March 2012

MEDICAL RESEARCH COUNCIL COGNITION AND BRAIN SCIENCES UNIT

NEWSLETTER

WHAT'S INSIDE

MRC | Cognition and Brain Sciences Unit

OUR UNIQUE RESOURCE - YOU

If you're reading this it's probably because you've already been to the Unit and participated as a volunteer in one of our studies. Already, you've done more than most people do to help researchers advance their studies into many of the diseases and conditions that affect us all throughout our lives. At the CBSU we would be unable to continue our work without your support - but we still need your help.

We ask you to keep spreading the word. Statistics show that our biggest recruitment aid is you, i.e. word of mouth. So, keep telling your friends and family about your experiences of volunteering at the Unit and encourage them to join the Panel.

Our volunteer panel, established over 20 years ago, is a unique resource with several thousand volunteers of all ages. It is an invaluable pool of volunteers for our researchers – but we always need new people to join.

Many of our researchers need to test up to a 100 different people for a particular project without using the same person twice, which is why we need a constant supply of new volunteers.

So, if you've already been to the Unit and participated in a test – why not come again and do another one soon – and you don't even have to wait for us to contact you. You can sign up for studies directly on our online system, and may even be able to find two studies ongoing at the same time and come with a friend.

If you're reading about us for the first time, or have been thinking of volunteering but 'putting it off' – take action now! We need everyone, and most people find it a rewarding experience and enjoy learning a bit more about 'brain science'. Our researchers will always be happy to explain their study to you and will never expect you do anything you are not happy with.

One valued volunteer who was recently interviewed for a University article was quoted as saying: 'Since I started volunteering 10 or 12 years ago I've become really interested.....one study I did was about early-onset Parkinson's Disease. I had to do a series of brain-hand coordination tests and these were repeated while I was in an MRI scanner. In the waiting room I met the wife of a patient and realised that my volunteering was having a real impact on people with diseases like Parkinson's. It really hit home,' she says.

Therefore, if you too want to make a difference to people like that, make 2012 the year you do something positive for research.

Signing up for studies couldn't be easier. Just logon to our online system at: http://mrc-cbu.sona-systems.com If you're a new volunteer you will be prompted to set up an account and complete some pre-screen questions. Then you can view the current studies for which you are eligible and sign up for them.

Thank you!

NEWS IN BRIEF

€1.5 million ERC grant for visual perception study

Nikolaus Kriegeskorte, a senior scientist in the Memory and Perception group has been awarded a Starting Grant from the European Research Council for investigating our visual perception and recognition of real-world objects. Object recognition is a still poorly understood key problem of systems neuroscience and artificial intelligence. Whereas high-level cognitive abilities like proving mathematical theorems and playing chess can be replicated in computers at a level matching or exceeding humans, the simple act of naming the objects in a visual scene turns out to be a very hard engineering challenge. The €1.5 million grant includes funding for staff members in Cambridge and Oxford to investigate the sequence of representational stages underlying object recognition and what in data. The central idea is to present the same real-world object images to human subjects and computer algorithms, have them perform closely matched recognition tasks on the images, and compare their internal representations, as measured with functional magnetic resonance imaging (fMRI).

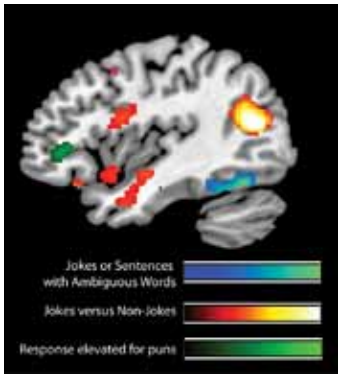
The importance of wearing a cycle helmet, as told by a six year old

During Action for Brain Injury Week, CBSU Scientist Fionnuala Murphy visited a local Cambridge primary to speak to five and six-year olds about their brains. The children now know what their brains look like, that the wrinkly surface is called the cerebral cortex and that they are born with nearly 100 billion tiny brain cells, or neurons. They generated ideas about what their brains are for and learned that scientists describe the brain as 'plastic', meaning that it learns and changes with experience. For this reason, they agreed that it was a good idea not only to work hard at their maths and literacy but also to spend plenty of time running, playing, and creating things.
The children had fun drawing pictures to illustrate how they could protect their brains while cycling and scooting around Cambridge. Notice the helmets … as one child said succinctly, 'helmets protect your skin; your skin protects your skull; your skull protects your brain; and your brain is for clever thinking'.

If you would like a CBSU scientist to visit your school please get in touch, and we will try to arrange something.

Brain scan project reveals how our brain processes jokes

A new study from CBSU Scientists Tristan Bekinschtein and Matt Davis with colleagues Jenni Rodd at University College London, and Adrian Owen at the University of Western Ontario has compared how the brain responds to ambiguous words in jokes and in sentences. Volunteers in the study activate reward areas in the mid-brain and striatum when hearing jokes but not when hearing normal sentences. This reward response increased with how funny the study participants found each of the jokes.



In addition to these reward areas the study also found a characteristic pattern of activity in language regions of the brain when the jokes used were puns. For example, 'Why don't cannibals eat clowns? Because they taste funny!' works because of the two meanings of the word 'funny'. Puns like this one activated the inferior frontal gyrus – an area involved in selecting between word meanings – more than jokes that didn't involve wordplay, or non-humorous sentences that contained words with more than one meaning. Brain areas involved in accessing word meaning, such as the inferior temporal gyrus, respond to ambiguous words both in jokes and sentences. This finding builds on previous fMRI work that used ambiguous words and sentences as a neural marker for comprehension in sedated individuals and vegetative patients. Here we show how brain processes involved in selecting the right meaning of spoken words contribute to the pleasure of getting a joke.

