

# Curriculum Vitae

Professor Padraic Monaghan

Current post: Professor, Department of Psychology, Lancaster University.

## Education

- 1999: PhD, Cognitive Science, University of Edinburgh.
- 1995: MSc Cognitive Science and Natural Language, University of Edinburgh, Distinction.
- 1994: BSc Mathematics and Philosophy, University of Manchester, 1<sup>st</sup> class Honours.

## Career

- 2007 – present: Professor, Department of Psychology, Lancaster University.
- 2003 – 2007: Lecturer, Department of Psychology, University of York, and Research Fellow at York Neuroimaging Centre.
- 2002 – 2003: Research Fellow, Department of Psychology, University of Warwick.
- 1999 - 2002: Research Fellow, Division of Informatics, University of Edinburgh.
- 1995 - 1996: Research Associate, Centre for Cognitive Science, University of Edinburgh.

## Major Research Interests

My principal interests are in the computational modelling of language and attentional processing. My interests are: (1) to align experimental, modelling, and imaging approaches to questions of the inter- and intra-hemispheric processing in the brain; (2) to investigate the statistical and phonological properties of language that assist in language acquisition; and (3) to combine psychometric and cognitive psychology and computational analyses of reasoning to expose individual differences in reasoning performance in humans.

### *Inter- and intra-hemispheric processing*

I have investigated the extent to which the two hemispheres process information separately and the points at which information must pass between them via either the corpus callosum or subcortical routes. I have implemented divided processors in computational models, to examine the modularity and conjoint processing in spatial and language tasks.

This research has successfully simulated normal and impaired behaviour. Impairing the left or right hemisphere in the model reflected the different incidence and severity of visuospatial neglect and neglect dyslexia following brain damage in patients. Impairing hemispheric transfer between the model's hemispheres in a model of reading resulted in behaviour characteristic of dyslexia, instantiating a long-standing theory of dyslexia as impairment to hemispheric communication.

I have investigated the split fovea model of reading with Dr. Richard Shillcock. We constructed neural network models of orthographic, phonological and semantic representations, and the mappings between them. Dr. Shillcock and I co-founded the Centre for Connectionist modelling of Cognitive Processes (<http://anc.ed.ac.uk/cccp>) as a cross-departmental, multidisciplinary research centre for this work. This centre ties together the related research of several PhD and MSc students, and collaborators at Harvard University and Birkbeck College London.

I developed this split-fovea modelling research in several novel directions. The influence of the language environment on processing in these models has reflected hemispheric asymmetries in the access to the visual lexicon, in terms of neighbourhood effects, word-length effects, and reading times. This research has been carried out in collaboration with Dr. Michal Lavidor at Hull University and Professor Andrew Ellis at the University of York. The models have accounted for hemispheric asymmetries in lexical decision, reading, and semantic processing.

In collaboration with Professor Stefan Pollmann I have investigated the advantages and disadvantages of divided processing between the hemispheres. We have triangulated behavioural, computational, and imaging methods to investigate the interactions between visual processing in the two hemispheres.

### *Statistical analyses of language*

I have recently conducted research on the development of lexical structure in early language learning. I am using artificial language learning experiments, psycholinguistic experiments, corpus-based statistics, and connectionist modelling techniques to investigate segmentation and categorisation in language acquisition. This research addresses the broad question of what environmental information is potentially available for children in learning the structure of their first language, and how they might pick up on and apply this information in developing an understanding of the language and its relationship with events and objects.

Relatedly, I am interested in the de Saussurian notion that sound-meaning mappings in language are arbitrary, and why this is optimal for a language system. I am conducting computational models to form the mapping for pseudo-languages that are arbitrary or that contain systematicity in the mapping. The arbitrariness results in ease of learning of meanings but impairs learning of syntactic categories, a possible reason for the sound-symbolism present in grammatical categories in natural languages.

I am also interested in the point at which children develop explicit awareness of the structure of their language at different levels from the phoneme level up to the sentence level. I have conducted computational analyses that suggest that children develop awareness when it is optimal for them to do so, in terms of storing and accessing their language.

