# Dr. Cai Wingfield

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## Employment and education

2017– Research Associate. Embodied Cognition Lab, Department of Psychology, University of Lancaster.

2015–16 Research Associate. Centre for Speech Language and the Brain, Department of Psychology, University of Cambridge.

2013–14 Software developer. Symplectic Ltd.

2010–13 PhD (Computer science and mathematics). University of Bath.
Thesis: "Graphical foundations for dialogue games".
Supervisors: Dr. John Power and Prof. Guy McCusker.

2009–10 Research Assistant. Neurolex group, MRC Cognition and Brain Sciences Unit.

2008–09 Masters of Advanced Study in Pure Mathematics. University of Cambridge.
Dissertation: "Cartesian closed categories and typed λ-calculus".

2005–08 BSc (Hons.) in Mathematics (1st class). University of Warwick.

## Journal publications

(*As first author. By convention, mathematics publications list authors alphabetically.)

Thwaites A, Wingfield C, Wieser E, Soltan A, Marslen-Wilson WD, Nimmo-Smith I (*submitted*) Entrainment to the CIECAM02 and CIELAB colour appearance models in the human cortex. *Vision Research*.

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.

(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 abstracts

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).

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).

**Selected talks**

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 λ-calculi. (*Part III Seminar Series*, University of Cambridge, 2009).

**Teaching**

2012 Course assistant. *Computer networking*. University of Bath.

2010–12 Tutor and course assistant. *Programming and discrete mathematics*. University of Bath.

**Other workshops and schools**

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.

**Other professional activities**

Contributor to open-source scientific software `github.com/rsagroup/rsatoolbox`, and member of core development team.

Main organiser, *Workshop on Algebra, Coalgebra and Topology*, University of Bath, March 2013.

**Technical skills**

Software proficiency (high): Python, C#, Matlab, JavaScript, R, Pandas, Shell script, LaTeX, Photoshop.

Software proficiency (moderate): PHP, CSS, Swift, Unity.

**Voluntary and charity work**

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