

# Dr. Cai Wingfield

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## Employment and education

- 2017– Research Associate. Embodied Cognition Lab, Department of Psychology, Lancaster University.  
PI: Louise Connell.
- 2015–16 Research Associate. Centre for Speech Language and the Brain, Department of Psychology, University of Cambridge.  
PI: Lorraine Tyler.
- 2013–14 Software developer. Symplectic Ltd.
- 2010–13 PhD (Computer science and mathematics). University of Bath.  
Thesis: “Graphical foundations for dialogue games”.  
Supervisors: John Power and Guy McCusker.
- 2009–10 Research Assistant. Neurolex group, MRC Cognition and Brain Sciences Unit.  
PI: William Marslen-Wilson.
- 2008–09 Masters of Advanced Study in Pure Mathematics. University of Cambridge.  
Dissertation: “Cartesian closed categories and typed  $\lambda$ -calculus”.
- 2005–08 BSc (Hons.) in Mathematics (1st class). University of Warwick.

## Journal publications

(\*As first author. By convention, mathematics publications list authors alphabetically. †As joint-first author.)

- Thwaites A, Wingfield C, Wieser E, Soltan A, Marslen-Wilson WD, Nimmo-Smith I (2018) Entrainment to the CIECAM02 and CIELAB colour appearance models in the human cortex. *Vision Research* 145:1–10. 10.1016/j.visres.2018.01.011.
- Wingfield C†, Su L†, Liu X, Zhang C, Woodland P, Thwaites A, Fonteneau E, Marslen-Wilson WD (2017) Relating Dynamic Brain States to Dynamic Machine States: Human and Machine Solutions to the Speech Recognition Problem. *PLOS Computational Biology*. 10.1371/journal.pcbi.1005617.
- McCusker G, Power AJ, Wingfield C\* (2015) A graphical foundation for interleaving in game semantics. *Journal of Pure and Applied Algebra* 219(4):1131–1174. doi:10.1016/j.jpaa.2014.05.040.  
(Highest-scored paper in University of Bath Computer Science departmental-level internal research review, 2016.)
- (Editors) Power AJ, Wingfield C (2014) Proceedings of the Workshop on Algebra, Coalgebra and Topology WACT 2013. *Electronic Notes in Theoretical Computer Science* 303:1–206. doi:10.1016/j.entcs.2014.02.001.
- Nili H, Wingfield C, Su L, Walther A, Kriegeskorte N (2014) A Toolbox for Representational Similarity Analysis. *PLOS Computational Biology* 10(4):e1003553. doi:10.1371/journal.pcbi.1003553 pmcid:PMC3990488.
- Bozic M, Tyler LK, Su L, Wingfield C, Marslen-Wilson WD (2013) Neurobiological systems for lexical representation and analysis in English. *Journal of Cognitive Neuroscience* 25(10):1678–1691. doi:10.1162/jocn\_a\_00420.
- McCusker G, Power AJ, Wingfield C\* (2012) A graphical foundation for schedules. *Proceedings of the 28th Conference on the Mathematical Foundations of Programming Semantics (MFPS XXVIII)*, *Electronic Notes in Theoretical Computer Science* 286:273–289. doi:10.1016/j.entcs.2012.08.018.

## Selected talks

- Wingfield C, Connell L. What kind of linguistic distributional information best predicts conceptual processing? A systematic cross-task comparison. (Special Session on Methods & Reproducibility, *Embodied and Situated Language Processing Conference*, Lancaster University, August 2018).
- Human and machine solutions for speech recognition: challenges with temporally changing models. (Invited speaker. *Representational Similarity Analysis & Advanced Computational Methods Workshop*, MRC Cognition and Brain Sciences Unit, University of Cambridge, May 2018).
- Multivariate mapping of speech representations in auditory cortex using machine models. (Invited speaker. Technische Universität Dresden, Dresden, July 2016).
- Multivariate mapping of speech representations in auditory cortex using machine models. (Invited speaker. Max-Planck-Institut für Kognitions- und Neurowissenschaften, Leipzig, July 2016).

