuivres @Jazz Festival du Monastier, Le Monastier, France. Directed by the collectif Polysons.  
<http://www.festivaldumonastier.fr/>

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## Academic Reports

- Ph.D. dissertation *Situated Perceptual Emotive and Cognitive Music Systems: a psychologically grounded approach to interactive music composition*
- Supervisors Prof. Paul FMJ Verschure, Universitat Pompeu Fabra, Barcelona
- Description I created SMuSe, a "Situated interactive Music Server", to study the influence of perceptually-relevant musical parameters on human perception, emotion and cognition in the context of novel multi-sensory media applications and therapies.
- Technical Report *From Sense to Sound: Mapping High-Level Sonic Percepts to Sound Generation*
- Supervisors Prof. Xavier Serra, Universitat Pompeu Fabra, Barcelona
- Description I devised a system that automatically learns to map high-level sonic percepts onto sound synthesis parameters. This allows for intuitive control over sound generation.
- Technical Report *Interactive Music Systems Design*
- Supervisors Prof. David Wessel and Matthew Wright, UC Berkeley, CA
- Description I realized several small projects related to interactive music systems, graphical and physical interfaces, "scrubbing" sound synthesis, as well as the organization of a taxonomy of sounds and a library of feature extraction algorithms.
- Technical Report *Automatic Retrieval of Sounds in Audio Databases*
- Supervisors Prof. Xavier Serra and Pedro Cano, UPF, Barcelona

|              |  |
|--------------|--|
| Description  | I devised a technique to hierarchically clusterize sounds by their degree of similarity and studied different sound descriptors and sound similarity measures. |
| D.E.A.       | <i>A Neural Network Principal Component Synthesizer</i>  |
| Supervisors  | Prof. David Wessel, UC Berkeley, CA, Gerard Assayag, IRCAM   |
| Description  | This project investigated the mapping of perceptual control to sound synthesis parameters using artificial neural networks.                                    |
| Diploma Eng. | <i>Scalable Sound Synthesis Using Principal Component Analysis</i>   |
| Supervisors  | Prof. Mark Sandler, King's College, London (now at Queen Mary University)  |
| Description  | This project involved scalable mechanisms for musical instruments sound synthesis, based on Principal Component Analysis.                                      |

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## Publications

### Book Chapters

- [1] Ulysses Bernardet, Sergi Bermudez i Badia, Armin Duff, Martin Inderbitzin, Sylvain Le Groux, Jonatas Manzoli, Zenon Mathews, Anna Mura, Aleksander Valjamae, and Paul F. M. J. Verschure. *The eXperience Induction Machine: A New Paradigm for Mixed Reality Interaction Design and Psychological Experimentation*. Springer, 2009.
- [2] Sylvain Le Groux and Paul F. M. J. Verschure. *Music Is All Around Us: A Situated Approach to Interactive Music Composition*. Exeter: Imprint Academic, April 2011.

### Journal Articles

- [3] Pedro Cano, Markus Koppenberger, Sylvain Le Groux, Julien Ricard, Nicolas Wack, and Perfecto Herrera. Nearest-neighbor automatic sound annotation with a wordnet taxonomy. *Journal of Intelligent Information Systems*, 24(2):99–111, 2005.
- [4] Sylvain Le Groux, Melissa Brotons, Jonatas Manzoli, and Paul F. M. J. Verschure. Perceptual determinants of emotional responses to sound in dementia patients: Towards a sound-based diagnosis. *Journal Publication*, Submitted.
- [5] Anna Mura, Jonatas Manzoli, Sylvain Le Groux, Zenon Mattew, Lucas Zimmerli, Ulysses Bernardet, and Paul F. M. J. Verschure. Interactive multimedia chronicle: from soundscape to audiovisual experience. *Peach Conference*, pages 21–24, 2007.

