The following PhD vacancies and research topics within the School of Psychology were compiled in November 2013 and were correct at the time of publication.

For further guidance on pursuing a PhD in any of these areas, please consult the School of Psychology website or contact the relevant members of academic staff as listed below.

**Behavioural Neuroscience**

**Dr Tobias Bast** ([tobiast.bast@nottingham.ac.uk](mailto:tobiast.bast@nottingham.ac.uk))

Research focuses on the behavioural functions of the hippocampus, a brain structure that plays a key role in everyday-type memories. There are currently two main lines of research:

**How does the hippocampus link memory functions to other behavioural functions (e.g., emotional, motivational, sensorimotor), so that memory can be translated into adaptive behaviour?**

The focus here is on functional links of the hippocampus to prefrontal cortex and subcortical sites.

**How does hippocampal dysfunction that characterises major neuropsychiatric diseases, especially schizophrenia, contribute to symptoms?**

The current focus is on hippocampal-prefrontal disinhibition (impaired function of GABAergic neurons), which has emerged as key feature of schizophrenia pathophysiology.

These questions are addressed using a multi-disciplinary, integrative in vivo approach that combines behavioural/cognitive testing with the manipulation and analysis of brain function in rodent models. Further information: [www.psychology.nottingham.ac.uk/staff/lpztb1/#_Research](http://www.psychology.nottingham.ac.uk/staff/lpztb1/#_Research)

**Dr Charlotte Bonardi** ([charlotte.bonardi@nottingham.ac.uk](mailto:charlotte.bonardi@nottingham.ac.uk))

I am happy to consider proposals on any topic relating to associative learning, including in how associative learning is impaired in psychopathological conditions. My past research has examined this in schizophrenia, personality disorder, Alzheimer's disease and addictive behaviour.

**Early cognitive deficits in AD**

A crucial problem in Alzheimer's disease (AD) management is how to diagnose the disease at an early stage when treatments might be effective. The purpose of the present proposal is to
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examine, in a genetically modified mouse expressing the features of AD, the learning abnormalities that develop prior to the onset of brain damage, and analyse the potential mechanisms for this learning deficit; thus our aim is to identify the precise way in which learning in these animals fails. This information should aid development of sensitive predictive tests for early diagnosis.

Conditional learning

This project aims to investigate the function of conditional cues – stimuli which signal the presence of an associative (i.e., predictive) relationship between two further stimuli (for example, two beers only give you a hangover when you have been smoking). Explaining conditional learning is a challenge for associative theories, and disruption of performance on conditional tasks has also been implicated in schizophrenia. This project could analyse the associative mechanisms underlying conditional learning, or use theories of conditional learning to explore how it is impaired in schizophrenia.

Hippocampus, space and time

There is still a lot of controversy about the exact role of the hippocampus in cognitive processes, and more specifically whether it is responsible only for performance on "complex" tasks (spatial learning), or whether it might play a role in more basic learning processes such as associative learning. We have recently reported that hippocampal damage can impair timing - the ability to accurately anticipate when a conditioned stimulus is followed by reinforcement. Timing, like spatial learning, is regarded by some as a complex task independent of simple conditioning, whereas others view it as a by-product of associative learning. This project could further explore these issues.

Dr Helen Cassaday (helen.cassaday@nottingham.ac.uk)

I’m always interested to hear your ideas about associative learning processes, their underlying brain substrates and/or their role in psychological and psychiatric disorder. I’m also interested in the wider implications of what I do, and you’re also very welcome to contact me about PhD options in any area in which I’ve published, see www.psychology.nottingham.ac.uk/staff/hjc

Brain substrates of associative learning

To investigate the underlying biology of associative learning mechanisms fundamental to normal cognition we use laboratory rats. The brain substrates under study are key to our understanding of addiction, age-related cognitive decline and schizophrenia. Currently available projects, for example, may compare the effects of localised treatments within nucleus accumbens on latent inhibition, based on past experience with the cue or ‘acquired salience’, and cue competition through overshadowing, based on relative intensity of the cue or ‘intrinsic salience’. We are addressing the distinct roles of the dopamine D1 and D2 receptor families through the use of pharmacologically selective receptor agents.
Nelson, A.J.D., Cooper, M.T., Thur, K.E., Marsden, C.A. & Cassaday, H.J. (2011). The effect of catecholaminergic depletion within the prelimbic and infralimbic medial prefrontal cortex on recognition memory for recency, location and objects, Behavioral Neuroscience, 125, 396-403.


**Associative learning anomalies: individual differences and disease**

Animal learning theories are also applied to human diseases in which associative processes are disordered, as well as to our understanding of individual differences. For example, in cases of schizophrenia and in schizotypy, we find that learning occurs inappropriately, about stimuli that would normally be treated as irrelevant, redundant or in some other way indistinct. We have successfully established associative learning procedures suitable for use with human participants. Currently available projects, for example, may involve testing participants with disorder of the dopaminergic system, in cases of ADHD, Tourette syndrome, schizophrenia and drug addiction.


**Dr Mark Haselgrove** ([mark.haselgrove@nottingham.ac.uk](mailto:mark.haselgrove@nottingham.ac.uk))

**The Role of Attention in Associative Learning**

An increasing body of evidence suggests that human and non-human animals can learn to vary the attention they pay to stimuli as a consequence of experience. Two theories have come to dominate this field. According to the theory proposed by Mackintosh (1975), animals learn to pay attention to stimuli which are good predictors of an outcome and ignore stimuli which are not. In contrast, the Pearce-Hall (1980) theory proposes that animals learn to pay more attention to stimuli which have an uncertain or unexpected outcome. We are now beginning to understand the mechanisms of, and interaction between, these two, seemingly, diametrically opposite theories: but there is still much research that needs to be done before we have a full understanding of the role of attention in associative learning. I would be interested in hearing from students who would like to investigate this topic with research that uses either animal or human experiments.