### *Reasoning research*

My research on the psychology of reasoning has focused on drawing together computational and psychological accounts of logic and problem solving. I am particularly interested in individual differences in task performance on syllogisms, conditional reasoning problems, logic courses, and more general problems such as those employed on the Graduate Recruitment Exam (GRE) test. I have been interested in relating psychometric measures to styles of reasoning, particularly with respect to the use of graphical and sentential representations to support reasoning. My PhD reported several experimental studies of reasoning. I have recently supervised a project using psychometrics to study insight problem solving.

### **Prizes and Awards**

- British Psychological Society Spearman Medal (2005) for outstanding work by an early-stage researcher.
- University of York Anniversary Lectureship (2005-6).
- World University Network travel award (2004).
- EU short-term fellowship in Neuroinformatics (2001).
- James Thorne prize for MSc thesis, University of Edinburgh (1995).
- Hilbert prize for Logic, University of Manchester (1994).
- Elizabeth Wegner prize for Philosophy, University of Manchester (1993).
- Prize for first year Philosophy, University of Manchester (1992).
- Hulme-Major Scholarship prize, University of Manchester (1991-1994).

### **Grants**

- 2007-2008. ESRC grant, sole PI, £79,400.
- 2005-2006. ESRC grant, PI with Nick Chater, £42,868.62. Rated outstanding.

- 2005-2009. EU Sixth Framework Research Training Network Grant, PI with 12 others, €3,000,000. Personal responsibility for €161,932.
- 2005. Innovation and Research Priming Fund, University of York, co-applicant with Amanda Perry, £5,772.

## **Teaching Experience**

### *Lecturing*

I have taught undergraduate courses in *Cognition, Introduction to Psychology, Scientific Skills for Psychology, Personality and Individual Differences*. I have also taught *Connectionism* and *Statistics and Research Methods* at postgraduate level.

### *Supervision*

- Giovanni Pagliuca (PhD 2005-present).
- Dominic Pearson (PhD 2005-present).
- Maribel Pulgarin (PhD 2005-present).
- Michelle St Clair (PhD 2004-2007).
- Markus Gonitzke, co-supervisor for Psychology PhD (2002-present).
- Luca Onnis, co-supervisor for Psychology PhD (2002-2003).
- Matthew Roberts, co-supervisor for Psychology PhD (2002-present).

## **Membership of Committees**

- Experimental Psychology Society committee member (2008-present).
- British Association for the Advancement of Science, Psychology section Press Officer (2007-present).
- Cognitive Science Society Tutorial Committee (2002-present).
- Member of the ESRC College of Postdoctoral Fellowships (2008-present).

## **Reviewing**

I have reviewed papers for the following journals:

Applied Psycholinguistics, Brain and Language, British Journal of Psychology, Cognition, Cognitive, Affective and Behavioral Neuroscience, Cognitive Brain Research, Cognitive Neuropsychology. Cognitive Science, Connectionist Science, Developmental Science, Dyslexia, International Journal of Psychology, Journal of Cognitive Neuroscience, Journal of Experimental Psychology: General, Journal of Experimental Psychology: Human Perception and Performance, Journal of Neurolinguistics, Neuropsychologia, Psychological Review, Quarterly Journal of Experimental Psychology.

## **Invited Papers**

I have been invited to present papers at the following institutions and events:

- University of Amsterdam (December 2008).
- Edinburgh University (July 2008).
- Radboud University of Nijmegen (June 2008).
- Max Plank Institute for Psycholinguistics, Nijmegen (June 2008).
- Royal Holloway (March 2008).
- Association of Educational Psychologists annual conference, keynote (October 2007).
- Sussex University (June 2007).
- Manchester University (November 2007).
- Hong Kong University (March 2006).
- Sydney University, Australia (March 2006).
- Charles Sturt University, Australia (February 2006).
- Macquarie University, Australia (February 2006).