### Peer-Reviewed Conference Proceedings

- [6] Ulysses Bernardet, Sergi Bermudez i Badia, Armin Duff, Martin Inderbitzin, Sylvain Le Groux, Wendy Anne Mansilla, Zenon Mathews, Anna Mura, Aleksander Valjamae, Sytse Wierenga, and Paul F. M. J. Verschure. The experience induction machine and its role in empirical research on presence. In *The 10th International Workshop on Presence*, 2008.
- [7] Pedro Cano, Markus Koppenberger, Sylvain Le Groux, Julien Ricard, Perfecto Herrera, and Nicolas Wack. Nearest-neighbor generic sound classification with a wordnet-based taxonomy. In *Proceedings of AES 116th Convention*, Berlin, Germany, 2004.
- [8] Pedro Cano, Markus Koppenberger, Sylvain Le Groux, Julien Ricard, and Nicolas Wack. Knowledge and perceptual sound effects asset management. In *Proceedings of 1st International Conference on E-business and Telecommunication Networks*, Setubal, Portugal, 2004.
- [9] Pedro Cano, Markus Koppenberger, Sylvain Le Groux, Julien Ricard, and Nicolas Wack. Semantic and perceptual management of sound effects in production systems. In *Proceedings of International Broadcasting Conference*, Amsterdam, The Netherlands, 2004.
- [10] Sylvain Le Groux, Jonatas Manzoli, Marti Sanchez, Andre Luvizotto, Anna Mura, Aleksander Valjamae, Christoph Guger, Robert Prueckl, Ulysses Bernardet, and Paul F. M. J. Verschure.

Disembodied and collaborative musical interaction in the Multimodal Brain Orchestra. In *NIME '10: Proceedings of the international conference on New Interfaces for Musical Expression*, Sydney, NSW, Australia, June 2010. ACM Press.

- [11] Sylvain Le Groux, Jonatas Manzolli, and Paul F. M. J. Verschure. Interactive sonification of the spatial behavior of human and synthetic characters in a mixed-reality environment. In *Proceedings of the 10th Annual International Workshop on Presence*, Barcelona, Spain, October 2007.
- [12] Sylvain Le Groux, Jônatas Manzolli, and Paul F. M. J. Verschure. VR-RoBoser: real-time adaptive sonification of virtual environments based on avatar behavior. In *NIME '07: Proceedings of the 7th international conference on New interfaces for musical expression*, pages 371–374, New York, NY, USA, 2007. ACM Press.
- [13] Sylvain Le Groux, Aleksander Valjamae, Jonatas Manzolli, and Paul F. M. J. Verschure. Implicit physiological interaction for the generation of affective music. In *Proceedings of the International Computer Music Conference*, Belfast, UK, August 2008. Queens University Belfast.
- [14] Sylvain Le Groux and Paul F. M. J. Verschure. PERCEPTSYNTH: Mapping perceptual musical features to sound synthesis parameters. In *Proceedings of IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*, Las Vegas, USA, April 2008.
- [15] Sylvain Le Groux and Paul F. M. J. Verschure. Neuromuse: Training your brain through musical interaction. In *Proceedings of the International Conference on Auditory Display*, Copenhagen, Denmark, May 18-22 2009.
- [16] Sylvain Le Groux and Paul F. M. J. Verschure. Situated interactive music system: Connecting mind and body through musical interaction. In *Proceedings of the International Computer Music Conference*, Montreal, Canada, August 2009. Mc Gill University.
- [17] Sylvain Le Groux and Paul F. M. J. Verschure. Towards interactive sonic therapy. In *Annual CyberTherapy and CyberPsychology 2009 Conference*, Villa Caramora, Italy, June 2009. Frontiers in Neuroengineering.
- [18] Sylvain Le Groux and Paul F. M. J. Verschure. Adaptive music generation by reinforcement learning of musical tension. In *7th Sound and Music Computing Conference*, Barcelona, Spain, July 2010.
- [19] Sylvain Le Groux and Paul F. M. J. Verschure. Emotional responses to the perceptual dimensions of timbre: A pilot study using physically inspired sound synthesis. In *Proceedings of the 7th International Symposium on Computer Music Modeling*, Malaga, Spain, June 2010.
- [20] Sylvain Le Groux and Paul F. M. J. Verschure. The SMuSe: An embodied cognition approach to interactive music composition. In *Proceedings of the International Computer Music Conference*, Ljubjana, Slovenia, September 2012.
- [21] Sylvain Le Groux and Paul F. M. J. Verschure. Subjective emotional responses to musical structure, expression and timbre parameters: A synthetic approach. In *Proceedings of the 9th International Symposium on Computer Music Modeling*, London, England, June 2012.
- [22] Anna Mura, Jonatas Manzolli, Paul F. M. J. Verschure, Behdad Rezazadeh, Sylvain Le Groux, Sytse Wierenga, Armin Duff, Zenon Mathews, and Ulysses Bernardet. Re(PER)curso: a mixed reality chronicle. volume Los Angeles, 2008 2008.