Schizotypy and Associative Learning

“Normal” Individuals who exhibit a preponderance of the negative symptoms of schizotypy (e.g. introversion, anhedonia) have a profile of learning that suggests these individuals do not encode all available stimuli when forming associations. This could be the consequence of deficits in prediction error, deficits in attentional function, or some combination of these and other factors. Experiments conducted in my laboratory have begun to explore this issue, but there is scope for much deeper investigation. I would be interested in hearing from students who would like to investigate this topic.


Dr Paula Moran (paula.moran@nottingham.ac.uk)

Psychopharmacology Interdisciplinary projects in rodents on how antipsychotic drugs used to treat schizophrenia work and developing novel animal models of schizophrenia to identify novel treatments. We have been using mice with genetic deletion of the dopamine D2 receptor to investigate the role of this receptor in how antipsychotic drugs modulate attention. See Bay-Richter et al., 2013 Neuropsychopharmacology 38 (8) 1512-1520. There are a number of genes that increase risk for schizophrenia such as neuregulin; for review see Karl, 2013 Frontiers in Behavioural Neuroscience, 7, 106. We are currently investigating how reduction in function of these genes affect cognitive behaviours such as attention and memory. We are also studying in the cognitive effects of drugs of abuse that induce psychotic symptoms such as ketamine and phencyclidine in particular their effects on learning and memory see LeCozannet et al, 2010, International Journal of Neuropsychopharmacology, 13(8)1011-1020.

Dr Jasper Robinson (jasper.robinson@nottingham.ac.uk)

My world view is that many psychological phenomena are explicable in terms of the formation of associations, or connections, between representations of stimuli, thoughts, emotions, etc. Associative analyses of behaviour have given us detailed insight into many areas of psychology. Information about association formation has come from studying animals in well-controlled laboratory settings as well as computer modelling and studies of clinical populations. More importantly, this information can be used to make new predictions about the possible roles of associations in other settings, which are often given (unnecessarily) detailed explanations. When such predictions are confirmed they can make a compelling case for associative analyses.
Below are a couple of projects that we could work on. They have a strong backing in animal work but it’s important to investigate them in people too.

Recognition memory

Recognition memory has long been studied, often in combination with brain lesions and pharmacological agents. We have recently found evidence that supports an associative analysis of recognition memory in rats and it would be interesting to look for such evidence in people too. One convenient, and well established, way to do this is by using eye-tracking apparatus to measure changes in the duration that people look at objects that are old (i.e., recognised) relative to objects that are new (i.e., not recognised). Acquired equivalence in elderly people. When two items are associated with the same outcome, we become prone to confuse them. E.g., if we learn that two people, Alice and Paul, like ice cream and we later learn that Alice dislikes bananas, we might likely to (falsely) assume that Paul also dislikes bananas. We have been looking at this acquired equivalence effect in elderly people and have found them to be less prone to the acquired equivalence effect. This is potentially important, not only because it gives information about learning in elderly people but because it helps to provide an associative explanation of age-related deficits in 'attentional set' learning. If you’d like to contact me to discuss these projects, or if you have your own please feel free to.

www.jasperrobinson.wordpress.com

Human Development and Learning

Dr Shiri Einav (shiri.einav@nottingham.ac.uk)

Trust and scepticism: Children's Selective Learning from Testimony

Young children learn about many aspects of the world from others. Although for the most part the information that people offer is true, testimony is not always reliable and some sources are more knowledgeable than others. So, to balance effectively the benefits and risks of accepting information from others, children need to evaluate the reliability of informants’ testimony, rather than show blind trust. Moreover, given the huge amount of testimony that children encounter every day, an efficient learning strategy would be to assess the value of such information not only in terms of its likely accuracy but also in terms of its relevance or utility. I’m interested in how these critical skills develop in early childhood. Doctoral research in this area would involve experimental studies to investigate empirically a range of questions on children’s trust and scepticism in the testimony of others and how this impacts on their learning from others.
Children’s use of questions to obtain information

In order to benefit from the knowledge and experience of other people, we often have to ask questions to elicit information from others. We know that children begin to ask questions from an early age, and they ask lots of them! However, much less is known about how children use questions as a tool to acquire new knowledge. I’m interested in how questions function as a mechanism that help children move forward from one knowledge state to another more adult-like knowledge state. Some relevant lines of enquiry for empirical research are: How does question-asking develop with age? What cognitive skills are involved? Under what circumstances are children most likely to seek knowledge through questions? How does question asking impact on children’s learning?

Dr Peter Mitchell (peter.mitchell@nottingham.edu.my), Malaysia Campus

Mentalizing

How effective are people in guessing what others are thinking and feeling? Can people effectively interpret the clues in facial expressions and body language to guess another person’s thoughts? Can people guess what happened to another person by observing facial expressions and body language? Can people guess another person’s character from facial expressions and body language? What do we know about individual differences in these abilities? Specifically, are people with autism spectrum disorders severely disadvantaged in being able to interpret facial expressions and body language? When people succeed in making accurate inferences based on facial expressions and body language, how do they do it? What features in particular do they attend to? When people are not so effective in making accurate inferences, what features are they attending to? In other words, which are the informative features and which features are not so informative? These research questions can be investigate in participants of various ages and with different kinds of clinical status. How do children develop in their ability to make educated guesses about the content of other people's minds? How does this ability change over the lifespan? What are the prospects in this area of socio-cognitive functioning for people with clinical disorders?

