

## Dr Ulrik Beierholm

Lecturer in Computational Neuroscience

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### About

Dr Beierholm is a computational neuroscientist researching issues on theoretical models of information processing at the behavioural level, i.e. how perceptual stimuli and cognitive instructions lead to human decisions and actions.

Dr. Beierholm is part of the [Centre for Computational Neuroscience and Cognitive Robotics \(CNCR\)](http://www.birmingham.ac.uk/research/activity/cncr/index.aspx) (<http://www.birmingham.ac.uk/research/activity/cncr/index.aspx>)

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### Qualifications

- B.Sc. (Physics, University of Copenhagen, 1999)
- M.Sc. (Physics, University of Copenhagen, 2001)
- PhD (Computation and Neural Systems, Caltech, 2007)

### Biography

Dr Ulrik Beierholm studied physics at University of Copenhagen before deciding on a research career in Neuroscience. From 2001 to 2007 he was a PhD student at the California Institute of Technology (Caltech) in the Computation and Neural Systems program, being rewarded a Fulbright fellowship. After his studies he completed further post-doctoral training at the Gatsby Computational Neuroscience Unit (at UCL) in London where he worked with Professor Peter Dayan on modelling learning and decision making while on a Marie Curie Reintegration grant.

### Teaching

- Introduction to Learning
- Introduction to Computational Methods (MSc)
- Advanced Computational Methods (MSc)
- Minds, Brains and Models (MSc)

### Postgraduate supervision

New students are always welcome to enquire via email about potential research positions/placements. See also [Dr Beierholm's FindAPhD page](http://www.findaphd.com/search/ProjectDetails.aspx?PJID=34647&LID=148) (<http://www.findaphd.com/search/ProjectDetails.aspx?PJID=34647&LID=148>).

### Research

Statistical learning models provide a powerful framework for analyzing and modeling human behavior and decision making. Dr Beierholm's research focuses on developing such models to understand human choices in perception, cognition and learning, and on testing them through psychophysics and fMRI.

Examples of research questions include:

- How do we learn based on rewards and punishment in our environment?
- What role does prior expectations about the structure of our environment play in our perception of it?
- How do we process uncertainty in e.g. a gambling task or in a spatial reaching task?
- How do different learning and control systems (e.g. habitual and cognitive) interact in human behavior and how are they presented in the brain?

### Other activities

Member of British Neuroscience Association, Society for Neuroscience and Society for Neuroeconomics.

Editor of the Bayesian section of the Springer 'Encyclopedia of Computational Neuroscience'

## Publications

Beierholm, U.R., Guitart-Masip, M., Economides, M., Chowdhury, R., Duzel, E., Dolan R. & Dayan P. (2013) Dopamine Modulates Reward-Related Vigor. *Neuropsychopharmacology*, 38: 1495-1503.

Guitart-Masip, M., Beierholm, U. R., Dolan, R., Duzel, E., & Dayan, P. (2011). Vigor in the Face of Fluctuating Rates of Reward: An Experimental Examination. *Journal of cognitive neuroscience*. doi:10.1162/jocn\_a\_00090

Beierholm, U. R., Anen, C., Quartz, S., & Bossaerts, P. (2011). Separate encoding of model based and model free valuations in the human brain. *NeuroImage*, 58(3), 955-962. doi:10.1016/j.neuroimage.2011.06.071

Wunderlich, K., Beierholm, U., Bossaerts, P., & O'Doherty, J. P. (2011). The human prefrontal cortex mediates integration of potential causes behind observed outcomes. *Journal of neurophysiology*. doi:10.1152/jn.01051.2010

Shams, Ladan, & Beierholm, Ulrik R. (2010). Causal inference in perception. *Trends in Cognitive Sciences*. doi:10.1016/j.tics.2010.07.001

Wozny, D. R., Beierholm, Ulrik R., & Shams, Ladan. (2010). Probability Matching as a Computational Strategy Used in Perception. (L. T. Maloney, Ed.) *PLoS Computational Biology*, 6(8), e1000871. doi:10.1371/journal.pcbi.1000871

Beierholm, Ulrik R., & Dayan, P. (2010). Pavlovian-Instrumental Interaction in "Observing Behavior." (T. Behrens, Ed.) *PLoS Computational Biology*, 6(9), e1000903. doi:10.1371/journal.pcbi.1000903

Beierholm, UR, Quartz, SR, & Shams, L. (2009). Bayesian priors are encoded independently from likelihoods in human multisensory perception. *Journal of Vision*, 9(5), 23. doi:10.1167/9.5.23.

Beierholm, U.R., Kording, K. P., Shams, L., & Ma, W. J. (2008). Comparing Bayesian models for multisensory cue combination without mandatory integration. *Advances in neural information processing systems*, 20, 81–88.

Wozny, D. R., Beierholm, Ulrik R., & Shams, Ladan. (2008). Human trimodal perception follows optimal statistical inference. *Journal of Vision*, 8, 1-11. doi:10.1167/8.3.24.

Körding, K. P., Beierholm, U., Ma, W. J., Quartz, S., Tenenbaum, J. B., & Shams, L. (2007). Causal inference in multisensory perception. *Plos One*, 2(9). doi:10.1371/journal.pone.0000943