- Auckland University, New Zealand (February 2006).
- Universität Magdeburg, Germany (November 2005).
- CNRS Dijon, France (November 2005).
- Swansea University (November 2005).
- CNRS Marseilles, France (October 2005).
- European Society of Cognitive Psychology, symposium on artificial grammar learning, Leiden (August 2005).
- European Society of Cognitive Psychology, symposium on brain and language, Leiden (August 2005).
- Natural Computing Applications Forum, York (May 2005).
- International Symposium of Cognitive Science, San Sebastian, Spain (May 2005).
- Birkbeck College, University of London (November 2004).
- University of California at San Diego (March 2004).
- Northern England Cognitive Neuropsychology Group, St James Hospital, Leeds (November 2003).
- University of Edinburgh (March 2003).
- University of Cardiff (March 2003).
- University of Hull (November 2002).
- Cornell University (November 2002).
- Experimental Psychology Society, symposium on language processing (July 2002).
- University of Glasgow (February 2002).
- University of Edinburgh (December 2001).
- Max Planck Institute for Cognitive Neuroscience, Leipzig (February 2001).
- University of Dundee (January 2001).
- University of Nottingham (September 1999).
- European Society for Cognitive Psychology Conference, symposium on reasoning (September 1999).
- University of Sussex (November 1997).

## **Publications**

### *Journal Articles*

- Arciuli, J. & Monaghan, P. (in press). Top down modulation of bottom up processes is associated with reading ability. *Laterality*.
- Fitneva, S., Christiansen, M.H., & Monaghan, P. (in press). From sound to syntax: Phonological constraints on children's lexical categorization of new words. *Journal of Child Language*.
- Arciuli, J. & Monaghan, P. (2009). Probabilistic cues to grammatical category in English orthography and their influence during reading. *Scientific Studies of Reading*, 13, 1-21.
- Seva, N., Monaghan, P., & Arciuli, J. (in press). Stressing what is important: Orthographic cues and lexical stress assignment. *Journal of Neurolinguistics*.
- Monaghan, P. & Rowson, C. (2008). The effect of repetition and similarity on sequence learning. *Memory and Cognition*, 36, 1509-1514.
- Monaghan, P. & Shillcock, R.C. (2008). Hemispheric dissociation and dyslexia in a computational model of reading. *Brain and Language*, 107, 185-193.
- de Vries, M., Monaghan, P., Knecht, S., & Zwitserlood, P. (2008). Syntactic structure and artificial grammar learning: The learnability of embedded hierarchical structures. *Cognition*, 107, 763-774.
- Monaghan, P., Christiansen, M.H., & Chater, N. (2007). The Phonological Distributional coherence Hypothesis: Cross-linguistic evidence in language acquisition. *Cognitive Psychology*, 55, 259-305.

- Monaghan, P. & Shillcock, R.C. (2007). Levels of description in consonant/vowel processing: Reply to Knobel and Caramazza. *Brain and Language*, 100, 101-108.
- Farmer, T., Christiansen, M.H., & Monaghan, P. (2006). Phonological typicality influences on-line sentence comprehension. *Proceedings of the National Academy of Sciences*, 103, 12203-12208.
- Monaghan, P., Chater, N. & Christiansen, M.H. (2005). The differential contribution of phonological and distributional cues in grammatical categorisation. *Cognition*, 96, 143-182.
- Onnis, L., Monaghan, P., Richmond, K., & Chater, N. (2005). Phonology impacts segmentation in speech processing. *Journal of Memory and Language*, 53, 225-237.
- Monaghan, P. & Shillcock, R.C. (2004). Hemispheric asymmetries in cognitive modeling: Connectionist modeling of unilateral visual neglect. *Psychological Review*, 111, 283-308.
- Monaghan, P., Shillcock, R.C. & McDonald, S. (2004). Hemispheric asymmetries in the split-fovea model of semantic processing. *Brain and Language*, 88, 339-354.
- Monaghan, P. & Pollmann, S. (2003). Division of labor between the hemispheres for complex but not simple tasks: An implemented connectionist model. *Journal of Experimental Psychology: General*, 132, 379-399.
- Monaghan, P. & Shillcock, R.C. (2003). Connectionist modelling of the separable processing of consonants and vowels. *Brain and Language*, 86, 83-98.
- Shillcock, R.C. & Monaghan, P. (2001). The computational exploration of visual word recognition in a split model. *Neural Computation*, 13, 1171-1198.
- Shillcock, R. Ellison, M.T. & Monaghan, P. (2000). Eye-fixation behaviour, lexical storage and visual word recognition in a split processing model. *Psychological Review*, 107, 824-851.
- Oberlander, J., Monaghan, P., Cox, R., Stenning, K., & Tobin, R. (1999). Unnatural language discourse: an empirical study of multimodal proof styles. *Journal of Logic, Language and Information*, 8, 363-384.
- Monaghan, P. & Shillcock, R. (1998). The cross-over effect in unilateral neglect: modelling detailed data in the line-bisection task. *Brain*, 121, 907-921.
- Shillcock, R., Kelly, M.L., & Monaghan, P. (1998). Processing of palindromes in neglect dyslexia. *Neuroreport*, 9, 3081-3083.

