

# Clinical Neuropsychology

Dear Reader,

This is our annual newsletter in which we detail our research activities over the past 12 months. This includes completed projects and also projects that are currently still underway. It is my pleasure to provide you with an overview of what has been happening- the kind of research we do, the people involved, the projects we have conducted and who has assisted us, all detailed below,

Best wishes,

*Skye McDonald.*

Professor Skye McDonald



## This Issue

- Deficits in social perception in opioid maintenance patients, abstinent opioid users and non-opioid users
- Assessing social cognition and communication in adolescents with Traumatic Brain Injury
- Trialling a brief intervention for deficits in recognising emotional prosody following severe Traumatic Brain Injury
- Deficits in comprehension of speech acts after Traumatic Brain Injury: The role of Theory of Mind and Executive Function
- Theory of Mind and empathy in high-functioning adults with autism spectrum disorder
- Emotional regulation impairments following severe Traumatic Brain Injury: An investigation of the body and facial feedback effects
- Do people with Traumatic Brain Injury experience ostracism?
- Investigation of emotion recognition in adults with Traumatic Brain Injury – Examining differential difficulty
- Amygdala volume predicts arousal and empathy deficits after severe Traumatic Brain Injury
- Social judgement in high-functioning adults with autism spectrum disorder
- Automatic facial responses to emotional stimuli in autism spectrum disorder
- Alcohol and cannabis effects on cognitive function
- Spontaneous and posed emotional facial expressions following severe Traumatic Brain Injury
- Facial mimicry and arousal to repetitions of affective movie clips
- A new test of social decision making for people with Traumatic Brain Injury
- Emotion in voice matters
- Habituation to emotional facial expressions from an OR perspective
- Can training on an inhibitory task influence alcohol consumption?
- Emotion recognition abilities in alexithymia
- Empathy deficits in alexithymia

### Studies in progress and new research starting in 2013

- Improvement of cognitive functioning in elderly people with Mild Cognitive Impairment
- Perception of emotions in voice after Traumatic Brain Injury
- Understanding mistake recognition in adults with Attention Deficit/Hyperactivity Disorder
- Complex emotion recognition in adults with Traumatic Brain Injury and Parkinson's disease – Development of Complex Audio-Visual Emotion Assessment Task (CAVEAT)
- Autonomic and neural correlates of dysregulated arousal in severe traumatic brain injury

### Alumni - Life After the Lab

### List of Publications



Brain Sciences  
UNSW

## Clinical Groups

The research that our team conducts is essentially concerned with disorders that arise from brain dysfunction due to structural or developmental conditions. We are interested in disorders that arise from a variety of different kinds of brain impairment including acquired brain impairment due to trauma, degenerative conditions and mild cognitive impairment. We are also interested in developmental conditions such as Parkinson’s disease, autism spectrum disorders and psychiatric conditions.

## Type of Research

Our research has a number of streams looking at (1) communication disorders (2) emotional disorders and (3) remediation. In each case we are interested in how these disorders impact upon everyday functioning. We have a particular interest in psychophysiology. Psychophysiological techniques allow us to measure bodily reactions to external events (like changes in heart rate and skin temperature). By measuring these we have a clearer understanding of how people respond emotionally to significant events.



Dr Cynthia Honan, Postdoctoral Research Fellow



Nicklas Parks, Research Assistant

*“By measuring psychophysiological events we have a clearer understanding of how people respond emotionally to significant events.”*

## Research Team

Our dedicated research team is led by Skye McDonald with the able assistance of Dr Jacqueline Rushby (NHMRC Clinical Research Fellow) and Dr Cynthia Honan (NHMRC CRE Postdoctoral Research Fellow). Dr Rushby has great expertise in psychophysiological techniques and is a sought after mentor for everyone in the lab. Dr Honan is a Clinical Neuropsychology Registrar and Registered Psychologist. She also has expertise in test development and advanced statistical procedures. We have two wonderful full-time research assistants: Alana Fisher and Rebekah Randall and two equally fabulous part-time assistants: Nicklas Parks and Jaimi Iredale. We were very sad to lose Thea Longman, Nicole Pesa and Therese English over the past year.

Our research assistants are available to take any calls or queries about the research program (02 9385 3590).



Rebekah Randall, Research Assistant

## PhD Successes

Dr Michelle Kelly successfully passed her thesis in midyear and will graduate in December. Dr Cynthia Honan has recently passed her PhD and will be graduating in April next year.

## Students

There are currently 5 PhD students in the team: Emily Trimmer, Matt Gerathy, Maurice Finn, Danielle Mathersul and Hannah Rosenberg. Several of our honours student recently completed their studies, and we would like to take this opportunity to congratulate Sucheta Gorolay, Bronwyn Hegarty, Jaimi Iredale, Olivia Schollar-Root and David Straton for their great efforts. Our new honours student for this year, Christopher Sufani, is currently busy in our lab working on his thesis titled *Perception of Emotions in Voice After Traumatic Brain Injury*.