- Understanding human speech recognition: Reverse-engineering the engineering solution using EMEG and RSA. (Invited speaker. *Interdisciplinary Workshop on Neurocomputation: From Brains to Machines*, University of Cambridge, November 2015).
- Using machine speech recogniser state to map phonetic speech responses in the human brain. (Invited speaker. *Computing and Information Systems Seminar*, Cardiff Metropolitan University, Cardiff, November 2015).
- Using multivariate analysis of fMRI data to investigate lexical representation. (Invited speaker. *Age, Hearing, and Speech Comprehension*, Brandeis University, Boston, MA, July 2014).
- Graphical foundations for dialogue games. (*Games for Logic and Programming Languages VIII (GaLoP)*, Queen Mary University London, July 2013).
- Graphical foundations for dialogue games. (Invited speaker. *Logic, Reasoning and Computation Seminar*, Laboratoire d'Informatique de Paris Nord, June 2013).
- Graphical foundations for dialogue games. (Invited speaker. *Birmingham Theoretical Computer Science Seminar*, Birmingham University, May 2013).
- A graphical foundation for schedules. (*Conference on the Mathematical Foundations for Programming Semantics*, University of Bath, June 2012).
- Graphical notation schemes. (*Young Researchers in Mathematics*, University of Bristol, April 2012).
- Universals and constructions on categories; Tortile tensor categories and other graphical notation schemes. (Lecture series. *Bristol Category Theory Seminars*, University of Bristol, 2011–2012).
- A graphical foundation for schedules. (Video-linked. *Mathematical Foundations Seminar*, University of Bath and University of Swansea, March 2012).
- Graphical notation for monoidal categories and braided monoidal categories. (Lecture series. *Logic and Semantics Seminars*, University of Bath, 2011).
- Cartesian closed categories and simply typed  $\lambda$ -calculi. (*Part III Seminar Series*, University of Cambridge, 2009).

### **Selected abstracts**

- Banks B, Wingfield C, Connell L. Linguistic distributional associations predict category member production. (*Embodied and Situated Language Processing Conference*, Lancaster University, August 2018).
- Banks B, Wingfield C, Connell L. Linguistic statistical associations predict category member production. (*Psycholinguistics in Flanders*, Ghent University, Belgium, June 2018).
- Wingfield C, Su L, Devereux B, Liu X, Zhang C, Woodland P, Fonteneau E, Thwaites A, Marslen-Wilson W. Multi-level representations in speech processing in brain and machine: Evidence from EMEG and RSA. (*Cambridge Language Sciences Symposium*, Cambridge, November 2016).
- Wingfield C, Su L, Devereux B, Liu X, Zhang C, Woodland P, Fonteneau E, Thwaites A, Marslen-Wilson W. Multi-level representations in speech processing in brain and machine: Evidence from EMEG and RSA. (*Society for the Neurobiology of Language*, London, August 2016).
- Wingfield C, Su L, Liu X, Zhang C, Woodland P, Thwaites A, Fonteneau E, Marslen-Wilson W. Investigating human speech recognition: Reverse-engineering the machine solution with EMEG and RSA. (*Organisation for Human Brain Mapping*, Geneva, June 2016).  
(Supported by £600 grant award from Guarantors of Brain charity.)
- Wingfield C, Su L, Liu X, Zhang C, Woodland P, Thwaites A, Fonteneau E, Marslen-Wilson W. Investigating human speech recognition: Reverse-engineering the machine solution with EMEG and RSA. (*Cambridge Neuroscience Seminar*, Cambridge, March 2016).
- Bozic M, Woolgar A, Fonteneau E, Whiting C, Su L, Wingfield C, Marslen-Wilson W. Modulation of speech processing following item repetition. (*Organisation for Human Brain Mapping*, Beijing, June 2012).
- Woolgar A, Bozic M, Fonteneau E, Whiting C, Su L, Wingfield C, Marslen-Wilson W. More repetitions or more items? The effects of repeating stimuli on MVPA for fMRI and E/MEG. (*Organisation for Human Brain Mapping*, Beijing, June 2012).
- Su L, Fonteneau E, Wingfield C, Bozic M, Marslen-Wilson W. Dynamic morpho-lexical processing revealed by time-resolved MVPA. (*British Association for Cognitive Neuroscience Conference and Annual Meeting*, Newcastle, April 2012).
- Power AJ, Wingfield C. Graphical notation schemes: a picture is worth a thousand binary tensor words. (*Milner Symposium*, University of Edinburgh, April 2012).
- Su L, Fonteneau E, Wingfield C, Bozic M, Marslen-Wilson W. Searchlight representational similarity analysis for complex morpho-lexical processes. (*Experimental Psychology Society Meeting*, London, January 2012).