#### *Peer-reviewed Conference Proceedings*

- Monaghan, P., Arciuli, J., & Seva, N. (2008). Constraints for computational models of reading: Evidence from learning lexical stress. *Proceedings of the 30th Annual Conference of the Cognitive Science Society*. Mahwah, NJ: Lawrence Erlbaum.
- Pagliuca, G. & Monaghan, P. (2008). Variable vulnerability of words to visual impairment: exploring grain-size effects in reading. *Proceedings of the 30th Annual Conference of the Cognitive Science Society*. Mahwah, NJ: Lawrence Erlbaum.
- St Clair, M.C. & Monaghan, P. (2008). Language abstraction: Consolidation of language structure during sleep. *Proceedings of the 30th Annual Conference of the Cognitive Science Society*. Mahwah, NJ: Lawrence Erlbaum.
- Monaghan, P. & Christiansen, M.H. (2006). Why form-meaning mappings are not entirely arbitrary in language. *Proceedings of the 28th Annual Conference of the Cognitive Science Society*. Mahwah, NJ: Lawrence Erlbaum.
- Pagliuca, G., & Monaghan, P. (2006). Dissociating word reading and lexical decision in neglect. *Proceedings of the 28th Annual Conference of the Cognitive Science Society*. Mahwah, NJ: Lawrence Erlbaum.
- Monaghan, P., Chater, N., & Hulme, C. (2005). Levels of representation in language development. *Proceedings of the 27th Annual Conference of the Cognitive Science*

*Society*. Mahwah, NJ: Lawrence Erlbaum.