Emily Trimmer, PhD Candidate



## This Newsletter

The aim of this newsletter is to inform you of how your involvement is contributing to our understanding of how the brain processes social and emotional information both before and after a brain injury, as well as what treatment techniques we are trialling. This newsletter presents 25 different studies. Each study is described in terms of what it was about, what we did, and what we found. Where studies have been submitted for publication, the reference to the article has been provided in case you want to read more about the study. In most cases it takes a long time for articles to be published, so most articles are not immediately available but will be in the next year or so. We have also detailed articles and conference presentations that are accepted for publication.

### Acknowledgements

Many people and agencies have been involved in coordinating and assisting in these research studies. We would especially like to acknowledge the outstanding brain injury rehabilitation teams at Ryde Royal Rehabilitation Centre, Liverpool Hospital and Westmead Hospital.

Several of these projects also represent collaborations with researchers at UNSW and other institutions, in particular, Robyn Tate at the Rehabilitation Studies Unit, University of Sydney, Leanne Togher at the Faculty of Health Sciences, University of Sydney, Shane Darke at the National Drug and Alcohol Research Centre, Melissa Green at the Black Dog Institute, Sydney and Marc Pell, McGill University, Montreal.

Finally, as always, we must express our deepest appreciation to all the people with a brain injury and their families, as well as our control participants, who have happily given their time and energy to contribute to our research. Without your willing participation none of this research would have been possible.



## Deficits in social perception in opioid maintenance patients, abstinent opioid users and non-opioid users

*Skye McDonald, Shane Darke, Sharlene Kaye & Michelle Torok*

### **What the study is about:**

Many opiate users have poor interpersonal behaviour and social functioning but the reasons for this are not often examined. Competent social skills are pivoted upon good social perception. Failure to accurately recognise and interpret social signals such as facial expression and body movement leads to misunderstandings, and responses that are indiscriminate or inappropriate. While deficits in social cognition are reported with low social skills and with people suffering from major depression, the extent to which opioid users experience such deficits is relatively unexplored. That was the aim of this study.

### **What we did:**

We interviewed 125 patients on methadone maintenance programs, 50 abstinent opiate users and 50 matched controls and assessed their ability to recognise the emotions, thoughts and intentions of speakers in naturalistic video vignettes taken from The Awareness of Social Inference Test (TASIT). We also administered a battery of tests to measure executive function, working memory, information processing speed, verbal and non-verbal learning, and psychological distress.

### **What we found:**

The methadone maintenance group was impaired on emotion perception and also gauging the thoughts and intentions of speakers. They were poorer than controls and also those who were abstinent. Controls and abstainers did not differ from each other. Their poor performance was associated with low premorbid IQ and poor cognitive function. Poor emotion recognition was also predicted by number of heroin overdoses. These findings suggest that clinical staff working with methadone maintenance patients should avoid hyperbole, humour, sarcasm and hints when communicating important therapeutic information, and use language to communicate and explain emotions rather than non-verbal cues.

### **To read more about this study:**

This paper is currently in press: McDonald, S., Darke, S., Kaye, S. & Torok, M. (In Press) Deficits in social perception in opioid maintenance patients, abstinent opioid users and non-opioid users, *Addiction*.

# TASIT

The **Awareness** of  
**Social Inference Test**  
Revised

## Assessing social cognition and communication in adolescents with Traumatic Brain Injury

*Skye McDonald, Therese English, Rebekah Randall,  
Thea Longman, Leanne Togher & Robin Tate*

### What this study was about:

Traumatic brain injuries (TBI) in children and adolescents can impair social cognition and communication skills, but there are few assessment tools suitable for adolescents. Our test, The Awareness of Social Inference Test (TASIT), uses professionally enacted audiovisual vignettes of everyday conversational exchanges and is a valid measure of social perception disorders in adults.

### What we did:

We tested 16 adolescents with TBI on TASIT. We also tested another 9 adolescents with brain injuries from other causes such as hypoxia and brain infections, but as their performance was very similar to those with TBI we focus here on the TBI group alone. We compared the performance of the TBI group to a group of 16 typically developing (TD) adolescents.

### What we found:

Adolescents with TBI were, on average, no different to their TD peers on TASIT 1 (emotion recognition) and TASIT 3 (recognising lies and sarcasm when provided with additional cues), but were impaired on TASIT 2 which required them to interpret sarcastic and sincere conversational exchanges with few cues other than the demeanor of the speakers. Within the TBI group, poor performance on TASIT correlated to both relative and self-reported communication difficulties at home. It also correlated with IQ, face recognition and severity of injury (as indexed by duration of post-traumatic amnesia). Overall, this study suggests TASIT is a valid measure for adolescents, although it raised questions as to how effective normative data is for comparing performance in social cognition during childhood and adolescence. This is a period of rapid development in skills and there is a great deal of variation across this age range, making it difficult to compare any one adolescent with others.

### To read more about this study:

This study is currently under review: McDonald, S., English, T., Randall, R., Longman, T., Togher, L. & Tate, R.L. (Under review) Assessing social cognition and pragmatic language in adolescents with traumatic brain injuries.