Cambridge Science CBSU contribution

As in previous years last March saw an entertaining and educational evening of demonstrations and lectures at the CBSU as part of the Cambridge Science Festival. The very popular open evening format will be repeated for 2012 on Wednesday 14th March and will feature lectures from three of our leading scientists highlighting our varied research, plus the chance to take part in some of our experiments exploring how the mind and brain work. Hands on activities will run for the first hour with time to meet the scientists and students doing the research followed by three short talks. For more on the Cambridge Science Festival and the numerous events happening in Cambridge visit the CSF website:
http://comms.group.cam.ac.uk/sciencefestival/

Ian Nimmo-Smith elected as Mayor of Cambridge

Long-serving and recently retired member of the CBSU, Ian Nimmo-Smith has been honoured with the award of Mayor of Cambridge. Ian had long combined his work at the Unit with being a local councillor for over 20 years and was leader of Cambridge City Council for a record seven years. At the same time, Ian worked at the CBSU for 40 years as Statistician and Methods expert and helped design many of the experiments we still use, ensuring both scientific rigour and statistical veracity.
We are delighted Ian's long service to public life has been recognised with the mayorship and we wish him a happy reign.

Eventful educational visit enjoyed by all

For the second year running CBSU staff enjoyed playing host to 25 sixth-form students who were taking part in a neuroscience residential course that took place during October half term week at Villiers Park, a local Educational Trust. Villiers Park is a national charity working to remove some of the barriers that can prevent young people from making the most of the educational opportunities available to them, in particular helping young people from less advantaged backgrounds achieve their academic potential. The week long neuroscience course gave the students a great opportunity to develop an understanding of how the brain works and what happens when damage takes place. The CBSU was delighted to welcome the students for an afternoon of talks, activities and tours of the Unit, including a visit to the MEG lab, and some hands-on experiments. The afternoon was interrupted by a fire alarm and hour-long evacuation of the building while several fire engines attended an incident on-site, but our valiant speakers just carried on with their talks standing on a kerbstone in the front car park, and the students were amused but appreciative of our 'keep calm and carry on' approach.

New roof and paintwork for the CBSU

Regular visitors to the CBSU will have noticed the scaffolding and roofing work being carried out over the winter. The original Edwardian roof of the old house had certainly seen better days and after a series of leaks and other problems it was agreed that the old tiles and roofing material all needed replacing. The roofing firm have since removed not just the original tiles but also huge amounts of the old horsehair used for insulation, which has made it an interesting if somewhat dirty and unpleasant job. Work should be completed by Spring 2012.

Scans reveal differences in brain structure in teenagers with conduct disorder

Brain scans of aggressive and antisocial teenage boys with conduct disorder (CD) have revealed differences in the structure of the developing brain that could link to their behaviour problems. The study, by scientists at the CBSU and the University Department of Psychiatry reveals that the brain differences were present regardless of the age of onset of the disorder, challenging the view that adolescence-onset CD is merely a consequence of imitating badly behaved peers. CD is a psychiatric condition characterised by increased aggressive and antisocial behaviour. It can develop in childhood or in adolescence and affects around five out of every 100 teenagers in the UK. Those affected are at greater risk of developing further mental and physical health problems in adulthood. While the group have previously shown that individuals with both forms of conduct disorder display abnormal patterns of brain activity, this new work marks an important advance in understanding the biology of aggression and violence by showing that differences in brain structure are linked to the disorder.

The research was funded jointly by the Wellcome Trust and the MRC.

Barbara Wilson wins Ramon Y Cajal award

Barbara Wilson, long time member of staff at CBSU and now a Visiting Scientist at the Unit has recently received the Ramon Y Cajal award from the International Neuropsychiatric Association for outstanding contributions to neuropsychiatry. Her award lecture was entitled "The past, present and future of neuropsychological rehabilitation".

WELCOME

Graduate students at the CBSU

Each October we have a new intake of PhD students here at the CBSU, coming from all over the world to perform research at the Unit and to gain their PhD or MPhil from the University of Cambridge. Last year we welcomed five new faces, including three MRC funded students, and two funded by the various University of Cambridge scholarships schemes. MRC funded students are fully supported through three years of study, with the places restricted to UK nationals and other EU candidates who have lived in the UK for three years prior to study. The Gates Foundation and the Cambridge International Scholarship Scheme offer funding awards managed by the University of Cambridge, and scholarships are prestigious and very competitively awarded. We were again delighted to receive two awards for our students, reflecting the quality of the international students we attract to the Unit.

The new students are already taking part in Unit research and conducting their own experiments, working on topics such as memory control in patients with post traumatic Stress Disorder, optical illusions, the emotion hierarchy and face recognition.


Agnieszka Jaroslawska


Seyed Khaligh-Razavi


Alex Walther


Jonathan O'Keeffe


Georgina Smith


Moos Peeters

Duncan Astle, Executive Processes group

Duncan joined the CBSU in January 2012 from Royal Holloway, University of London. Duncan uses cognitive neuroscience techniques to explore how the brain develops through childhood into early adulthood. In particular he focuses on the development of short-term memory and attention, and the interplay between the two. Electroencephalography (EEG) and magnetoencephalography (MEG) are used because they can capture very rapid neural processes and are entirely non-invasive and safe to use with children. Over the coming years Duncan's programme will focus on the neural mechanisms that underpin developmental improvements in attention and memory, how they operate in children with memory deficits, and the extent to which we can boost these mechanisms with targeted intervention.