Dr Claire O’Malley (claire.omalley@nottingham.ac.uk)

My research interests are in the application of psychological theories and methods to the design and use of computer supported collaborative learning (CSCL) environments: basic research on the development of collaboration in children and on understanding the processes involved in effective collaborative learning; designing CSCL environments that are underpinned by the psychology of learning and evaluating their educational effectiveness; basic studies of human communication (verbal and nonverbal); applied studies of the impact of different media (e.g., video links) on communication processes and collaborative task performance; location-aware ubiquitous computing, mobile learning and tangible technologies for learning. If you are
Dr Lucy Cragg (lucy.cragg@nottingham.ac.uk)

My main research interest is the typical and atypical development of executive functions which I study using behavioural and neuroimaging methods, particularly electroencephalography (EEG). Executive functions are the skills that allow us to regulate our thoughts and behaviour, known as cognitive control. I am interested in how executive functions and the underlying brain systems change during childhood and adolescence as well as the relationship between executive function and other areas of development such as social cognition, language and maths. For more information visit www.psychology.nottingham.ac.uk/staff/lpzlc. I am open to any topic that falls within my research expertise - some possible topics include: How do the brain systems for ignoring distractions develop? Do children use the same brain systems for choosing between competing responses and inhibiting an impulsive action? How do language and inner speech support the development of executive functions? Do you need good executive functions to be good at maths?

Dr Nicola Pitchford (nicola.pitchford@nottingham.ac.uk)

What are the early processes of visual word recognition?

Currently, very little is known about the processes involved in the early stages of recognizing printed words, from visual input to letter/word identification. Doctoral research in this area will involve conducting computerized experiments on skilled and/or developing readers, of English or different orthographies. It is also possible to conduct research with poor readers (dyslexic), either children or adults.

Can cognitive and motor interventions support neurodevelopmental progression in children following tumour resection to the cerebellum?

Tumour to the cerebellum in early childhood can have severe impact on neurodevelopmental outcome with marked problems in cognitive and motor functioning. Interventions targeted early in childhood could help to ameliorate some of these difficulties and could shed light on the neural underpinnings of these associated functions. Doctoral research in this area would involve working with patients in their homes and/or clinical settings, coordinating staff involved with the research project (including families, academics, and clinicians), and may also involve some functioning imaging research.

Impairments to dorsal stream processing in the brain

The dorsal pathway in the brain projects from primary visual cortex to the parietal lobes and is often referred to as the “where” pathway, as it is involved in motion processing, spatial
cognition and visual motor planning. The ventral pathway projects from visual cortex to the temporal lobes and has been termed the “what” pathway, as it is involved in shape perception, visual memory and recognition of familiar objects/faces. Impairments to dorsal pathway functioning have been suggested as a defining characteristic of many developmental disorders, as well as healthy ageing. However the selectivity of this deficit is equivocal and its underlying nature is currently unknown. [uses: psychophysics/computer models].

Dr Elizabeth Sheppard (elizabeth.sheppard@nottingham.edu.my), Malaysia Campus

I am currently interested in projects exploring how culture (especially between Asian and western populations) impacts on the perception, cognition, and diagnostic features of individuals with ASD. For example, research has previously shown that people in western, individualist countries tend to have a more localised, detail-focused processing style in contrast with people in Asian collectivist countries, who process things more holistically within context. Moreover Asians attend to different parts of faces when recognising faces or identifying facial expressions. I am interested in projects exploring whether these cultural differences give rise to differences in the manifestation of ASDs and also how they affect the utility of existing diagnostic tools in non-western cultures. I am also interested in various aspects of driver cognition including hazard perception applied in a Malaysian setting. The majority of previous research on driver behaviour has been conducted in western countries which have a low accident rate and where hazards occur relatively infrequently. In contrast the accident rate is high in Malaysia and a large number of hazards occur naturally in daily driving. This affords a unique opportunity to explore how environment and context affect our perceptual and attention processes on the road.

Dr Harriet Allen (h.a.allen@nottingham.ac.uk)

I am interested in how perception interacts with attention over the lifespan. Attention might enhance vision in a number of ways. Attention might simply speed up how quickly we respond to a stimulus, it might make us more likely accept that a stimulus is present, it might reduce the noise associated with the stimulus or increase the signal perceived from the stimulus. I’m particularly interested in what happens to ignored stimuli. Is ‘attend to this’ really the opposite to ‘don’t attend to that’? As well as being interested in the effects of attention on vision, I’m interested in how these change with age. As we grow older both our perceptual and attention systems change. There are changes at the level of the eye (glasses wearing gets more common), the visual system and the attention systems (ignoring distractions gets harder). Can attention be used to compensate for visual changes? Are there ways to artificially enhance vision to help people cope with changes in attention mechanisms? I’m also interested in how this applies to the real world. For example, in driving, how do we avoid getting distracted by adverts and how do we most effectively provide information to the driver. I use psychophysical,
Personality, Social Psychology and Health

Dr Alexa Spence (alexa.spence@nottingham.ac.uk)

My research focuses on attitudes, broader related perceptions (particularly risk perceptions) and how these translate into behaviour. I am particularly interested in environmental psychology and the areas of energy and climate change as well as new digital technologies, often in relation to energy and climate change, e.g. smart meters. See more information and publications at www.alexaspence.weebly.com. In particular I’m interested in projects within Public Perceptions of Energy and/or Climate Change. I am particularly interested in risk perceptions here, the abstract nature and overall psychological distance of climate change, and how experiences or imagination may influence these perceptions (e.g. through experiences of events such as flooding). Interactions with technology I am concerned with how people engage, interact, and are influenced by new forms of digital technologies in a number of ways. Smart metering and Energy Monitoring With the current rollout of smart meters, I’m exploring how and when people are engaged by these devices, how people interact and cooperate (or conflict) in meeting energy goals, and the potential for developing new ways of engaging people. I am also interested in particular in the potential for communal energy displays and associated mobile phone applications. How location and context may influence digital engagement I’m interested in how spatial location and activity may influence people’s interactions with technologies. Might people perceive information differently, and therefore also respond to this differently, when this is received when they are travelling, or when they are in a spatially distant environment compared to a static office or home environment? Risk perceptions and behaviour I’m concerned with how people perceive risk, and key characteristics of risk issues that have a disproportionate influence on how people respond, e.g. emotional reactions (cf. the affect heuristic). I’m also interested in how people consider risks differently when thinking in terms of society, other people, or in terms of their own personal considerations.