- St Clair, M.C. & Monaghan, P. (2005). Categorizing grammar: Differential effects of preceding and succeeding contextual cues. *Proceedings of the 27th Annual Conference of the Cognitive Science Society*. Mahwah, NJ: Lawrence Erlbaum.
- Monaghan, P. & Christiansen, M.H. (2004). What distributional information is useful and useable in language acquisition? *Proceedings of the 26th Annual Conference of the Cognitive Science Society*, pp.963-968. Mahwah, NJ: Lawrence Erlbaum.
- Onnis, L., Monaghan, P., Christiansen, M.H., & Chater, N. (2004). Variability is the spice of learning and a crucial ingredient for detecting and generalizing in nonadjacent dependencies. *Proceedings of the 26th Annual Conference of the Cognitive Science Society*, pp.1047-1052.
- Monaghan, P., Chater, N. & Christiansen, M.H. (2003). Inequality between the classes: Phonological and distributional typicality as predictors of lexical processing. *Proceedings of the 25th Annual Conference of the Cognitive Science Society*.
- Monaghan, P., Gonitzke, M. & Chater, N. (2003). Two wrongs make a right: Learnability and word-order consistency. *Proceedings of the 25th Annual Conference of the Cognitive Science Society*.
- Reali, F., Christiansen, M.H. & Monaghan, P. (2003). Phonological and distributional cues in syntax acquisition: Scaling-up the connectionist approach to multiple-cue integration. *Proceedings of the 25th Annual Conference of the Cognitive Science Society*.
- Monaghan, P. & Shillcock, R.C. (2001). Applying neuroanatomical distinctions to connectionist cognitive modelling. In R. French (Ed.) *Proceedings of the 6th Neural Computation and Psychology Workshop*. London: Springer-Verlag, pp.1-12.
- Monaghan, P. & Shillcock, R.C. (2001). Connectionist modelling of semantics using context vectors. *Sempro-2001: Cognitively Plausible Models of Semantic Processing*. Edinburgh, July 2001.
- Shillcock, R.C. & Monaghan, P. (2001). Understanding dyslexia in terms of the neuro-anatomy of normal visual word recognition. In *Proceedings of the 5th British Dyslexia Association International Conference*.
- Shillcock, R.C. & Monaghan, P. (2001). Connectionist modelling of surface dyslexia based on foveal splitting: Impaired pronunciation after only two half pints. *Proceedings of the 23rd Annual Conference of the Cognitive Science Society*. Edinburgh: Lawrence Erlbaum Associates, pp.916-921.
- Monaghan, P., Stenning, K., Oberlander, J. & Sönströd, C. (1999). Integrating psychometric and computational approaches to individual differences in multimodal reasoning. *21st Annual Conference of the Cognitive Science Society*. Vancouver: Lawrence Erlbaum Associates, pp.405-410.
- Shillcock, R., Ellison, M.T. & Monaghan, P. (1999). The optimal behaviour of a split model of word recognition resembles observed fixation behaviour. *Proceedings of the 21st Annual Conference of the Cognitive Science Society*. Vancouver: Lawrence Erlbaum Associates, pp.653-658.
- Shillcock, R., Monaghan, P. & Ellison, M.T. (1999). The SPLIT model of visual word recognition: Complementary connectionist and statistical cognitive modelling. In D.Heinke, G.W.Humphreys & A.Olson (Eds.) *Connectionist Models in Cognitive Neuroscience: The 5th Neural Computation and Psychology Workshop*. London: Springer-Verlag, pp.3-12.
- Monaghan, P. (1998). Modelling individual differences in reasoning. *Proceedings of the 2nd European Conference on Cognitive Modelling*. Nottingham University Press, Nottingham.
- Monaghan, P. & Stenning, K. (1998). Effects of representational modality and thinking

style on learning to solve reasoning problems. *Proceedings of the 20<sup>th</sup> Annual Conference of the Cognitive Science Society*. Madison, WI: Lawrence Erlbaum Associates, pp.716-721.

- Shillcock, R. & Monaghan, P. (1998). Using physiological information to enrich the connectionist modelling of normal and impaired visual word recognition. *Proceedings of the 20<sup>th</sup> Annual Conference of the Cognitive Science Society*. Madison, WI: Lawrence Erlbaum Associates, pp.945-950.
- Oberlander, J., Cox, R., Monaghan, P., Stenning, K., & Tobin, R. (1996). Individual differences in proof structures following multimodal logic teaching. *Proceedings of the 18<sup>th</sup> Annual Meeting of the Cognitive Science Society*. La Jolla, CA: Lawrence Erlbaum Associates, pp.201-206.