Duncan Astle

Lastly...

...we also welcomed some smaller collaborators this year – Clare Cook who worked in the MEG laboratory had a baby boy Harvey Arthur Dylan in November 2011, and Georgie Morrill who worked in the Imaging Administration team also had a baby boy in February 2012 named Felix.

GOODBYE

Some well known faces left the Unit during the last 12 months

We had a slight 'brain drain' when Adrian Owen and his team (Damian Cruse, Adam Hampshire, Beth Parkin) all moved to the University of Western Ontario, Canada where Adrian was awarded a highly prestigious Canada Excellence Research Chair (CERC) in Cognitive Neuroscience and Imaging and is now setting up a new research facility.

His departure also meant we lost Jessica Grahn, Adrian's wife and one of our favourite post-docs who studied music and the brain, and then in Spring 2011, Rhodri Cusack who had been at the Unit for over 10 years, and was one of key MRI innovators also joined them, along with his wife Lorina Naci who has also been working at the Unit as a post-doc researcher. They have now all settled in Canada but come back often to visit and continue to be collaborators on many CBSU projects. Beth Parkin has since returned to the UK and works once more at the Unit, now on the Cam-CAN project, see more on this later.

Ann-Marie Golden worked in the Emotion Group and was part of the original team of the Cambridge Centre for Affective Disorders (C2:AD). Ann-Marie had also been running Mindfulness training at the Unit for some time before leaving in August 2011 to take up a new post, also coincidentally in Canada, but hundreds of miles away from the others.

Philip Barnard had been at the Unit for nearly 40 years when he retired in Spring 2011. One of the earliest people to work on Human-Computer Interaction, Phil was a pioneer in the understanding of how we use machines and worked with IBM for many years on research projects. He continued this interest with one of his final projects working with the new Microsoft Sensecam technology exploring how the brain remembers events through captured images. Phil's other work included many different aspects of emotion research from anorexia nervosa through to depression and anxiety.

His later work also included a new interest in choreography and cognition, leading to some novel work with leading choreographer Wayne Macgregor. Phil was a major contributor to the success of the Unit from its' earliest days as the Applied Psychology Unit, and including stints as Assistant Director and Acting Director during the transition to the Cognition and Brain Sciences Unit. He continues to work as a Visiting Scientist with the Unit, and now claims to have published more papers since he left than in the previous few years of his paid time!


Adrian Owen


Damian Cruse


Adam Hampshire


Jessica Grahn


Rhodri Cusack


Lorina Naci

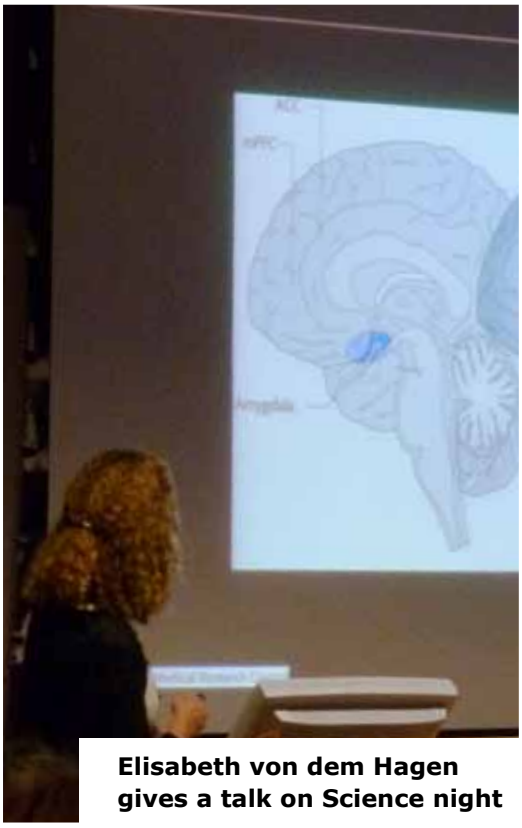

Ann-Marie Golden


Philip Barnard

2011 IN PHOTOS

Susan Gathercole gives her first talk as new Director at the Unit

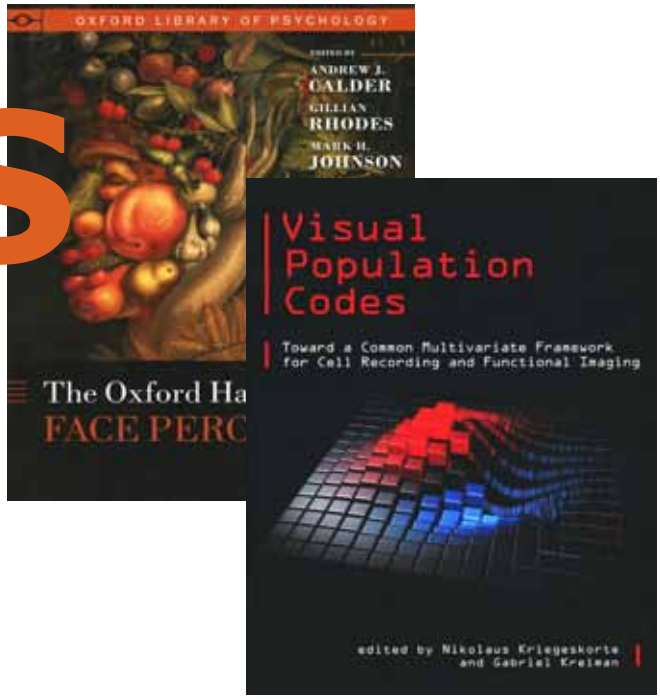
Former Director William Marslen-Wilson's farewell event



Elisabeth von dem Hagen gives a talk on Science night

Wear it Pink day at the Unit for Breast Cancer awareness

NEW BOOKS



The Oxford Handbook of Face Perception

One of the CBSU Programme Leaders, Andy Calder of the Emotion Group, and other leading researchers in face processing research produced "The Oxford Handbook of Face Perception", an edited volume providing the most comprehensive and commanding review of this field ever published.