Dr Eamonn Ferguson (eamonn.ferguson@nottingham.ac.uk)

Altruism, Charitable Donations and Blood Donation

Why do we help others, especially strangers or give to charity? I am interested in exploring the underlying mechanism associated with human altruism. I am interested in integrating theory from psychology, economics and biology to understand altruism towards strangers and kin, and in particular with respect to charitable donations especially blood and organ donation. I am interested in testing competing theories form economics (e.g., warm glow and strong
reciprocity), psychology (empathy and negative state relief) and biology (reciprocity and reputation building) within this domain. Personality and Altruism I am interested in the role of individual difference with respect to emotional regulation and understanding (e.g., empathy & alexithymia) to understand behaviour in economic games designed to explore human altruism (e.g., ultimatum games, dictator games, public good games). Emotions (anger, spite) are seen as one key proximal determinant of departure from the standard selfish model in these games. Those with an inability to understand emotion (e.g., alexithymics) should therefore, be less susceptible to such effects. There is great behavioural heterogeneity in these types of games and I am interested in the way in which personality may help us to understand some of this heterogeneity.

Health Communications

I am interested in the ways in which people respond to public health information designed to improve their health. In particular I am interested in cases where well intentioned strategies results in counter-productive and detrimental effects. We have recently been developing a line of work in the area of counter-normative messaging (messages that are deign to improve health behaviour, by expressing a belief that is counter to the accepted norm: e.g., stress is good for you). The rise of evidence based medicine is resulting in counter-normative messaging being used more and more. We are interested in exploring if such messages result in counter-productive outcome such worse health (symptom reporting, health care utilization) and identifying the mechanism that contribute to this effect.

Dr Claire Lawrence (claire.lawrence@nottingham.ac.uk)

My work broadly seeks to contribute towards answers to the question: What makes people behave aggressively and violently? This takes me to examinations of social processes, individual differences, cognition and brain structure and function. I would be happy to supervise PhDs in any aspect of these areas – but in particular: Under what circumstances are people triggered to act aggressively? I am particularly interested in the effects of frustration and provocation together with individual differences in sensitivity to different external triggering factors. I use a variety of methods to measure aggressive behaviour in the lab, and I am interested in supervising PhDs developing new methods. How do people evaluate the behaviors of others? Aggressive responses are more likely when people believe that they have been provoked by another individual – and so the way in which people make these evaluations can be crucial. Work on hostile attribution biases has shown the importance of examining the perceptual processes involved when categorizing the behaviours of others as aggressive. I am interested in supervising PhDs examining the processes involved in evaluating ambiguous and aggressive behaviours. Who is more likely to behave aggressively? Certain personality traits have been more associated with aggressive behaviours. For example, despite received wisdom identifying those with low self-esteem being more likely to act aggressively, the wealth of evidence shows that it is those with very high self-esteem who are prone to act aggressively in the light of provocation. I am interested in supervising PhDs which examine the role of personality variables
that increase (e.g. psychopathy, narcissism, Machiavellianism) as well as reduce (e.g. empathy, agreeableness) the likelihood and intensity of aggressive behaviour. How do we reduce aggressive behaviour? My research has demonstrated that several features can reduce aggressive responses in otherwise aggressive individuals. For example, lack of anonymity in aggressive responses reduces physical aggression in females, but not males. In addition, the presence of a protagonist who ‘turns the other cheek’ can result in reduced aggression for some individuals, but increased aggression for others. I am interested in supervising PhDs which investigate interventions which reduce aggressive behaviour in the lab.

Dr Ellen Townsend (ellen.townsend@nottingham.ac.uk)

My research currently examines key psychological constructs associated with self-harmful thoughts and behaviours such as attachment style, attitudes (implicit and explicit), hopelessness, defeat and entrapment. Methods I have used to examine these factors include experiments, semi-structured interviews, questionnaires and Audio Computer Assisted Self-Interview.

Dr Chuma Owuamalam (chuma.owuamalam@nottingham.edu.my), Malaysia Campus

My current interest is on the influence of social perceptions on attitudes, behaviour and well-being of members of historically disadvantaged/stigmatized groups (such as ethnic minorities, women and mental health patients, and single mothers). I am particularly interested in the processes underlying people’s beliefs about the impressions they make on others (i.e., meta-perceptions) and, how these beliefs in turn impact mental health, as well as behaviours that may be adopted to bring about social change. I would be especially interested in supervising projects that aim to explore interventions that could enhance harmony between conflicting groups, especially when such conflicts are rooted in meta-perceptions. Being at the cross-road of Western influence and collectivistic cultural orientations of the East, Malaysia, with its diverse ethnic mix, offers a unique opportunity to examine these ideas and to test the efficacy of some Westernstyle interventions for promoting intergroup harmony. Other topics that are closely related to the research programme outline above are also welcome.
Cognition & Cognitive Neuroscience: Cognition & Language

Dr Peter Chapman (peter.chapman@nottingham.ac.uk)

The Psychology of Driving

I am happy to supervise any research that looks at aspects of traffic and transport psychology, though my particular interests are in cognitive influences (perception, attention, memory, decision making) on car drivers’ behaviour. The research group is currently developing an instrumented car and a full motion driving simulator that would be available for recording driver behaviour (including physiological responses and eye movements) both in simulated environments and while driving on real roads.