## Trialling a brief intervention for deficits in recognising emotional prosody following severe Traumatic Brain Injury

*Skye McDonald, Leanne Togher, Robin Tate, Rebekah Randall, Therese English & Alison Gowland*

### What this study is about:

Many adults with acquired brain injuries, including traumatic brain injuries (TBI) have impaired emotion perception. Impaired perception of emotion in voice can occur independently to facial expression and represents a specific target for remediation. No research to date has addressed this.

### What we did:

We used a randomised controlled trial to examine the efficacy of a short, 6 session treatment for improving the ability to recognise emotional prosody for people with acquired brain injury, mostly TBI. Ten participants were allocated to treatment and 10 to waitlist.

### What we found:

There were no significant treatment effects for group, but analyses of individual performances indicated that 6 of the treated participants made demonstrable improvements on objective measures of prosody recognition. The reasons why some participants showed improvements while others did not was not obvious. Improvements on objective lab-based measures did not generalise to relative reports of improvements in everyday communicative ability, nor was there clear evidence of long term effects.

### To read more about this study:

This study is currently in press: McDonald, S., Togher, L., Tate, R., Randall, R., English, T. & Gowland, A. (In Press) Trialling a brief intervention for deficits in recognising emotional prosody following severe Traumatic Brain Injury. *Neuropsychological Rehabilitation*.

## Deficits in comprehension of speech acts after TBI: The role of Theory of Mind and Executive Function

Cynthia Honan, Skye McDonald, Alana Fisher, Alison Gowland & Rebekah Randall

### What this study was about:

Theory of Mind (ToM) is a term used to describe a person's ability to form inferences about another person's beliefs or intentions, and is a critical component of effective communication. ToM abilities are mediated by frontal brain structures that are also thought to mediate executive processes such as cognitive flexibility, inhibition, and working memory. Given that frontal lobe brain structures are usually compromised following traumatic brain injury (TBI), it is not surprising that both abilities are commonly affected in this population. There is much debate, however, about whether ToM is dependent on executive functioning or not. The issue is complicated by the fact that many ToM tasks use complex stories requiring a significant capacity to understand. This study aimed to determine whether ToM is dependent on executive

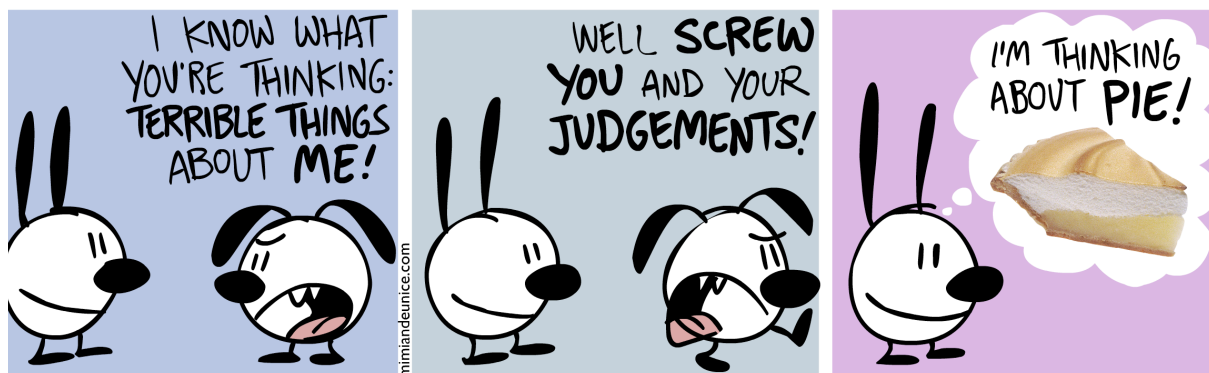
functions or whether these abilities are, in fact, modular (i.e., are independent functions).

### What we did:

A group of 24 people with severe brain injury and 24 people with similar backgrounds but without any brain injury participated in the study. Videotaped vignette segments, containing a woman talking about her recent experiences or a news reader, were shown to all participants. The vignettes were specifically presented so that they contained either minimal executive function demands, high cognitive flexibility demands, high working memory demands, or high inhibition demands. Participants completed both low and high ToM questions and tasks after viewing the vignettes in each of these varying executive conditions.

### What we found:

In the high working memory demand condition, individuals with TBI were more impaired on high ToM tasks. This poor ToM performance remained even after taking into account the high working memory demands of the task. Individuals with TBI were also more impaired on high ToM tasks in the high inhibition condition. Poor ToM performance here was fully accounted for by poor inhibitory control. These results indicate that ToM may be partially dependent on working memory demands, but not entirely. While poor inhibition also interfered in our ToM task it is not clear whether the task itself was tapping ToM as we expected. TBI participants did not perform more poorly than non-TBI participants in the flexibility tasks.