The human face is unique among social stimuli in conveying such a variety of different characteristics. A person's identity, sex, race, age, emotional state, focus of attention, facial speech patterns, and attractiveness are all detected and interpreted with relative ease from the face. Humans also display a surprising degree of consistency in the extent to which personality traits, such as trustworthiness and likeability, are attributed to faces. In the past thirty years, face perception has become an area of major interest within psychology, with a rapidly expanding research base. Yet until now, there has been no comprehensive reference work bringing together this ever-growing body of research.

The Oxford Handbook of Face Perception looks at the functional and neural mechanisms underlying the perception, representation, and interpretation of facial characteristics, such as identity, expression, eye gaze, attractiveness, personality, and race. It examines the development of these processes, their neural correlates, congenital and acquired disorders resulting from their breakdown, and the theoretical and computational frameworks for their underlying mechanisms. With chapters by an international team of leading authorities from the brain sciences, the book is a landmark publication on face perception.

Visual Population Codes

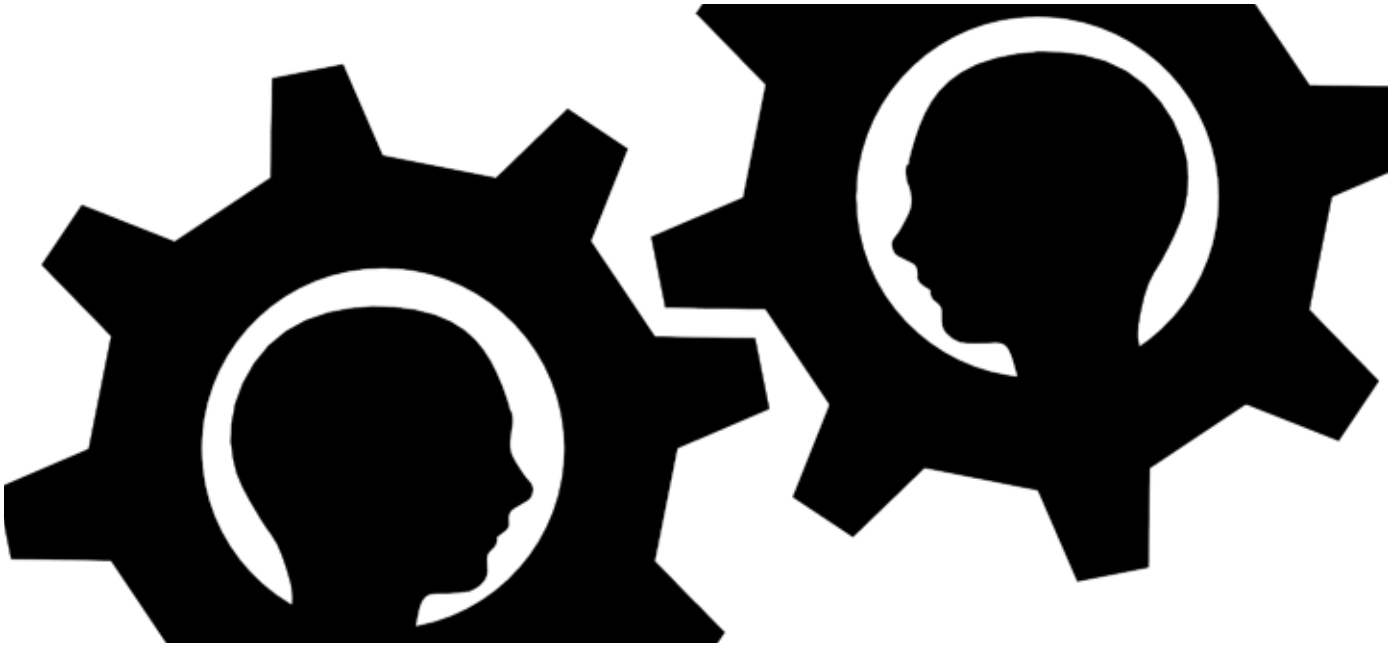
The CBSU's Nikolaus Kriegeskorte and Gabriel Kreiman of Harvard University edited the book "Visual Population Codes: Toward a Common Multivariate Framework for Cell Recording and Functional Imaging", which was published last November by MIT Press.

The book is about the representation of visual information in populations of neurons. Although the concept of "population code" appeared decades ago in neurophysiological studies of brain function, the dominant approach to measurement and analysis has been to focus on one cell or imaging voxel at a time and characterise its selectivity. Over the past decade, researchers have begun to analyse the information in complex activity patterns across populations of neurons.

The book describes the advances brought on by this approach along with the methods that made them possible. It may serve as an introduction, overview, and reference for scientists and graduate students across disciplines who are interested in vision and, more generally, in understanding how the brain represents and processes information. The book is organised according to the flow of visual information from the retina to the highest stages of ventral-stream processing.

