MATTHEW VOWELS M.S., MSc., B.Mus (Hons) *Tonmeister*

EDUCATION

2019 - **PhD in Machine Learning and Computer Vision. Sup. Prof. Richard Bowden.**
Development of SOTA machine learning tools for human understanding and representation learning, with applications to mental health and psychology.
Centre for Vision, Speech and Signal Processing, University of Surrey, UK

2018 - 2019 **MSc in Computer Vision, Robotics and Machine Learning, summa cum laude, *Distinction*.**
University of Surrey, UK
Thesis: Deriving robust representations of facial expression. Novel convolutional variational autoencoder architecture 'Gated-VAE'.

- Space Robotics and Autonomy
- Computer vision
- Deep learning and machine learning
- Advanced Digital Signal Processing
- Image and video compression
- Speech synthesis, speech-to-text, and audio signal processing.

2017-2018 **M.S. in Family Science, *Distinction*. Sup. Prof. Nathan Wood.**
University of Kentucky, USA
Thesis: The application of spectral and cross-spectral analysis to social sciences data.

- Psychology of human interaction.
- Econometrics module on time series analysis and forecasting (following the work of James D. Hamilton)
- Paper on a comparison of Welch's method and spectrograms for frequency domain identification of seasonality in non-stationary time series
- Hierarchical linear modeling

2008-2012 **Bachelor of Music (Honours) Tonmeister, *1st class***
University of Surrey, UK
Dissertation: Subjective data acquisition tasks: Pairwise dissimilarity tasks, sorting tasks and napping tasks with multi-dimensional scaling.
The degree modules included:

- Acoustics
- Time series analysis
- Principles of modulation (channel codecs, signal transmission)
- Signal processing (linear algebra, convolution, Z-transform, spectral and cepstral analysis, information and sampling theory)
- Computer systems
- Transducers and electroacoustics
- Video engineering

2005-2008 **A-levels**
Music, Mathematics, and Physics. Grades: All **A**

EMPLOYMENT

2020-present **Loudspeaker Design Consultant**
Providing detailed designs and systems advice to leading consumer electronics companies.

2012-present **Associate Lecturer**
University of Surrey – Staff Page
Second-year undergraduate electroacoustics lecturer for the mechanics and acoustics of electroacoustic audio transducers.
Student numbers: approx. 30 per annum

2012-2020 **Project Manager and Acoustic Designer**

Orbitsound UK Ltd., London
EPSRC S3A: Future Spatial Audio for an Immersive Listener Experience at Home – industry project partner.
Technology investment presentations for major London-based investment firms. Designing the acoustic platforms for products and managing an international team for the lumped parameter acoustic simulation, prototyping, development, test, and manufacture of these products. Also managed FEA engineers for details high-frequency simulation and transducer optimization. Undertaking double-blind listening tests and leading sales-team training.
Products Designed: AIR D1, DOCK E30, P70, P70W, A70, A60, Spaced360, M9LX, S3 subwoofer, S4 subwoofer [non-exhaustive selection shown in image above]
Product Sales Regions: UK (John Lewis, PC World, Harrods), Hong Kong, Australia/New Zealand, USA

2017-2018 **Graduate Teaching and Research Assistant**
University of Kentucky
Teaching and grading undergraduate course in Financial Counseling.
Research assistant for journal articles in economic strain, financial wellbeing, financial counseling, financial risk tolerance, risk aversion, financial anxiety, and financial literacy.

2009-2010 **Student Internship**
Harman Automotive, Bridgend, Wales
Managed UK division of the subjective evaluation department – training a panel of listeners, undertaking subjective listening and objective acoustic tests, and product assessment.
Undertook Binaural Room Impulse Response (BRIR) measurements with rotating dummy head for real-time BRIR interpolation and convolution.

Commercially available products. Acoustics and form designed by Matthew Vowels with Orbitsound Ltd.