### Conference Presentations

- [23] Sylvain Le Groux. Extraction of relevant controllers for the analysis by synthesis of musical sounds. In *International Society for Music Information Retrieval, Graduate School*, Barcelona, Spain, October 2004.
- [24] Sylvain Le Groux. Synthetic, perceptive, emotive and cognitive music systems. In *Instrumenta Contemporanea. Contemporary Music Festival.*, Oaxaca, Mexico, August 2008. Instrumenta Oaxaca.

- [25] Sylvain Le Groux. The brain tuner: Bci-based music interaction. In *Convergent Science Network School on Neurophysiology Techniques*, volume Advanced Techniques for Neuronal Networks Investigation and Advanced Techniques for neuronal networks investigation and brain-machine interfacing, Padova, Italy, March 2011.
- [26] Sylvain Le Groux, Melissa Brotons, Jonatas Manzolli, and Paul F. M. J. Verschure. Perceptual determinants of emotional responses to sound in dementia patients: Towards a sound-based diagnosis. In *Music, Science and Medicine: Frontiers in Biomedical Research and Clinical Applications*. New York Academy of Science, March 2011.
- [27] Sylvain Le Groux, Melissa Brotons, Zenon Matthews, Jonatas Manzolli, Patricia Marti, and Paul F. M. J. Verschure. Effects of sonic features on the affective states of dementia patients: A pilot study. In *17th International Symposium for Research in Music Behavior*, Baton Rouge, LA USA, 2007. Louisiana State University.
- [28] Sylvain Le Groux, Melissa Brotons, and Paul F. M. J. Verschure. A study on the influence of sonic features on the affective state of dementia patients. In *Conference for the Advancement of Assistive Technology in Europe*, San Sebastian, Spain, October 2007.
- [29] Sylvain Le Groux, Martin Inderbitzin, and Martin Frohlich. This is you brain on brain date. In *Brain and Mind Series at Swissnex San Francisco*, San Francisco, CA, October 2010. Swissnex.
- [30] Sylvain Le Groux, Zenon Matthews, Melissa Brotons, Jonatas Manzolli, and Paul F. M. J. Verschure. Effects of sound features on the affective state of dementia patients. In *The 10th International Workshop on Presence*, Barcelona, Spain, February 2008.
- [31] Sylvain Le Groux and Paul F. M. J. Verschure. Towards affective state modulation through sonic therapy. In *Brain Tuning Workshop: Music, Emotions and Brain Plasticity*, Helsinki, Finland, February 2009. University of Helsinki, Frontiers in Neuroscience.
- [32] Sylvain Le Groux and Paul F. M. J. Verschure. Towards emotion-driven interactive sound design: Bridging the gaps between affect, physiology and sound generation. In *6th Sound and Music Computing Conference*, Porto, Portugal, July 2009.
- [33] Sylvain Le Groux and Paul F. M. J. Verschure. A synthetic approach to the study of musically-induced emotions. In *Society for Music Perception and Cognition*, Rochester, NY, August 2011.