NEW TREATMENT TRIAL LAUNCHED FOR CHILDREN

Richard Meiser-Stedman, Emotion Group



Clinical Psychologists within the CBSU's Emotion group have recently been awarded a £250,000 grant from the National Institute of Health Research (NIHR) "Research for Patient Benefit" programme to look at the treatment of post-traumatic stress disorder (PTSD) within 3-8 year olds. Their previous studies have shown that young children – contrary to popular belief – are just as susceptible as older children, teenagers and adults to experiencing psychiatric problems following traumatic events such as assaults and road traffic accidents. These reactions can, in some instances, last for months or even years – with a potentially huge impact on that child's later social functioning, academic success and mental health.

The importance of treating this reaction is clear. But how? Building on previous work Tim Dalgleish, Richard Meiser-Stedman and Anna McKinnon will look at how a form of psychological treatment called cognitive behavioural therapy (or "CBT") can be tailored for this vulnerable age group. The Cognition & Brain Sciences Unit has a long history of conducting research into CBT (mainly with depressed adults). These studies show time and again that the devil is in the detail – by identifying the particular mechanisms that maintain a psychiatric disorder, more effective and efficient treatments can be developed.

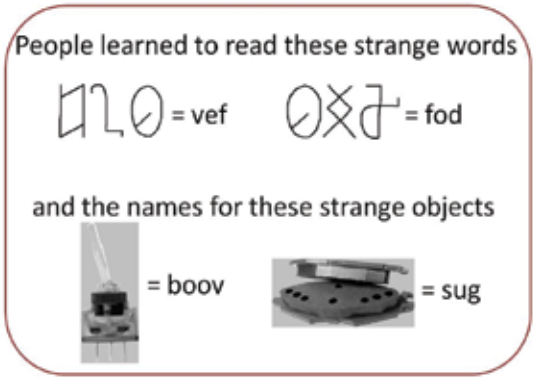
This new trial – dubbed "PYCES" (Parents and Young Children after Extreme Stress) – will not only look at whether PTSD can be successfully treated using a developmentally-tailored CBT programme, but also identify much more accurately the cognitive, biological and familial factors that put a young child at risk of this kind of psychiatric disturbance.

HOW DO WE LEARN TO READ?

Jo Taylor, Kathy Rastle and Matt Davis, Language Group

Can you remember what it was like learning to read? Or maybe you've got a child who's trying to learn?
Now think how effortlessly you read these sentences. As an adult we can read 250-300 words per minute, an incredible feat, especially when you consider that we can only listen to and comprehend comfortably about 180 words per minute. The efficiency with which we read text might suggest that a part of our brain is dedicated to, or specialised for reading. However, research has struggled to determine whether this is the case, for example, most studies find that the brain regions that people use for word reading are also activated when they name objects. Our research uses a new method to investigate whether there are special neural systems for reading: Artificial Language Learning – where we measure people's brain activity *whilst* they are learning to read.

In our experiment, adults who were members of our volunteer panel learned to read new words written in unfamiliar symbols. They also learned new names for strange looking objects. Some examples of these words and objects can be seen in the picture.



What makes these tasks different from each other is that each symbol in the words has a particular sound. People start to work out what sound each symbol makes and this helps them remember how to read the words. They can't do this with the objects so they just have to remember their names. By looking at people's brain activity during the experiment we can see which brain areas are most important for discovering the relationships between letters and sounds. This is really exciting because working out how to break words down into parts and apply letter-sound rules is arguably the most important skill children have to grasp when learning to read.

Learning to read English is particularly difficult due to its notoriously complex spelling system. Take the words tough, bough, cough and dough… oh, and hiccough, thorough, bought and through! Understanding how we learn all these irregularities is another key area in which we hope that Artificial Language Learning methods can help. In a recent experiment, members of our panel again learned to read new words written in unfamiliar symbols, like the ones in the picture. However, this time, some of the symbols had different pronunciations in different words!
By looking at brain activity as people learned these irregular spellings we can work out how they do so. Do they try and remember the visual form of irregular words more precisely? Or do they use their verbal memory to judge which pronunciation sounds right? We hope that discovering which brain systems help us learn the complexities of the English writing system will improve our understanding of why some children struggle with reading and spelling.

We're very excited about publishing the results of these experiments, some of which we have already presented at conferences and universities in the USA, Australia, Spain, and of course the UK! Our experiments also form part of a BBC4 documentary on Dyslexia, part of a series called Growing Children, which we're told is to be aired fairly soon so keep an eye out!

THE CAMCAN PROJECT

CAMBRIDGE CENTRE FOR AGEING AND NEUROSCIENCE

The CamCAN project began in October 2010 and will run for five years in the first instance. As more and more people in the UK are living to a 'ripe old age', it is important to understand how we can best maintain good cognitive health across our adult lives since 'ageing healthily' helps people to maintain independence, social connection and a sense of well-being.

Although the popular view of ageing is as a process of decline and decay, new scientific discoveries have suggested a very different view – one in which the brain remains flexible and adaptable across the lifespan, with many cognitive abilities being preserved. A major aim of the CamCAN research is to understand the nature of these brain–cognition relationships across the course of our adult lives, and to change the perspective of ageing in the 21st century by highlighting the importance of abilities that are maintained into old age.