## Theory of Mind and empathy in high-functioning adults with autism spectrum disorder

Danielle Mathersul, Skye McDonald & Jacqueline Rushby

### What this study was about:

Theory of Mind (ToM; also referred to as social intelligence, mentalising, or cognitive empathy) is the ability to understand the mental states of others and thus infer their feelings, thoughts, intentions, beliefs, desires and potential behavioural reactions to situations. It has been argued that higher functioning individuals with autism spectrum disorders (ASDs) have specific deficits in more complex, advanced levels of ToM but not simple ToM, yet the questionable ecological validity (how well they approximate real-world functioning) of some tasks reduces the strength of this assumption. The aim of the present study was to investigate performance on an ecologically valid test of ToM in high-

functioning adults with ASDs who have normal IQ and language abilities.

### What we did:

The present study employed The Awareness of Social Inference Test (TASIT) which uses video vignettes to assess comprehension of subtle conversational inferences (sarcasm, lies/deception). Associations between performance on TASIT (advanced ToM) and cognitive and affective empathy were also investigated. Forty high-functioning adults with ASDs and 37 non-clinical controls participated.

### What we found:

The high-functioning adults with ASDs demonstrated specific deficits in comprehending the beliefs, intentions and

meaning of non-literal expressions (sarcasm, lies/deception). They also had significantly lower cognitive and affective empathy. Cognitive empathy was also related to ToM performance, whereas affective empathy was only related to group membership (clinical diagnosis). These results have implications for neural systems known to underlie ToM and social cognition more generally, which may be a potential underlying mechanism for advanced ToM deficits in ASDs.

### To find out more about this study:

Mathersul, D., McDonald, S., & Rushby, J. A. (Submitted) Understanding advanced theory of mind and empathy in high-functioning adults with autism spectrum disorder.

# Emotional regulation impairments following severe Traumatic Brain Injury: An investigation of the body and facial feedback effects

Marie Dethier, Sylvie Blairy, Hannah Rosenberg & Skye McDonald

**What this study is about:**

Difficulties in the regulation of emotion are among the most common and debilitating consequences of severe TBI. Many patients fail to return to work, have decreased leisure activity, or experience breakdowns in intimate relationships as a result of changes in emotional behaviours. TBI commonly impairs both the expression and experience of negative affective states. There may be increases of irritability, aggression, and impulsivity, or alternatively, a diminution of arousal and motivation and a high level of apathy. The aim of this study was to investigate body and facial feedback. Body and facial feedback designates the fact that emotional experience is affected by cues generated by afferent feedback produced by changes in the muscles involved in body posture and facial expression. These two processes have a role in healthy emotional regulation, and its investigation may improve the understanding of the difficulties of patients with TBI dealing with the regulation of negative emotions, and of anger in particular.

**What we did:**

A group of 24 people with severe TBI and a group of 28 people from similar backgrounds but without an injury took part in this study. We read them instructions that asked them to adopt facial expressions and body postures (that were associated with a particular emotion) and maintained these positions for 10 seconds. Expressions and postures entailed anger, sadness, and happiness as well as a neutral (baseline) condition. After each expression/posture manipulation, participants evaluated their subjective emotional state (including cheerfulness, sadness, and irritation).

**What we found:**

Participants with TBI were less reactive to the effects of facial and body feedback than control participants, especially for the emotion of anger, as can be seen in Fig 1. It means that whereas control participants reported increased feelings of irritation after adopting an angry posture and facial expression, TBI participants were not: their feelings of irritation were of similar intensity

in the different conditions. Reported problems in the regulation of negative emotions, especially anger, following TBI may come, in part, from difficulties that people with TBI have in correctly recognising their own emotions. As emotional knowledge has an important role in emotional regulation, it stands to reason that people with TBI may have problems regulating feelings of anger because they do not recognise them. Findings from the present study have important clinical implications. Rehabilitation of emotion regulation deficits following TBI may need to target the disconnection between emotional behaviour and emotional awareness in order to bring emotional behaviour under conscious control.

**To find out more about this study:**

Dethier, M. Blairy, S., Rosenberg, H. & McDonald, S. (In Press) Deficits in processing feedback from emotional behaviours following severe TBI. *Journal of the International Neuropsychological Society.*