Emotion and Memory

I supervise PhD students with interests in cognitive aspects of emotion-memory interactions. Recent PhD students have looked at – Facial EMG as a predictor of autobiographical memory and laboratory-presented emotional material; Influences at encoding and retrieval on memory for emotional material; Directed forgetting of emotional material. Visual Search and Memory in Dangerous situations Memory for dangerous situations is systematically distorted in terms of the amount of information remembered, the type of information remembered, and in other ways such as memory for the duration of events. This research explores attention (e.g. via eye movements recordings) in dangerous situations and relates this to subsequent memory. So far we have looked at memory in dangerous driving situations, and also for roller coasters.

Dr Ruth Filik (ruth.filik@nottingham.ac.uk)

My research interests lie in investigating the cognitive and neural mechanisms underlying language comprehension. I would be particularly interested in supervising projects in the following areas: the comprehension of figurative language (such as irony and metaphor), the processing of anaphoric reference, the effect of context on language comprehension, influence of various linguistic devices such as quantifiers or focus particles. I am also interested in supervising projects in applied cognitive psychology, in particular, relating to communication in a healthcare setting. Methods that I typically use to investigate these issues include eye-tracking and cognitive neuroscience techniques (mainly EEG). For more information, and to see papers that I have published in these areas, please visit: www.nottingham.ac.uk/psychology/people/ruth.filik
Dr Alastair Smith (alastair.smith@nottingham.ac.uk)

My research is broadly concerned with how we process and understand the spatial world around us, encompassing perception, cognition, and action. The approach has been to study these processes in the range of spatial scales that we naturally encounter. At the level of small-scale construction, I conduct research on drawing behaviour and the processes that transform a mental representation into motor commands. As well as running behavioural experiments, this work has involved detailed individual case and group studies of neurological patients with acquired disorders of spatial representation in various functional domains (i.e. constructional apraxia, unilateral visual neglect). At larger scales, I am interested in the processes that allow us to search, navigate, and represent our position in an environment. This work has concentrated on the typical development of spatial abilities (in adults and children) and atypical development in individuals with Williams Syndrome and Autism Spectrum Disorder. I am willing to consider PhD proposals in any of these areas, and am particularly interested in addressing whether spatial behaviours are equivalent across scales or reference frames. There is also the potential to maximise on collaborative links with colleagues in Geography in order to utilise satellite tracking and virtual reality technologies to understand naturalistic navigational behaviour.

Dr Walter van Heuven (walter.vanheuven@nottingham.ac.uk)

My research interests are in the area of language processing and bilingualism, particularly visual word recognition, linguistic and non-linguistic implications of bilingualism, the bilingual brain, and foreign language acquisition. My research involves a variety of techniques such as fMRI, ERP, eye-tracking, and computational modelling. More information about my current research can be found on my website: www.psychology.nottingham.ac.uk/staff/wvh Please contact me to discuss any project ideas that you have that fall within my research expertise. Examples of potential topics for a PhD project: What are the key factors that impact the activation time course of representations involved in second language word recognition? How and when does bilingualism impact non-linguistic control tasks? What is the time course of automatic unconscious word translation? What is the impact of watching subtitled foreign language films on foreign language acquisition?

Dr Richard Tunney (richard.tunney@nottingham.ac.uk)

The learnability of embedded hierarchical structures in artificial languages

The cognitive processes involved in artificial grammar learning (AGL) have long been a source of controversy. Nonetheless as a paradigm AGL remains appealing because it allows the researcher to examine selected aspects of language in isolation. A large literature from the mid-1960s to the turn of the century settled on a consensus that AGL recruited similarity processes based on episodic memory that were relevant to the study of natural languages only if one took
the position that language acquisition is statistical rather than symbolic in form (Pothos, 2007). However, this literature was largely restricted to simple finite-state languages that have very few properties of natural languages. A second wave of interest using languages with centre-embedded structures (AnBn grammars) using EEG and fMRI has apparently revealed evidence for language abstraction involving Broca’s area. These findings stand in stark contrast to the findings using finite-state grammars (Fitch & Friederici, 2012). Centre embedded structures are an important feature of natural languages because, unlike finite state grammars, they minimally require a context free grammar. However, a number of research groups have cast doubt on this interpretation and instead suggested that simpler non-linguistic mechanisms involving counting the number of A and B elements in each sentence might provide a more parsimonious model (de Vries, Monaghan, Knecht, & Zwitserlood, 2008). The aim of this project is to discriminate between these two models.


Can pro-social behaviour be primed?

A number of recent studies have claimed that pro-social or altruistic behaviour can be elicited by means of social-priming. One classic study appeared to show that participants were more generous in a dictator game after they had unscrambled sentences with spiritual content than participants who had unscrambled sentences composed of neutral words (Shariff & Norenzayan, 2007). However, studies similar to this have been criticized because they might be the result of demand characteristics or because they fail to replicate (Shanks et al., 2013). I would be interested in supervising a series of tightly controlled experiments that would determine the boundary conditions for these effects and explore potential mechanisms.