To do this, the CamCAN project is recruiting, through local GP surgeries, hundreds of healthy volunteers living in the Cambridge City area and aged from 18 years up to those in their late 80s. To understand how cognitive abilities develop and change over the adult lifespan, the CamCAN project will be using many sources of information, including demographic and lifestyle (such as diet, exercise habits, educational achievement), information about brain structure and function (from MRI/fMRI and MEG scans) and measures of performance on cognitive tasks in a range of areas such as memory, language, emotion processing, face recognition, fine motor skills, and so on, because normal ageing can affect all these different factors, which can also interact with each other. Looking at all these different aspects is the best way of getting a complete picture of how the mind and brain develop and change over the lifespan in order to preserve cognitive function. The extent of this neural flexibility and the potential for neural reorganisation to preserve cognitive functions is one of the important issues that the CamCAN project will look at.

Such a large-scale project necessarily involves the cooperation of many researchers and collaborators to provide an interdisciplinary view of the ageing mind and brain. The core research teams include members of research groups in the Departments of Experimental Psychology, Public Health and Primary Care, Psychiatry, Clinical Neurosciences, and Engineering in the University of Cambridge and the Medical Research Council's Cognition and Brain Sciences Unit. Over 30 project researchers and collaborators are contributing to a new view of adult development that incorporates demographic, psychological, physical, and neural measures.

The demographic information (diet, education, etc) is collected by Research Interviewers during a home visit, but the remainder of the information, the brain scans and performance on various cognitive tasks, is all being carried out here at the CBSU. Initially, CamCAN volunteers will visit the CBSU three times in total. On each visit they will take part in some

The CamCAN team: Tina Emery, Claire Hanley, Sharon Erzinclioglu

cognitive testing, thus providing a comprehensive view of performance across a wide spectrum of cognitive abilities. In addition, on one of these visits they will also have an MRI scan (when each volunteer will be given a picture of their brain to take home), and on another they will undergo an MEG scan. It is estimated that this initial round of testing will take around 2½ years to complete. Once this first stage is completed, a small sample, 280 in total, of the volunteers who come for all three visits will be invited back to help out with some further tests. Several researchers at the CBSU are involved in the CamCAN project, and four of our Research Assistants, Beth, Claire, Sharon and Tina, are responsible for testing and scanning the CamCAN volunteers. Whilst there are lots of past and current studies looking at cognitive function and how it changes in diseased brains, there is very little information available about how healthy brains age. Everyone involved in the CamCAN Project is extremely grateful to all the volunteers taking part and giving up so much of their time to help with this vital research and the CBSU is very pleased to be such an important part of this exciting project.

If you are interested to find out more information about the CamCAN project, go to the website: www.cam-can.com.

MEASURING SPEECH COMPREHENSION IN THE BRAIN USING MEG

Lucy MacGregor & Yury Shtyrov, Language Group

In a typical conversation speakers utter around 150 to 200 words per minute and as listeners we are able to understand speech spoken a lot more quickly than this. How do our brains do this? To understand how the brain is able to deal with speech so efficiently we need a technique that enables us to measure the temporal dynamics of brain processes in different brain regions with millisecond precision – magnetoencephalography (MEG) provides such a possibility.

MEG records tiny magnetic fields (smaller than one millionth of the size of the earth's magnetic field) that are present above the surface of the head and reflect the activation of large groups of neurons in the brain. Volunteers are required to sit under a helmet-shaped device containing 306 hidden superconducting sensors that are highly sensitive to magnetic fields (**See images 1 and 2**).

In a recent study using MEG, panel volunteers have helped us understand more about the speed with which the brain is able to access neural representations of words – that is, memories of words encoded by the brain. Volunteers heard real words (such as "lake") intermixed with nonsense words ("lape") whilst their brain activity was recorded using MEG. To target the earliest, automatic processes involved in spoken word recognition, volunteers were asked to focus their attention on a silent film and to ignore what they heard. Results showed that in as little as 50 ms after the presentation of acoustic information required to identify a word (for example as "lake" rather than "late"), there was greater activation to the real words than to the nonsense words in the brain's temporal cortex. This finding suggests our brains can access long-term memories of known words extremely rapidly and helps our understanding of the basic processes involved in speech comprehension. (**See image 3**)

The MEG device is quiet and comfortable, and completely non-invasive – it records brain activity passively without applying any currents or fields to the volunteer. This makes the MEG technique very suitable for most adult volunteers as well as for children and patients. As part of a larger collaborative project involving scientists at the CBSU, Anglia Ruskin and the Free University Berlin, we are

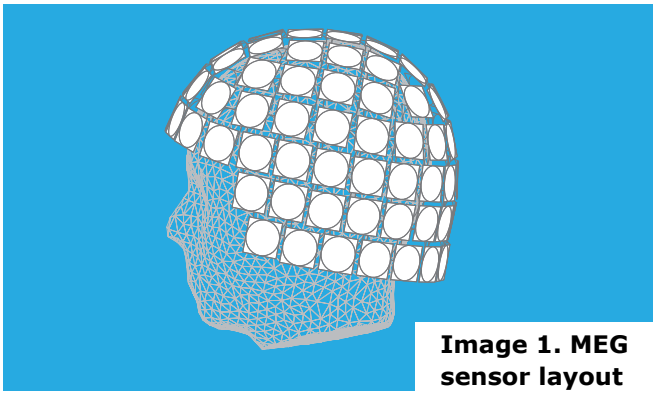


Image 1. MEG sensor layout

also running the word recognition study on volunteers with chronic aphasia who have acquired speech and language difficulties following a stroke. The overall aim of the project is to test the effectiveness of a new type of therapy – Intensive Language Action Aphasia Therapy (ILAT) – compared to conventional therapy. By measuring MEG responses to words before and after therapy we will see whether it can lead to any long-term changes to the brain processes involved in word recognition.