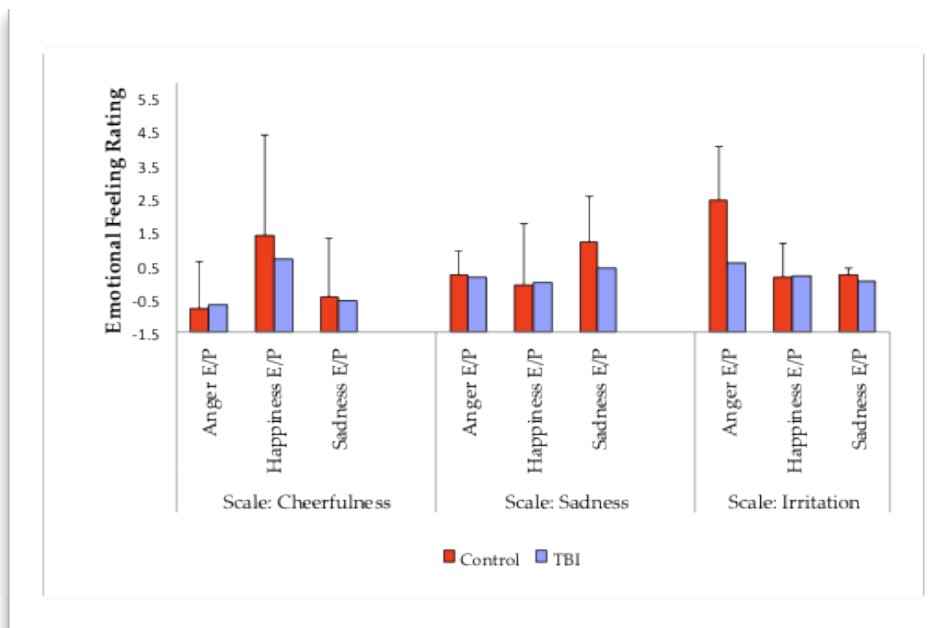


Figure 1. Means of subjective emotional feeling rating for participants with severe TBI and control participants as a function of the emotional scale and the expression/posture manipulation (E/P).



## Do people with Traumatic Brain Injury experience ostracism?

*Michelle Kelly, Skye McDonald & David Kellet*

### **What the study is about:**

People with Traumatic Brain Injury often report increased social isolation or reduced social support as a consequence of their injury. Changes in social support are generally across the domains of family relationships, friendships, social activities and employment. Social isolation and inadequate social support is known to have detrimental effects on people's mood. It is, therefore, not surprising that people with a brain injury experience psychiatric disorders such as depression secondary to their injury. While links between self-reported changes in social support and psychological outcomes have been drawn, there is no evidence for the direct and immediate effects of ostracism, or an acute experience of social isolation on individuals with a brain injury. Research into this area is particularly important given that how a person reacts or copes with a single social experience may determine whether future opportunities for interactions are likely. Given the evidence that individuals with a brain injury subjectively report lower levels of arousal when it comes to emotionally-laden stimuli, particularly negative stimuli, and have a different physiological response to emotional stimuli, it is unclear whether they will 'feel' the pain of ostracism to the same extent as healthy controls.

### **What we are doing:**

This study looked at the psychological and physiological effects of ostracism (being socially excluded by one or more other people) in 14 adults with a brain injury, and compared them to 16 matched control participants. The Cyberball ball tossing game was used to induce an immediate experience of social exclusion. Participants were asked to play an online game of toss with other volunteers. On one occasion they were excluded from the game, on the next they were included fairly in the game. We then asked participants to report on how they felt after each game. Also, sometimes we feel as though we are not having an emotional response to a situation yet our body says differently. Using small electrodes attached to the

fingertips, we are able to measure very small changes in heart rate and perspiration that represent emotional responses. Data is still being collected.

### **What we have found so far:**

Against predictions, preliminary results suggest little difference between groups on the self-reported effects of ostracism, however, while not significant, the observed trend suggests that participants with a brain injury display a different physiological response (skin conductance levels) to ostracism than control participants. Specifically, adults with a brain injury displayed higher levels of arousal during the inclusion condition, when compared with the ostracism (exclusion) condition. This might suggest that those with a brain injury are having a larger emotional response when being included rather than when being excluded. This poses a problem as we may rely on our emotional responses to drive or motivate behaviour that will help us to rejoin a group or re-engage socially. If our physiological responses do not tell us there is a problem, we may not be driven to do something about it.

### **To find out more about this study:**

Kelly, M., McDonald, S., Kellet, D. (Submitted) The Psychological Effects of Ostracism Following Traumatic Brain Injury

Contact Michelle Kelly:  
Michelle.Kelly@hnehealth.nsw.gov.au







## Investigation of emotion recognition in adults with Traumatic Brain Injury (TBI) – Examining differential difficulty

*Hannah Rosenberg, Skye McDonald, Marie Dethier, Roy Kessels & Fred Westbrook*

### What the study is about:

Difficulties interpreting social situations and understanding the emotions portrayed by others are common following a traumatic brain injury (TBI). The ability to quickly and accurately recognise how other people are feeling is crucial in a variety of everyday social situations and improving our understanding of these difficulties is important in order to promote functioning post-injury.

An issue that arises from research into emotion recognition concerns the differential difficulty in recognition of the various emotions. Research suggests that while some emotions (such as happiness) are easier to recognise, others (such as fear) are more difficult. This means, for example, that it is generally easier to recognise when someone is happy than when that person is scared.

### What we are doing:

The research is being conducted as part of a Ph.D in the School of Psychology at the University of New South Wales. Participants with a brain injury as well as control

participants were asked to view a series of real-time interactive morphs of faces, between two endpoint facial expressions of the same identity, from 0% emotion (neutral face) to 100% emotion. The faces expressed six emotions: happiness, surprise, anger, disgust, sadness and fear, in different intensities, ranging from 20% to 100%. They were asked to select what emotion best described how the person in the picture was feeling, as well as to undergo conventional neuropsychological tests.