Surrogate utility estimation

The aim of the project is to quantify the extent to which people are able to estimate another person’s utility for a decision outcome. That is, how good are we at making decisions for other people (Ziegler & Tunney, 2012). The principle aim is to compare next of kins’ predicted utilities for their partner with the partners’ actual stated utilities. This study will determine whether
health-based utilities differ when estimated on behalf of other people, by comparing what the other person would estimate compared to what the person would estimate for themselves when asked the same series of hypothetical health state questions (Wendler & Rid, 2011). The results will go beyond research that has been conducted before in that previous work on self-other decision-making has been restricted to binary end-of-life decision accuracy (Shalowitz, Garrett-Mayer, & Wendler, 2006), and there exists as yet no research on health states in surrogate decision making. We will be able to quantify the extent to which utility estimation differs when compared between the surrogate and the wishes of the recipient. This will allow some theoretical predictions about the cognitive processes that we use to estimate another person’s utilities. For instance, whether we attempt to simulate the other person’s decision or hypothetically place ourselves in their position, and to explore what factors affect the degree of error in surrogate decision-making.


Cognition & Cognitive Neuroscience: Visual Neuroscience

Dr Tim Ledgeway (timothy.ledgeway@nottingham.ac.uk)

How is texture-defined motion detected by the visual system?
Moving objects typically differ from their surroundings in terms of their textural properties (e.g. surface markings), but how these cues are extracted by the visual system to encode movement is still little understood. [uses: psychophysics/computer models/TMS]

How are the direction and speed of global object motion encoded?
We know a great deal about how the visual system extracts velocity information from individual (localised) edges in the visual world, but rather little about how that information is subsequently combined to reveal the overall movement of complex objects. [uses: psychophysics/computer models/TMS]

Detection of spatially-extensive image contours and shapes
How the visual system is able to detect the outlines/boundaries of arbitrary spatial objects in cluttered visual scenes, by linking local measurements of edge orientation is an unresolved issue.
Impairments to dorsal stream processing in the brain

The dorsal pathway in the brain projects from primary visual cortex to the parietal lobes and is often referred to as the “where” pathway, as it is involved in motion processing, spatial cognition and visual motor planning. The ventral pathway projects from visual cortex to the temporal lobes and has been termed the “what” pathway, as it is involved in shape perception, visual memory and recognition of familiar objects/faces. Impairments to dorsal pathway functioning have been suggested as a defining characteristic of many developmental disorders, as well as healthy ageing. However the selectivity of this deficit is equivocal and its underlying nature is currently unknown. [uses: psychophysics/computer models].

Dr Linda Bowns (l.bowns@nottingham.ac.uk)

How do we compute motion in two-dimensional objects like images or when we view natural scenes?

We know a lot about how the brain responds to moving images, but not how it uses that information to compute local speed and direction. This project will build on my previous publications in this area to tease out the precise human mechanisms involved in computing local velocity.

Simulation and testing a complete model of motion?

This project will improve the current simulation of a motion model that I am developing by testing it on artificial and natural scenes, and comparing the response of the model to human performance. [Methods: psychophysics, computer modeling]

Dr Jonathan Peirce (jonathan.peirce@nottingham.ac.uk)

My work investigates the way in which the visual system detects particular combinations of edges when recognising objects. Are dyslexics incapable of detecting particular edge combinations? A number of studies have aimed to find a low-level, visual cause of dyslexia. One possibility is that dyslexics may be unable correctly to detect the precise relative locations of particular edge combinations. [uses: psychophysics with dyslexic and ‘normal’ populations]

How groups of edges are detected by the visual system? We know a great deal about how the visual system extracts information about individual edges in the visual scene, but rather little about how that information is used and combined. [uses: psychophysics/fMRI/computer models]
Dr Denis Schluppeck (denis.schluppeck@nottingham.ac.uk)

The aim of my research is to understand how we use our senses of vision and touch to gather information about the world and how we use that information to make decisions that are critical for our personal survival and well-being. In the visual domain, I study how humans perceive the colour, form, and motion of visual objects and make decisions based on those perceptions. In the somatosensory system, I am mostly interested how the sensory sheet of the body surface is topographically mapped onto cortical (and subcortical) areas and how other basic stimulus properties are encoded in the brain. I use a combination of functional magnetic resonance imaging (fMRI), psychophysics, and computational modelling. Most recently, I have conducted MRI experiments at ultra-high field (7 T) in collaboration with colleagues at the Sir Peter Mansfield MR Centre at the University to explore the use of functional and anatomical imaging at very high spatial resolution. 1. Functional imaging of columnar and laminar organization in the human visual system. 2. Mapping the human somatosensory system with high-resolution fMRI. 3. “Mind-reading” – using multivariate pattern classification to decode perceptual states from functional imaging data. [methods: functional MRI at 3 T and 7 T in normal subjects, computational modelling, psychophysics, data analysis] If you have other possible projects in mind, don’t hesitate to contact me to discuss your ideas.

Dr Ben Webb (b.webb@nottingham.ac.uk)

Perceptual Learning; neural plasticity; visual adaptation; individual differences; sensory integration; neural computation; I supervise projects that investigate the way in which visual experiences shape the function of the visual brain and how we combine different sources of visual information to make perceptual decisions. In particular, I am interested in how visual experiences ranging from very short timescales (e.g. visual adaptation) to longer timescales (e.g. perceptual learning) interact to shape visual brain function over entire the lifespan. As part of this work, we are investigating how individuals differ in their state of visual adaptation to the environment and how this contributes to learning. We also harness the knowledge garnered about basic mechanisms of experience-dependent plasticity to develop treatments for improving the visual quality of life of adult and children suffering with amblyopia ('lazy eye') and age-related macular degeneration. My research in mainly conducted using psychophysics to measure the visual performance of humans whilst we change something about their visual experiences of the environment (e.g. alter their adapted state or visual reality). The lab also makes use of eye movement recordings, fMRI (in collaboration with Dr. Denis Schluppeck, University of Nottingham), extracellular recordings from populations of neurons in visual cortex (in collaboration with Professor Carandini, UCL), and computational modelling. Before applying, please have a look at the publications on my website http://www.psychology.nottingham.ac.uk/research/vision/bsw/. Informal enquiries should be made to ben.webb@nottingham.ac.uk.
Dr Daniel Shub (daniel.shub@nottingham.ac.uk)

My work focuses on increasing the understanding of auditory perception and processing to help hard of hearing individuals.

