Three Postdoctoral Research Associates (UCL and QMUL)

Job Description Post 1

Job Title: Postdoctoral Research Associate

Department: Psychology

Reports to: Prof Alan Johnston

Grade: 7

Main Purpose

The post-holder will carry out research on dynamic face perception. This will include designing and running psychophysical experiments, analyzing the results, and writing these up for publication. The post-holder will be an integral member of the research team.

Duties and Responsibilities

- To contribute to the design of a range of experiments related to dynamic face perception.
- To set up and run experiments in consultation with Prof Johnston, ensuring that experiments are appropriately supervised and supported. To record, analyse and write up the results of experiments.
- To prepare and present findings of research activity to colleagues for review purposes.
- To prepare progress reports on research for funding bodies as required.
- To contribute to the preparation and drafting of research bids and proposals.
- To contribute to the overall activities of the research team and department as required.
- To contribute to the induction, direction and support of other research staff and students as requested.
- Responsible for ensuring that equipment is safe and maintained in working order.
- As duties and responsibilities change, the job description will be reviewed and amended in consultation with the post-holder.
- The post-holder will carry out any other duties as are within the scope, spirit and purpose of the job as requested by the line manager or Head of Department/Division.

- The post-holder will actively follow UCL policies including Equal Opportunities and Race Equality policies.

The post-holder will maintain an awareness and observation of Fire and Health & Safety Regulations.

The post-holder will act as Seminar Leader for an undergraduate seminar group for one term per year.

Personal Specification for the Postdoctoral Research Associate Post 1

Knowledge - including Qualifications

- PhD in an area related to Cognitive Science, Experimental Psychology or Neuroscience

Relevant Skills

- Basic research skills
- Ability to make video recordings and use existing software to generate novel stimulus sequences
- Ability to use computer packages to manipulate video sequences, create experiments and analyse data
- Ability to program in at least one computer language, preferably MATLAB
- Ability to present complex information effectively to a range of audiences
- Effective written and verbal communication skills including proven ability to write up data, evidenced through publication record (including papers in international peer-reviewed journals)
- Problem-solving abilities

Relevant Experience

- Experience with MATLAB and programming languages
- Experience of multi-disciplinary research environment
- Experience of video-based research
- Experience with motion tracking

Personal Qualities

- Ability to work collaboratively and as part of a team
- Conscientiousness, reliability and a commitment to high quality research
- Excellent personal and communication skills
- Deep interest in human visual mechanisms
- Deep interest in inter-disciplinary research
- Commitment to UCL's policy of equal opportunity and the ability to work harmoniously with colleagues and students of all cultures and backgrounds

Job Description & Person Specification for Post 2

Job description and person specification for post 2 can be found at:
http://www.psychol.ucl.ac.uk/info/JohnstonFacesRA.pdf

Job Description Post 3

Job Title: Postdoctoral Research Associate

Department: Psychology

Reports to: Prof Alan Johnston

Grade: 7

Main Purpose

The post-holder will carry out research in the perception of global motion. This will include designing and running psychophysical experiments, analyzing the results, and writing these up for publication. The post-holder will be an integral member of the research team.

Duties and Responsibilities

- To contribute to the design of a range of experiments related to global motion perception.
- To set up and run experiments in consultation with Prof Johnston, ensuring that experiments are appropriately supervised and supported. To record, analyse and write up the results of experiments.
- To prepare and present findings of research activity to colleagues for review purposes.
- To prepare progress reports on research for funding bodies as required.
- To contribute to the preparation and drafting of research bids and proposals.
- To contribute to the overall activities of the research team and department as required.
- To contribute to the induction, direction and support of other research staff and students as requested.
- Responsible for ensuring that equipment is safe and maintained in working order.

- As duties and responsibilities change, the job description will be reviewed and amended in consultation with the post-holder.

- The post-holder will carry out any other duties as are within the scope, spirit and purpose of the job as requested by the line manager or Head of Department/Division.

- The post-holder will actively follow UCL policies including Equal Opportunities and Race Equality policies.

- The post-holder will maintain an awareness and observation of Fire and Health & Safety Regulations.