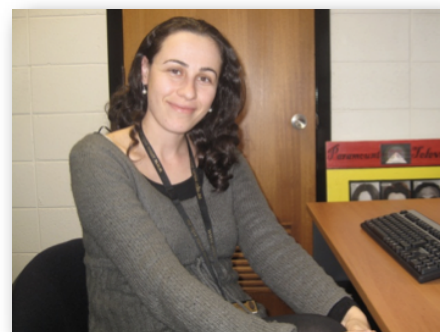
### What we found:

In comparison to control participants, those in the TBI group were less accurate overall in correctly recognising the expressions of surprise, anger, disgust, and happiness. Further, participants in both the control and the TBI groups were poor in recognising fearful facial expressions in lower intensities. However, while control participants improved their accuracy as the intensity increased, the accuracy of the participants in the TBI group remained low. This suggests that fear is especially difficult to recognise from faces for both control participants and

people with a TBI, with the latter group finding it equally difficult even when the intensity of the fearful expression increases.

### To find out more about this study:

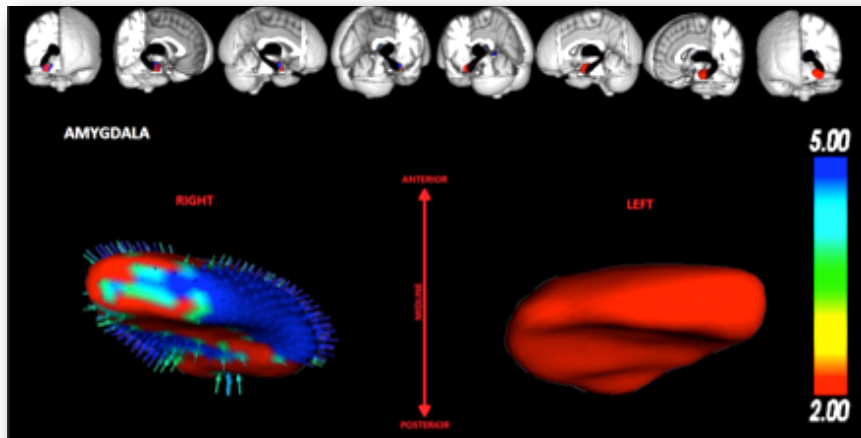
Contact Hannah Rosenberg:  
[hannah.rosenberg@unsw.edu.au](mailto:hannah.rosenberg@unsw.edu.au)



Hannah Rosenberg, PhD Candidate

# Amygdala volume predicts arousal and empathy deficits after severe traumatic brain injury

Jacqueline Rushby, Skye McDonald, Nicklas Parks, Jaimi Iredale, Rebekah Randall & Olivier Piguet



Dr. Jacqueline Rushby  
Post Doctoral Researcher

Figure 1. Illustrates volume differences in the right and left amygdala, between TBI and controls. Volume loss is reflected by the blue regions, the red regions reflect where no differences were found between groups.

### What the study is about:

People with severe traumatic brain injury (TBI) often find social situations challenging because they can no longer respond to the emotional state of others. Loss of emotional responsivity, i.e., reduced facial mimicry and autonomic arousal to facial expressions, have been reported to be associated with low self-reported emotional empathy following TBI (de Sousa, McDonald, Rushby et al., 2011). To date, however, no comparisons have been made between changes in brain morphometry and loss of emotional responsiveness. The current study aimed to determine whether a relationship is evident between brain regions implicated in emotion processing and changes to arousal regulation and empathic ability.

### What we did:

We compared grey matter volume from brain regions thought to be involved in the regulation of arousal and emotional responsiveness, specifically the bilateral amygdale, insula and thalamus, with resting arousal (measured by mean skin conductance level (SCL) over 2 minutes with eyes-closed) and self-reported cognitive and emotional empathy scores. To date, 16 adults (12 male; mean age = 38 years) with severe TBI (mean PTA = 81 days; ≥ 5 years post injury) and 16 matched controls (12 males; mean age 46 years) have participated.

### What we found:

Reduced grey matter volume was found in several structures examined in TBI compared with controls, with the largest reduction found in the right amygdala (illustrated in Figure 1). Compared to controls, TBI participants had lower resting arousal-SCL and cognitive empathy, but higher emotional empathy levels (see Table 1). Reduced amygdala volume was associated with lower arousal, and lower cognitive empathy. It was also associated with greater self-reported emotional empathy. Overall, the present study shows that amygdala reduction after TBI leads to deficits in the regulation of physiological arousal and empathy.

MEASURE	EFFECT
Right Amygdala	TBI < Control
Left Amygdala	TBI = Control
Right Insula	TBI < Control
Left Insula	TBI = Control
Right Thalamus	TBI < Control
Left Thalamus	TBI < Control
Arousal (SCL)	TBI < Control
Emotional Empathy	TBI > Control
Cognitive Empathy	TBI < Control

Table 1. Shows the differences found for TBI participants compared with controls for each brain structure examined, arousal, and self-reported empathy scores.