PUBLICATIONS

ACCEPTED

Vowels, M.J., Camgoz, C., Bowden, R. (in print) VDSM: Video Disentanglement with State-Space Models and Deep Mixtures of Experts. *Conference on Computer Vision and Pattern Recognition (CVPR).*

Vowels, M.J. & Mason, R**.** (2020) Comparison of pairwise dissimilarity and projective mapping tasks with multi-dimensional scaling and auditory stimuli. *Journal of Audio Engineering Society.*

Vowels, M.J., Camgoz, C., Bowden, R. 2020 NestedVAE: Isolating common factors via weak supervision. *Conference on Computer Vision and Pattern Recognition (CVPR).*

Vowels, M.J., Camgoz, C., Bowden, R. 2020 Gated Variational AutoEncoder: Incorporating weak supervision to encourage disentanglement. *15th IEEE Conference on Automatic Face and Gesture Recognition*.

Vowels, M.J., Mark, K.P., Vowels, L.M., & Wood, N.D. 2018 Using spectral and cross-spectral analysis to identify patterns and synchrony in couples' desire. PLOS ONE 13(10): 1-19.

Vowels, M.J., Vowels, L., Wood, W. (in print) Spectral and Cross-Spectral Analysis – a Tutorial for Psychologists and Social Scientists. *Psychological Methods*.

Hilpert, P., Brick, T. R., Fleuckiger, C., **Vowels, M.J.**, Cueleman, E., Kuppens, P. and Sels, L. 2019 What can be learned from couple research: Examining emotional co-regulation processes in face-to-face interactions. *Journal of Counseling Psychology.*

Ross, B**.**, Gale, J., Wickrama, K., Geotz, J. & **Vowels, M. J.** 2019 The impact of family economic strain on work-family conflict, marital support, marital quality, and marital stability during the middle years. *Journal of Personal Finance, 18(2).*

UNDER REVIEW

Vowels, M.J., Camgoz, C., Bowden, R. (under review) D'ya like DAGs? A Survey on Structure Learning and Causal Discovery.

Vowels, M.J., (under review) Limited Functional Form, Misspecification, and Unreliable Interpretations in Psychology and Social Science. arXiv:2009.10025

Vowels, L.M., **Vowels, M.J.,** Mark, K.P. (under review) Is Infidelity Predictable? Using Explainable Machine Learning to Identify the Most Important Predictors of Infidelity. psyArXiv.

Vowels, L.M., **Vowels, M.J.,** Mark, K.P. (under review) Uncovering the Most Important Factors for Predicting Sexual Desire Using Explainable Machine Learning. psyArXiv.

Vowels, L.M., **Vowels, M.J.,** Mark, K.P. (under review) Identifying the Most Important Predictors of Sexual Satisfaction Using Explainable Machine Learning. PsyArXiv.

Vowels, M.J., Camgoz, C., Bowden, R. (under review) Targeted VAE: Structured Inference and Targeted Learning for Causal Parameter Estimation.

Mendez, O., **Vowels, M. J.** & Bowden, R. (under review) Now you see me, now you don't: Learning object specific neural blindness.

IN PREPARATION

Vowels, M.J., Hilpert, P. (in preparation) Gottman's Breakup Predictions 2.0: Machine Learning Algorithm Predicting Breakups Based on Emotion Co-Regulation.

Ross, B**.**, & **Vowels, M.J.** (in preparation). Examining the impact of family economic strain on work-family conflict, marital support, marital quality, and marital stability during the middle years.