- Su L, Fonteneau E, Wingfield C, Marslen-Wilson W. The dynamics of complex morpholexical processes revealed by searchlight representational similarity analysis of MEG/EEG data. (*Neurobiology of Language Conference*, Annapolis, MD, November 2011).
- Bozic M, Su L, Wingfield C, Marslen-Wilson W. Characterizing lexical complexity computations in the fronto-temporal language network. (*Society for the Neurobiology of Language*, San Diego, CA, November 2010).
- Fonteneau E, Bozic M, Su L, Wingfield C, Billi Randall, Marslen-Wilson W. Spatiotemporal dynamics of morphological processing: an MEG/EEG investigation. (*Society for Neuroscience*, San Diego, November 2010).
- Su L, Wingfield C, Bozic M, Fonteneau E, Kriegeskorte N, Marslen-Wilson W. A Multimodal Approach to Representational Similarity Analysis. (*Organisation for Human Brain Mapping*, Barcelona, June 2010).
- Bozic M, Su L, Wingfield C, Marslen-Wilson W. Characterizing lexical complexity computations in the fronto-temporal language network. (*Cognitive Neuroscience Society*, Montréal, April 2010).

### **Teaching**

- 2012 Course assistant. *Computer networking*. University of Bath.
- 2010–12 Tutor and course assistant. *Programming and discrete mathematics*. University of Bath.

### **Professional activities**

- Programme Committee member of international *Embodied and Situated Language Processing Conference*, Lancaster University, August 2018.
- Co-organiser of *Representational Similarity Analysis & Advanced Computational Methods Workshop*, MRC Cognition and Brain Sciences Unit, University of Cambridge, May 2018.
- Member of PROSPR (Promoting Open Science Practices in Psychology), Lancaster University. The UK's first departmental-level open science advocacy workgroup.
- Contributor to open-source scientific software [github.com/rsagroup/rsatoolbox](https://github.com/rsagroup/rsatoolbox), and member of core development team.
- Main organiser of international *Workshop on Algebra, Coalgebra and Topology*, University of Bath, March 2013.

### **Professional training and development**

- 2018 Lancaster Bayesian Methods Workshop, Lancaster University.
- 2012 Logic and Interaction Winter School, Centre International de Rencontres Mathématiques.
- 2011 Oregon Programming Languages Summer School, University of Oregon.

### **Professional membership**

- Member of the Cognitive Science Society.
- Member of the Society for the Neurobiology of Language.
- Member of the Organization of Human Brain Mapping.

### **Technical skills**

- Software proficiency (high): Python, C#, Matlab, JavaScript, R, Pandas, Shell, LaTeX, Photoshop.
- Software proficiency (moderate): PHP, CSS, Swift, Unity.

### **Voluntary and charity work**

- 2017– Graphic Designer, voluntary. Aston–Mansfield youth charity.