What makes communicating at the pub difficult?

We know that the background noise causes individual words to be missed, but we do not know if background noise also increases the effort it takes to communicate. It is particularly difficult for hard of hearing individuals to communicate in noise situations. [method: psychophysics with 'normal' and hearing impaired populations]

How do we process acoustically degraded speech?

Speech can be acoustically degraded in a variety of ways (e.g., mp3 compression and the addition of 'echoes'/reverberation) without substantial decreases in intelligibility. We do not know how well the auditory system can switch between the different processing strategies required to understand degraded speech. [method: psychophysics, computational modeling]

Dr Neil Roach (neil.roach@nottingham.ac.uk)

My research aims to understand perceptual phenomena in terms of the underlying neural mechanisms. This typically involves a combination of psychophysical experimentation and physiologically motivated computational modelling. I am interested in supervising projects that apply this approach to address questions concerning normal and abnormal sensory processing. Potential research topics include, but are not limited to: What is the role of prediction in visual processing? In a constantly changing world, the ability to predict future events can be vital. Financial analysts, for example, exploit patterns in the ebb and flow of market conditions to estimate the outcome of investment decisions. Meteorologists simulate trends in atmospheric conditions to forecast the weather. Although we are typically unaware that it is happening, our brains are also constantly forming predictions. The ability of the brain to predict the consequences of our actions has been studied by scientists for many years. However, the capacity of our senses to form predictions is far less well understood. For an example of recent work on this question, see Roach et al. (2011), Visual motion induces a forward prediction of spatial pattern, Current Biology, 21, 740-745. How does the brain code the timing of sensory events? Being able to perceive the flow of time is essential to just about every aspect of our lives. However at present, we don’t have a clear understanding of how our brains manage to keep track of time. One way of getting insight into this process is to study situations in which our perception of time is distorted. Interestingly, this seems to occur rather frequently - for example, in the laboratory the perceived duration and temporal order of auditory and visual stimuli can be distorted via adaptation. For an example of recent work on this question, see Roach et al (2011), Asynchrony adaptation reveals neural population code for audio-visual timing, Proceedings of the Royal Society, B, Biological Sciences, 278, 1314-1322. 21
Cognition & Cognitive Neuroscience: Perception & Action

Dr Stephen Jackson (stephen.jackson@nottingham.ac.uk)

Neural basis for unwanted thoughts and actions

Understanding the nature of the brain mechanisms that allow us to regulate our behaviour is a fundamental problem for neuroscience and is of considerable clinical importance in understanding and treating the consequences of mental illness. This is because behavioural dysregulation and/or disorders of cognitive control are strongly associated with a number of common mental illnesses including: Attention Deficit Hyperactivity Disorder [ADHD]; Tourette syndrome [TS]; and Obsessive Compulsive Disorder [OCD]. In this project we will use magnetic resonance imaging to investigate the functional anatomy of unwanted actions.

Neural circuits involved in the suppression of tics in Tourette syndrome

Tourette syndrome (TS) is a developmental neuropsychiatric disorder characterised by the presence of chronic vocal and motor tics. Tics are involuntary, repetitive, stereotyped behaviors that occur with a limited duration. The neurological basis of TS is unclear at this time however it is agreed that the basal ganglia, including circuits that link the striatum to the frontal lobes, are dysfunctional. It has been suggested that individuals who learn to successfully control their tics do so by recruiting an enlarged or enhanced network of cortical areas that are involved in the cognitive control of behaviour. In this project we will use neuroimaging techniques (e.g., functional MRI, diffusion tensor imaging, transcranial magnetic stimulation) to investigate and quantify this hypothesis.

Brain plasticity and functional re-organisation in the adolescent brain

During adolescence the brain undergoes considerable change and may impact upon important behaviours such as impulse control, aggression, risk taking, etc. The aim of this project will be to investigate this hypothesis using behavioural measures and multimodal brain imaging and brain stimulation techniques (e.g., functional MRI, diffusion tensor imaging, transcranial magnetic stimulation, magnetic resonance spectroscopy).

Neural representation of movement and updating of the 'body-schema'

Damage to the posterior parietal cortex can lead to a disorder of visually guided reaching movements known as optic ataxia (AO). We have previously suggested that the brain area most often associated with optic ataxia – the medial aspect of the posterior parietal cortex -- is important for maintaining a dynamic, up-to-date, representation of the postural configuration of the body [i.e., the body 'schema']. We will investigate this hypothesis by studying reaching movements to visually defined and posturally defined targets in neurologically healthy individuals and patients with optic ataxia. This project will make use of kinematic analyses of
reaching movements and fMRI. My lab is equipped with 2-joint robot arm for measuring movement and also an MRI-compatible 2-joint robot for measuring movements in the MR scanner.

**Neural basis for the modulatory effects of motor intention on perception**

Psychophysical studies have repeatedly demonstrated that visual stimuli presented close to the onset of a saccadic eye movement are mislocalised spatially and temporally. Similarly, psychophysical and electrophysiological studies have demonstrated that the intention to execute a limb movement leads to reduced tactile sensitivity on the limb that is about to be moved. This project will use magnetic resonance imaging and/or transcranial magnetic stimulation techniques to investigate how motor intention influences tactile perception.

**Dr Alan Sunderland** (alan.sunderland@nottingham.ac.uk)

**Clinical Neuropsychology Research into assessment, recovery and rehabilitation after brain damage due to stroke, head injury or in Alzheimer’s Disease**

I am happy to supervise clinical research projects related to my recent work in two areas – disorders of action & tool-use and approaches to rehabilitation; preserved familiarity & recollection in memory impairment and evaluation of memory training.