MEG is a fantastic brain imaging technique because it provides a continuous measure of brain activity that can be localised to specific regions of the brain. This means we can use MEG not only to investigate how the brain understands speech, but to explore all kinds of cognitive processes such as memory, attention and emotion, which involve the dynamic and complex interplay of different brain structures.

Image 2. The MEG device used at the CBSU (manufactured by Elekta Neuromag)

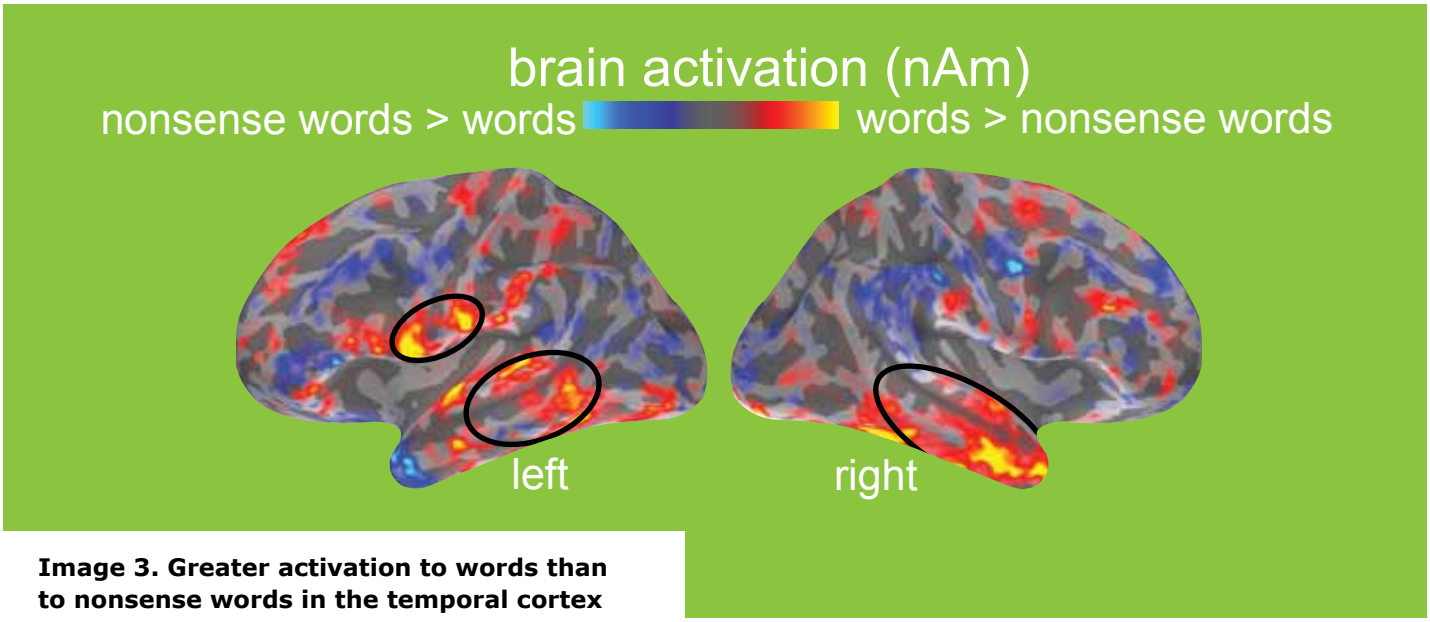


Image 3. Greater activation to words than to nonsense words in the temporal cortex

LOOKING YOU IN THE EYE:

WHAT EYE GAZE CAN TELL US ABOUT AUTISM SPECTRUM CONDITIONS

Elisabeth von dem Hagen & Andy Calder, Emotion Group

Have you ever had a conversation with a friend and not made eye contact with them? Probably not. In fact, it's quite likely that you looked into their eyes in order to work out what they are thinking or feeling. As natural as this type of behaviour may seem to us, individuals with Autism Spectrum Conditions (ASC) have difficulties with these types of social situations. They will often tend to avoid making eye contact and may also have difficulties making sense of what another person is thinking or feeling.

Together with our colleagues at the Autism Research Centre, University of Cambridge, we are trying to understand just what is different about how the autistic brain processes socially relevant signals like eye gaze. To do this, we first investigated what happens in the typical, non-autistic, brain by placing CBSU panel volunteers into our MRI scanner and showing them pictures of faces looking either at them (making eye contact) or away from them (averted gaze). In the typical brain, a network of specific brain regions typically lights up in response to eye contact. This network includes regions that tend to be involved in the ability to think about what another person is thinking or feeling. The fact that these regions respond more strongly to eye contact than to averted gaze is consistent with the particularly important role of eye contact in social situations. When we look at individuals with ASC however, we find a very different pattern emerging. Although the same brain regions are involved, they respond more strongly to averted gaze and much less to eye contact.

These initial observations tell us that the brains of individuals with ASC and typical volunteers don't respond in the same way to eye contact, suggesting that eye contact doesn't carry the same significance for individuals with ASC. Our next steps will be to determine whether communication between the different brain regions involved in processing gaze information is different in individuals with ASC and typical individuals, and what aspects of performance in processing eye gaze relate to these changes. Answering these types of questions will hopefully bring us closer to fully understanding the brain mechanisms underlying social difficulties in individuals with ASC.