- The post-holder will act as Seminar Leader for an undergraduate seminar group for one term per year.

Personal Specification for the Postdoctoral Research Associate Post 3

Knowledge - including Qualifications

- PhD in an area related to Cognitive Science, Experimental Psychology or Neuroscience

Relevant Skills

- Basic research skills
- Ability to make psychophysical measurements or eye movement recordings
- Ability to use computer packages to create experiments and analyse data
- Ability to program in at least one computer language, preferably MATLAB
- Ability to present complex information effectively to a range of audiences
- Effective written and verbal communication skills including proven ability to write up data, evidenced through publication record (including papers in international peer-reviewed journals).
- Problem-solving abilities.

Relevant Experience

- Experience of psychophysical, modelling and eye-tracking techniques
- Experience with MATLAB and programming languages
- Experience of multi-disciplinary research environment

Personal Qualities

- Ability to work collaboratively and as part of a team
- Conscientiousness, reliability and a commitment to high quality research
- Excellent personal and communication skills
- Deep interest in human visual mechanisms
- Deep interest in inter-disciplinary research

- Commitment to UCL's policy of equal opportunity and the ability to work harmoniously with colleagues and students of all cultures and backgrounds

Further information

The Department of Psychology was rated 5* in the 2001 RAE exercise. UCL provides one of the richest research environments internationally for work on visual information processing, with a large number of seminar series attracting international speakers. Professor Johnston is the Director of Vision@UCL an interdisciplinary network for vision research in London, which has its own interdisciplinary seminar series www.vision.ucl.ac.uk - and Deputy Director of CoMPLEX (Neuroinformatics) – www.complex.ucl.ac.uk which is an interdisciplinary centre supporting the use of mathematics, computing and engineering in the Life Sciences. Many researches in the Department are also members of the Institute of Cognitive Neuroscience and there are close links with the Institute of Ophthalmology and the Gatsby Computational Neuroscience Unit. The Vision Group has ample computing and experimental facilities with motion analysis, motion perception, dynamic face perception and temporal perception as key areas of research. The successful candidate will join an interdisciplinary group working at the interface between Experimental Psychology, Computer Science and Mathematical Biology. (see also www.psychol.ucl.ac.uk/info/about.htm)

The Computer Vision group at QMUL is one of the largest in the UK and internationally leading in its work on the extraction of object behaviour models and dynamic face models from image sequences and live video (www.dcs.qmul.ac.uk/research/vision/). The work has been widely applied to vehicle and people detection, object tracking, counting and recognition in public space CCTV, human gesture recognition for visually mediated interaction and abnormal behaviour recognition in visual surveillance. A current significant focus is in crime prevention, with work on real-time surveillance and biometrics. Core expertise includes dynamic scene analysis, mathematical modelling, multi-view geometry, pattern recognition and learning, biologically inspired vision and image compression. An additional new research line concerns the extraction of 3D information from image sequences using geometric information. In particular, research is being carried out into self-calibration of cameras and 3D metric reconstruction of scenes viewed by uncalibrated cameras. Work is also being undertaken to develop novel computer vision algorithms and hardware based on neurobiological principles. Profs Johnston and McOwan have a 15 year history of successful collaboration. (see also www.dcs.qmul.ac.uk/)

Project Summary - Non-technical (Posts 1 and 2)

Analysing Dynamic Change in Faces (EPSRC)

- To develop new tools for 3D facial motion capture and analysis.
- To characterise modes of variation in meaningful segments of facial motion

- To utilise artificially generated stimuli and novel measurement techniques to allow psychophysical experiments exploring the perception of facial action and the imitation of human facial motion.