# Alcohol and cannabis effects on cognitive function

*Janette Smith, Richard Mattick & Jaimi Iredale*

### What the study is about:

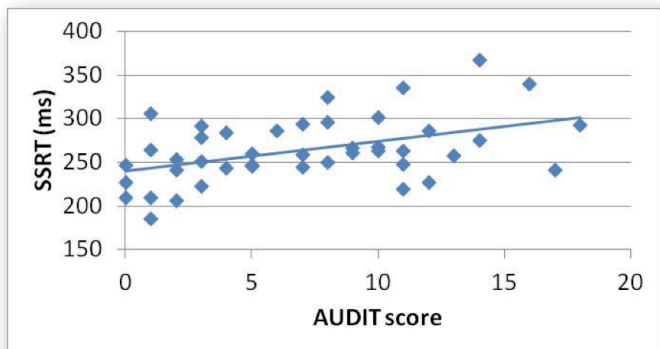
Current knowledge concerning the effects of alcohol and cannabis on cognitive function is based on older, more established/dependent users, and principally focusses on memory dysfunction alone. Our research examines a younger cohort with less exposure to alcohol and cannabis, but who are potentially at more risk of damage to their still-developing brains. Secondly, we combine assessment of not only memory but also executive function processes (including control of inappropriate responses, decision-making, and control of attention), which are increasingly important in models of the development and maintenance of substance abuse.

### What we did:

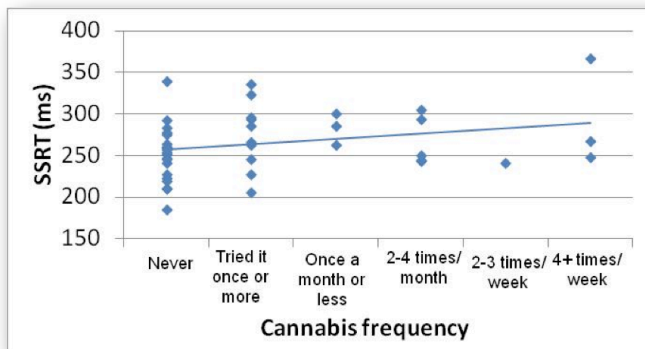
We have recruited 47 of a planned 60 participants aged 18-21 years. Participants report on their usual use of alcohol and other drugs, and complete tests of memory, behavioural and attentional control, and decision-making while we record the brain's electrical activity.

### What we found:

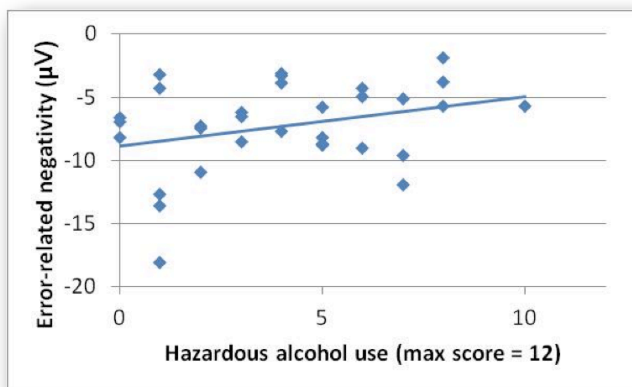
Data analyses are ongoing, but so far there is a strong correlation between hazardous alcohol use (on a scale called the Alcohol Use Disorders Identification Test; a score above 8 indicates hazardous alcohol use) and stop-signal reaction time (SSRT), a measure of how long a person needs to be able to stop an inappropriate response. Shorter SSRT is related to better inhibitory capabilities, so our results so far suggest poor inhibitory control of behaviour in heavier drinkers.



In contrast, the relationship for cannabis use frequency appears much weaker; however, few regular cannabis users have been recruited and these results may change with new subjects.



Lastly, a measure of brain function called the error-related negativity, or ERN, was measured. This is a brain potential which indexes the monitoring of actions and detection of errors, and greater negativity relates to better performance monitoring. Hazardous drinking is associated with a smaller ERN, indicating deficient monitoring of performance in hazardous drinkers.



Although data collection is still ongoing, if the results reported here hold when the full sample is collected, it suggests there are atypicalities in inhibitory processing and performance monitoring in a much younger group, with less exposure to alcohol and cannabis, than previously considered in other studies of older, more dependent users with longer use histories.



## Spontaneous and posed emotional facial expressions following severe Traumatic Brain Injury

*Marie Dethier, Sylvie Blairy, Hannah Rosenberg & Skye McDonald*

### **What this study is about:**

Dramatic interpersonal problems result frequently from severe TBI. These include relationship failures, increased social isolation, loneliness, and reduced social networks. Non-verbal communication skills, both the recognition and the expression of non-verbal behaviours, have been described as an important component in the maintenance of successful social relationships. To date, the research in patients with TBI has largely explored nonverbal emotion recognition: a significant proportion of adults with TBI present impairments in decoding emotional facial expression. However, nonverbal emotion expression has remained mainly unexplored. The object of the present study was to test the intensity of spontaneous expressions and the accuracy of posed expressions (in response to both visual and verbal cues) of patients with TBI.

### **What we did:**

Twenty-three participants with TBI and 27 control participants from similar backgrounds took part on this study. To test spontaneous expressivity, we asked participants to relate personal angry, happy, and sad events. We tested posed expressivity with two tasks. In the first one, they were asked to mimic the facial expressions presented on a photograph and in the second one, to produce emotional facial expressions on the basis of a word. Participants' faces were filmed during the three tasks and their emotional facial expressions were coded via judges' ratings.