WORKING MEMORY GROUP

Welcome to the members of the new research group working with the CBSU Director Professor Susan Gathercole, who joined us last year. The group are interested in what causes memory and learning difficulties in childhood, and in developing new ways of overcoming these difficulties. They are just about to start working in schools with children who are struggling academically, and will be trying to understand their core difficulties. One particular interest is in the ability to hold information in mind for brief period while carrying out other demanding activities, which is crucial for many lessons in school. The group will also be investigating the brain processes involving working memory in children and how these might change with training, and will be the first users of our child-friendly neuroimaging facilities at the Unit to do this. Ways of helping overcome memory and learning difficulties will include intensive practice at computerised tasks.

Sue's group are also interested in health conditions in middle and older age that may have an important impact of people's abilities to remember, focus attention, and carry out complex mental activities.

Joni is a cognitive developmental psychologist interested in working memory, attention and executive function. Her previous research has focussed on the role of working memory in children's mathematical skills, and on understanding the cognitive and behavioural profiles of children with disorders of memory and attention. Joni is currently interested in understanding the core deficits that predispose individuals to cognitive developmental disorders, and is developing and evaluating targeted interventions to overcome these difficulties.

As such, she will be leading streams of work within the team that will investigate the origins of different developmental disorders of working memory and explore the mechanisms and therapeutic value of working memory training.

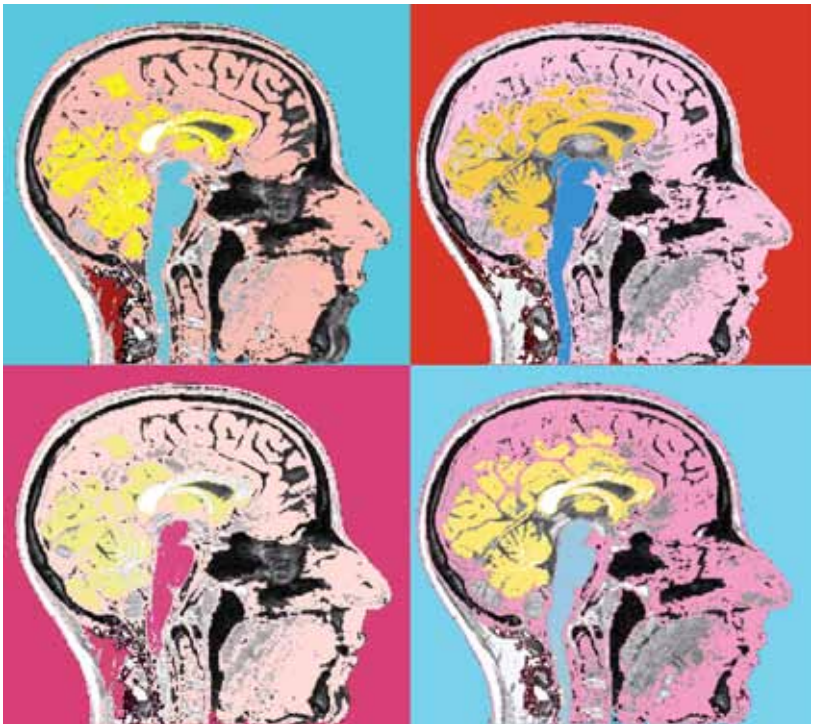
Working Memory Group: Joni Holmes, Sally Butterfield, Francesca Cormack, Susan Gathercole

Francesca's previous research has focused on the cognitive and neural deficits seen in dementia, epilepsy and following cardiovascular disease and heart surgery, using a range of techniques including EEG and MRI. As well as contributing to the work of the group on working memory training, particularly with regards to neuroimaging, she is currently involved in describing in detail the pattern of cognitive performance associated with blood pressure and relating this to structural and functional brain imaging. Francesca is particularly interested in evaluating effects of medical, surgical and cognitive interventions in populations at cardiovascular risk.

Sally's academic background is psychology, linguistics, speech and language therapy. Before coming to the CBSU, her experience included working with children and young people with special language needs. At the CBSU Sally has collaborated on projects that have included speech and language and working memory: since she has been a long-standing member of CBSU, you may have participated in one with her.

THE ART OF NEUROSCIENCE

Charlotte Rae, Executive Processes Group



In addition to revealing the inner workings of the human brain, the MRI scans we collect at the CBSU can also be intriguingly beautiful. As a neuroscientist, it is incredibly exciting to see in detail the brain of a living, breathing person. Even to a non-specialist, the odd shapes and folds of this walnut-like organ inside our heads invoke a deep fascination. Many neuroscientists around the globe, inspired by the beauty of their research images, have started combining brain imaging techniques with art. Particularly famous are the multi-coloured MRI rug, and anatomically accurate knitted brain, created by neuroscientists at the University of Oregon in the USA.

As researchers at the CBSU tend to "try out" our experiments on colleagues before unleashing it on Panel Members, many CBSU staff have plenty of their own MRI scans handy with which to get creative.

Inspired by the recent trend in combining art and neuroscience, I decided to blend my own plain black-and-white MRI image with the colours of Andy Warhol's "Marilyn". After a couple of hours experimenting with photoshop, I had a rather unique self-portrait. The resulting picture was featured in a Brain Art Competition at the 2011 Human Brain Mapping conference, and has since made waves on the Internet, "illustrating the rise of brain imaging in popular culture" (http://www.scientificamerican.com/slideshow.cfm?id=brain-art-shows-off-neuroscience-aesthetic-side#5).

The next project (aside from continuing my PhD work on brain structure and function in Parkinson's disease) will probably be a brain Mondrian, or possibly a brain Klimt – although a brain Picasso might be the easiest to photoshop!