CONFERENCE TALKS / TUTORIALS / WORKSHOPS

2021	**Vowels, M.J.** Explanation versus Interpretation: Machine Learning Techniques for Qualified Empirical Conclusions. Surrey Reproducibility Society Workshop.
2020	**Vowels, M.J.** Prediction and Causality: Either, Both or Neither? Surrey Reproducibility Society Workshop.
2020	**Vowels, M.J.** Statistical Rituals. University of Surrey ReproducibiliTea talk. Presentation slides.
2020	**Vowels, M.J.** Disentangled, Fair, and Causal Approaches to the Latent Variable Modeling of Internal State. MLSS – Tuebingen. YouTube presentation.
2020	**Vowels, M.J.**, Hilpert, P. Gottman's breakup predictions 2.0: Machine learning algorithm predicting breakups based on emotion co-regulation. IARR.
2020	**Vowels, M.J.** Tutorial on causal inference with Targeted Maximum Likelihood Estimation and its incorporation into gradient descent frameworks. YouTube video.
2020	**Vowels, M.J.** Tutorial on causal considerations (SEM/SCM perspective) for linear model coefficient estimation with examples in Python. YouTube video.
2019	**Vowels, M.J.** The British Machine Vision Association (BMVA), One Day Meeting: Generative Networks in Computer Vision and Machine Learning. Incorporating weak supervision to encourage disentanglement with VAEs. BMVA 2019 YouTube video.
2019	**Vowels, M.J.** 3 Hour Department tutorial: Demystifying Variational AutoEncoders – with relevant topics and developments. University of Surrey, Centre for Vision, Speech and Signal Processing. Tutorial Slides.
2019	**Vowels, M.J.,** Vowels, L.M., Wood, N.D., NCFR Theory Construction and Research Methodology Workshop (2019), Texas: Insights into the Cycles of Family Life Via Spectral and Cross-Spectral Analysis. Workshop Materials.
2018	**Vowels, M.J.** IASR (2018), Madrid: The application of spectral and cross-spectral analysis to social science time series data.

SKILLS

Coding: Python (deep learning, statistics, computer vision/video, DSP), Matlab (computer vision, data processing, statistics, engineering, DSP), Max/MSP (audio/video, prototyping, DSP).
Typesetting: LaTex
Deep Learning APIs: Tensorflow, PyTorch, Pyro (probabilistic programming language).
File Storage / Versioning: Git

CONTRIBUTIONS

2019	**Awesome-Video-Generation:** A curated (growing) list of ~150 awesome papers on video generation, state-space modeling, and related topics. Awesome VideoGen GitHub Link.
2019	**Awesome-VAEs:** A curated (growing) list of ~800 awesome papers on VAEs and related topics. Awesome VAEs GitHub Link.
2019	**Awesome_ML_for_mental_health**: A curated (growing) list of ~233 awesome papers on machine learning for mental health. Awesome Mental Health GitHub Link.
2019	**EmoTVrater:** research application for real-time, frame-by-frame capture of participant valence rating in response to video playback. Implemented in University of Surrey's psychology department's research laboratory. Coded and compiled for Mac OSX using Max/MSP. EmoTVrater GitHub Link.

SCHOLARSHIPS AND AWARDS

2019-22	**Doctoral College PhD Studentship Award** University of Surrey
2017-18	**Tuition Scholarship** University of Kentucky
2016	**No.1 best-selling album** in international **Amazon**, and **No.2 best-selling album** in international **iTunes** Blues charts with Kris Barras' *Lucky 13* (piano, backing-vocals, engineering, mix & mastering).
2008-12	**Tuition Scholarship** University of Surrey

2008 **Piano Grade 8, *Distinction,*** Associated Boards of the Royal Schools of Music

ADDITIONAL PEDAGOGICAL TRAINING

2020 **MLSS Tuebingen** Summer School (180 accepted of 1300+ applicants)

2020 **IEEE Conference on Face and Gesture Recognition Doctoral Consortium** acceptance.

2017-2018 **Neural Networks and Deep Learning Specialization**

- Stanford University Online (Certified)

Mathematics for Machine Learning: Specialization

- Imperial College London (Certified)

Neural Networks for Machine Learning

- University of Toronto Online (Certified)

Machine Learning

- Stanford University Online (Certified)

Advanced Machine Learning: Deep Learning in Computer Vision: Specialization

- National Research University Higher School of Economics (Certified)

Applied AI with DeepLearning

- IBM Watson IoT Data Science Online (Certified)

Computational Investing

- Georgia Institute of Technology Online

Deep Learning A-Z™: Hands-On Artificial Neural Networks

Python for Finance and Algorithmic Trading

Essential Mathematics for Artificial Intelligence

- Microsoft online : DAT256x

Complete Guide to TensorFlow for Deep Learning with Python

2009 **Max/MSP Coding and Software Design Course**
Goldsmiths, University of London