- To deliver interdisciplinary science based educational outreach to UK schools

Humans are very good at understanding and interpreting the motion of others peoples faces. We can effortlessly recognise emotions and interpret subtle facial behaviours such as sardonic smiles, thoughtful frowns or questioning looks, but the question remains, how do we do this? We need new computer based tools to be able to explore this fascinating area of psychology. In this project we will develop a new form of three-dimensional camera system that will allow us to record the movements of people's faces and then process this video information to discover the components of movements that go to make them up. Once we are able to discover the parts of movements that add together to make familiar facial expression we can use this to be able to create new faces; in much the same way as a music mixing desk allows you to blend together different sounds, we will have software that allows us to mix new faces with whatever expressions we select. Using this new tool we can then carry out experiments to look at how we process faces and imitate other people's facial movement. We will examine how observing the movement in one persons face can be translated into movements of our own face to imitate the action. Because the faces we use are created in the computer we can manipulate them in any way we like. This new technology will allow us to address a large set of basic questions. Can we imitate a person if the face seen only from the side or if it is shown upside down? Do we do better when we imitate our self, a friend or a stranger? We can even create caricatures of faces, where we exaggerate particular movements, to evaluate how these facial gestures are represented in the human face processing system. A better understanding of how imitation works will help us understand social behaviours and their development, and also help in developing computer systems that can both recognise and react to our facial expressions. The new face mixing software will also have commercial applications, for example it can be of use in the computer games and entertainment industry. Movements from one persons face can be used as the instructions to be transferred to create another persons face making the same movement. This will allow for example a voice actor to control the movements of a characters face in addition to simply providing the expressive dialogue, the generation of high quality realistic synthetic actors or faster more efficient ways to video conference over your mobile phone.

Project Summary (Post 3)

From Local to Global Motion Perception (BBRSC)

- To develop a new model of global motion perception based on local interactions between elements representing the computed local velocity field.

- To look for properties in human global motion perception that are characteristic of the operation of a local, iterative, distributed, rule-based mechanisms.

- Specifically, we will investigate the effects of stimulus density on perceived direction and speed in Gabor arrays.

- We will use the ocular following response to measure dynamic changes in perceived global direction.

- We will use psychophysical techniques and the ocular following response to study the factorisation of the local velocity field into local and global components.

- We will provide model fits to the data to explain how these global measures reflect local rules and operations.

General Summary

A good example of global motion is the experience you have of snow flakes blown by the wind. You know there is a global cause - the wind, but that realisation is carried by the motion of each individual snowflake. A single snowflake doesn't carry enough information about the global pattern. The question is, how do visual neurones that only see a small part of the snow storm deliver an impression of the global motion? The standard explanation is that in higher areas of the brain neurones add up the signal from many neurones, each of which respond to a part of the display. The problem with this idea is that these neurones would attribute a single value for their whole field, the motion of each snowflake would be lost and the process would average over areas that need to be kept distinct, like the motion of a person in front of a window with the snow storm behind. The motion of a flock of starlings appears to be directed, but actually it has been shown that one can explain the global collective behaviour with a few simple rules. Idealised versions of these systems have been applied to diverse problems in computer science including solving global optimisation problems. We think that this general approach can resolve the conundrum of how to link local and global motion perception. We intend to build a model to investigate what global effects a particular set of local rules for combining local motion might have. We also intend to investigate visual motion phenomena that appear to indicate (because they show a dependence on spatial density, or evolve over time, or show some change in global motion due to local influences) that the human visual system contains a dynamic, evolving global motion system, which can represent large scale events while remaining locally precise.

Technical Summary

The linking of local and global information remains a fundamental problem for vision science. We need to characterise the motion of objects and surfaces but neurones in the early part of the cortical pathway only see a very small portion of the object. Because of the aperture problem the average of the local estimates of velocity always provides an underestimate of the true object motion. Information from different parts of the object needs to be combined in a way that takes into account the relationship between local and global motion. In addition, simply averaging local motion signals will blur any motion discontinuities at object boundaries that provide important information for image segmentation. Taking inspiration from work on collective animal behaviour, such a schooling and flocking, in which complex behaviour can be modelled using simple local rules, and recognising the successes in computer science that have come from abstracting and generalising these systems to solve global optimisation problems, we intend to investigate whether global motion percepts can be arrived at by the propagation of information through local interactions. One aim is the partitioning of the velocity estimates locally into global and local motion components. We will also investigate whether the global motion system exhibits behaviour characteristic of a local

interactive rule-based system, such a dependency on the density and spatial distribution of elements, evolution of a global solution over time and hysteresis. We will also develop mathematical and computational models to manage the complexity of generating global predictions from local rules.