#### *Important notes, reviews and review articles*

- Monaghan, P. (2006). Left and right brain: Insights from neural networks. *The Psychologist*, 19 (5), 274-277. (Reprinted in *Psychomedia*, 10, 18-21.)
- Monaghan, P. & Christiansen, M.H. (2006). Iconic versus arbitrary mappings and the cultural transmission of language. In Cangelosi, A., Smith, A.D.M., & Smith, K. (Eds.), *The evolution of language: Proceedings of the 6<sup>th</sup> international conference (EVOLANG6)*, pp.430-1. Singapore: World Scientific.
- Monaghan, P., Chater, N. & Christiansen, M.H. (2003). Multiple Cue Integration in Language Acquisition. Talk presented at the *German Linguistics Society Conference*. Munich, March 2003.
- Shillcock, R.C., McDonald, S. & Monaghan, P. (2003). Reading and the split fovea. Commentary on Reichle et al., The E-Z Reader model of eye movement control in reading: Comparisons to other models. *Behavioral and Brain Sciences*.
- Monaghan, P. & Pollmann, S. (2002). Modelling inter- and intra-hemispheric processing. Talk presented at the *Sixth International Conference on Cognitive and Neural Systems*. Boston, May 2002.
- Monaghan, P., Shillcock, R.C., Lavidor, M. & Ellis, A. (2001). Hemispheric asymmetries in lexical decision. Talk presented at the *Twelfth Conference of the European Society for Cognitive Psychology*. Edinburgh, September 2001.
- Payne, L., Boardman, R., Monaghan, P. & Shillcock, R. (1999). A split connectionist model of visual errors in deep dyslexia. Poster presented at *AMLaP-99, Architecture and Mechanisms for Language Processing*. Edinburgh, September 1999.
- Monaghan, P. (1999). Learning style and restraining the language: Individual differences in solving syllogisms. Talk presented at the *Eleventh Conference of the European Society for Cognitive Psychology*. Gent, September 1999.
- Monaghan, P. & Stenning, K. (2000). Individual differences in belief bias effects in reasoning. Talk presented at the *Fourth International Conference on Thinking*. Durham, August 2000.
- Monaghan, P., Kelly, M.L. & Shillcock, R. (1998). Connectionist modelling of neglect dyslexia. Poster presented at the *Neural Modeling of Cognitive and Brain Disorders Workshop*. Maryland, June 1998.
- Shillcock, R. & Monaghan, P. (1998). Foveal splitting and modelling word recognition. Poster presented at the *Neural Modeling of Cognitive and Brain Disorders Workshop*. Maryland, June 1998.

#### *Book Chapters*

- Monaghan, P. & Christiansen, M.C. (2008). Integration of multiple probabilistic cues in syntax acquisition. In Behrens, H. (Ed.), *Corpora in language acquisition research: History, methods, perspectives*, pp.139-164. Amsterdam: John Benjamins.

- Pagliuca, G. & Monaghan, P. (2008). Grain size effects in reading: Insights from connectionist models of impaired reading. In French, R.M. & Thomas, E. (Eds.), *From associations to rules: Connectionist models of behavior and cognition, proceedings of the 10<sup>th</sup> neural computation and psychology workshop*, pp.89-99. Hackensack, NJ: World Scientific.
- Christiansen, M.H. & Monaghan, P. (2006). Discovering verbs through multiple-cue integration. In K. Hirsh-Pasek & R.M. Golinkoff (Eds.), *Action meets word: How children learn verbs* (pp.88-107). Oxford: Oxford University Press.
- Shillcock, R.C. & Monaghan, P. (2004). Reading, sublexical units and scrambled words: Capturing the human data. *Proceedings of the 8<sup>th</sup> Neural Computation and Psychology Workshop*. World Scientific.
- Stenning, K. & Monaghan, P. (2003). Strategies and knowledge representation. Sternberg, R. & Leighton, J.P. (Eds.) *The Nature of Reasoning* (pp.129-168). Cambridge University Press.
- Monaghan, P. & Stenning, K. (2003). Generalising individual differences and strategies across different deductive reasoning domains. D. Hardman & L. Macchi (Eds.) *Thinking: Psychological Perspectives on Reasoning, Judgment and Decision Making* (pp.45-62). Chichester: Wiley.
- Hicks, J. & Monaghan, P. (2001). Explorations of the interaction between split processing and stimulus types. In S. Wermter, J. Austin & D. Willshaw (Eds.) *Emergent Computational Neural Architectures Based on Neuroscience*. Springer: Heidelberg.
- Stenning, K. & Monaghan, P. (2000). Linguistic and graphical representations and the characterisation of individual differences. In S. O Nualláin (Ed.) *Spatial Cognition*. Amsterdam: John Benjamins.
- Shillcock, R., Kelly, M.L., & Monaghan, P. (1997). Modelling within-category function word errors in language impairment. In W. Ziegler & K. Deger (Eds.) *Clinical Linguistics and Phonetics*. Whurr: London.

### **Research collaborations:**

Joanne Arciuli: stress patterns in speech.

Nick Chater: language and information theory. Minimum description length, Kolmogorov complexity, and Bayesian approaches to language processing.

Morten Christiansen: artificial language processing, impact of phonology on language acquisition and structure of the lexicon.

Andrew Ellis: age of acquisition. MEG and fMRI of reading processes.

Richard Shillcock: hemispheric communication and language processing: computational and statistical modeling of language.