**Cognitive processes in everyday life**

This covers similar areas of interest in action and memory but extends it into studies of normal memory and control of action. Of particular interest at present is the role semantic memory and executive control in the manipulation of everyday objects (tools, handles etc) and how this changes with age. What processes are involved in selection of an appropriate grasp? What brain systems are involved? How do these develop in childhood and decline with age?

**Dr Roger Newport** (roger.newport@nottingham.ac.uk)

Body ownership; pain; movement agency; sensory integration; motor control. I supervise projects that investigate the way in which we control and recognise our own body and actions. In particular, I am interested in how our brain represents our body image (a conscious internal representation of the appearance of our body and our attitudes towards it) and our body schema (an unconscious representation of the body that the brain uses for action and to solve problems such as moving through space and reaching for objects). Investigating how the brain processes the body can help us to understand important issues such as unexplained pain, body image distortion, developmental deficits and brain damage. My research is mainly conducted using a virtual reality device called MIRAGE that displays real-time video of your own hand so that it appears in the same physical location as your real hand (www.miragemultisensoryillusions.blogspot.co.uk/p/aboutmirage). The live video of your hand
can be manipulated so that the size and shape of your hand or any object in the environment can be changed instantaneously, as can the speed and timing of your movements. Using this technique we can give the impression of having multiple, stretched, shrunk, misbehaving or even missing limbs. The application of these methods allows the investigation of a variety of key issues related to the body, pain, motor control, movement agency and sensorimotor adaptation in normal, damaged and developing brains, especially those with sensory disorders. The lab also makes use of a robotic arm, skin conductance, skin temperature, grip force, movement kinematics, neuropsychology and transcranial magnetic stimulation. Prospective students are strongly encouraged to read recent publications by this group before applying. 

http://www.nottingham.ac.uk/Psychology/People/roger.newport For informal enquiries, please contact roger.newport@nottingham.ac.uk

Dr Martin Schürmann (martin.schuermann@nottingham.ac.uk)

A single brain area can represent multiple aspects of the environment or of the individual’s body. For example, stimuli of two sensory modalities can converge on one brain area, as in the case of auditory and vibrotactile stimuli that share a representation in auditory belt areas. Similarly, in certain motor areas the representation of the individual’s own actions overlaps with areas activated during the observation of other individuals’ movements. To study shared representations in the brain, the following projects will be pursued using functional magnetic resonance imaging (fMRI, for optimal spatial resolution) and whole-head magnetoencephalography (MEG, for millisecond temporal precision). Crossmodal activation of auditory brain areas by tactile stimuli has been observed with functional magnetic resonance imaging (fMRI) in healthy subjects (Schürmann M, Caetano G, Hlushchuk Y, Jousmäki V, Hari R, NeuroImage 2006; 30: 1325-1331). Such co-activation could be related to facilitated hearing when sounds co-occur with vibrotactile stimuli delivered to the subject’s palm. Future studies need to explore to what extent auditory brain areas contribute to the analysis of sound-like temporal patterns in vibrotactile stimuli. Shared representations in the brain have also been suggested as a correlate of social perception: the observer’s motor areas are activated during the perception of other persons’ movements or postures. For example, we searched for brain correlates of the exceptional perceptual salience of abnormal postures. In an fMRI study, subjects viewed computer-generated pictures of distorted hand postures. Cortical activation sensitive to distorted (vs. natural) finger postures was found in the primary motor cortex, postcentral somatosensory areas, and amygdala. This activation pattern suggests that the instantaneous “gut feelings” during the observation of bodily distortions in others are related to embodied percepts that also involve affect-related brain areas (Schürmann M, Hlushchuk Y, Hari R, Human Brain Mapping, 2011; 32: 612-623). Future studies will explore brain activation patterns during the observation of normal and abnormal hand postures, including postures related to tool use. Social perception is also relevant to decision making. We studied brain activation patterns in an economic game with multiple players where competition imposes constraints on subjects’ decisions. The setup was developed from a game where subjects typically accept equal-share offers but reject unduly small offers. Using fMRI, we studied adjustment to competition in this game: subjects competed against another person for the
share of the stake. For medium-sized, but not for minimum offers, competition increased the likelihood of acceptance and was associated with increased brain activation bilaterally in the temporo-parietal junction, a region associated with mentalizing. The results suggest a network of brain areas supporting decision making under competition, with incentive-dependent mentalizing engaged when the competitor’s behavior is difficult to predict and when the stake is attractive enough to justify the effort (Halko ML, Hlushchuk Y, Hari R, Schürmann M, NeuroImage 2009; 46: 542-548). Facilities for the required methods, fMRI and MEG, are available in the Sir Peter Mansfield Magnetic Resonance Centre on the campus of the University of Nottingham.

Dr Debbie Serrien (deborah.serrien@nottingham.ac.uk)

The functional specialisation and integration of hemispheric activity during cognitive skills

The prevalent view is that specialised functions of the cortical hemispheres are essential for behavioural performance. That is, both hemispheres have different functional capacities that provide distinct contributions to skilled behaviour. However, little is known about how the hemispheres cooperate to achieve an optimal outcome. This PhD project will study the neural correlates of skilled behaviour in order to identify domain-general and domain-specific characteristics that guide performance outcomes across the lifespan.

The neural dynamics of motor dexterity

In right-handers skilfulness associates with left hemisphere dominance; a prioritisation that has been attributed to anatomical and functional asymmetries of cortical brain regions. Whereas right-handers have been extensively studied in the literature, limited data are available from other handedness groups. This PhD project will evaluate and contrast the neural dynamics of motor behaviour in different handedness groups.