### **What we found:**

Participants with TBI had less intense sad expressions when relating a sad event compared to control participants. No group difference emerged in the happy and angry events. Participants with TBI were also impaired in their ability to pose sad

emotions. These findings suggest that patients with TBI are impaired at expressing sad expressions either spontaneously or deliberately. This may reflect difficulties in the initiation or suppression of facial expression as well as an impaired knowledge of the facial configuration of sad expression.

### **To read more about this study:**

Dethier, M., Blairy, S., Rosenberg, H., & McDonald, S. (2012). Spontaneous and Posed Emotional Facial Expressions Following Severe Traumatic Brain Injury. *Journal of Clinical & Experimental Neuropsychology: Official Journal of the International Neuropsychological Society*.

# Facial mimicry and arousal to repetitions of affective movie clips

Jacqueline Rushby, Skye McDonald, Rebekah Randall, Arielle de Sousa & Emily Trimmer

### What the study is about:

Over a number of studies, we have shown that severe traumatic brain injury (TBI) is associated with reduced facial mimicry to pictures of facial expressions, affective scenes, and short affective movie clips. These effects are related to a reduction in self-reported emotional empathy, which is defined as ‘the tendency to mimic the verbal, physiological, and/or behavioural aspects of another person’s emotional experience/expression, and thus to experience/express the same emotions oneself’ (Hsee et al, 1990, p. 328). Empathy is thought to be critical for successful interpersonal functioning, as it provides an individual with the ability to understand and respond to the emotional experiences of others. The current study explored whether repeated exposure to emotionally evocative film clips would enhance facial mimicry responses in participants with TBI.

### What we did:

Nineteen participants with TBI and 23 control participants viewed five repetitions of six two-minute film clip segments containing pleasant (*When Harry met Sally* and *Mr Bean’s Christmas*), unpleasant (*My Bodyguard* and *Cry Freedom*), and neutral content (*Birds and Stream* taken from the documentary *Danali*). Two facial muscles were monitored while participants watched the films: the zygomaticus, which activates when we feel happy, smile or laugh; and the corrugator, which activates when we feel unhappy or frown. We also monitored skin conductance level (SCL), which measures arousal changes over time.

### What we found:

In line with our previous research (McDonald et al., 2010; de Sousa et al., 2011) TBI participants showed impaired corrugator responses to negative films (illustrated in Figure 1), but normal zygomaticus responses to positive films (Figure 2). Both groups showed a reduction in zygomaticus responses to repeated presentation of the positive clips, but only control participants showed a reduction to the negative clips – TBI responses were consistent over repetitions. In regards to arousal, control participants showed increased SCL to affective clips compared with neutral, whereas TBI participants showed no changes in arousal to any of the film clips (Figure 3). Follow-up work in our group is investigating how these findings may be incorporated into our socio-emotional rehabilitation program.

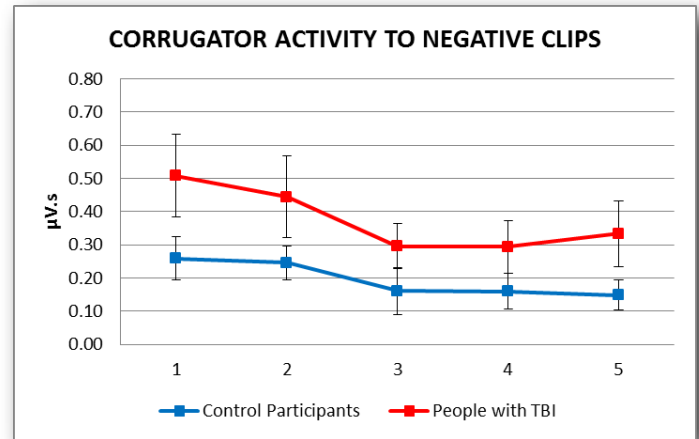


Figure 1.

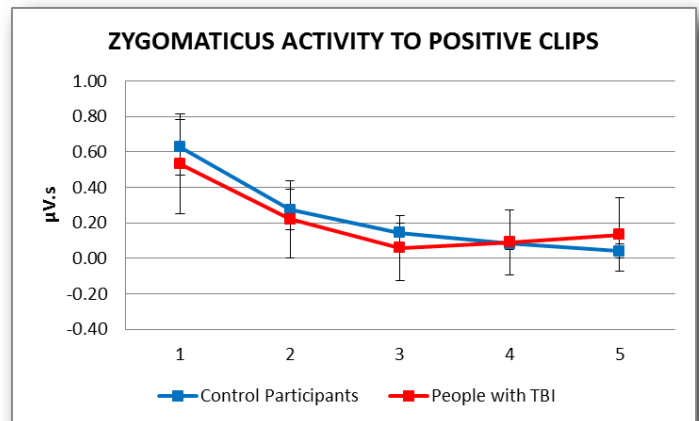


Figure 2.

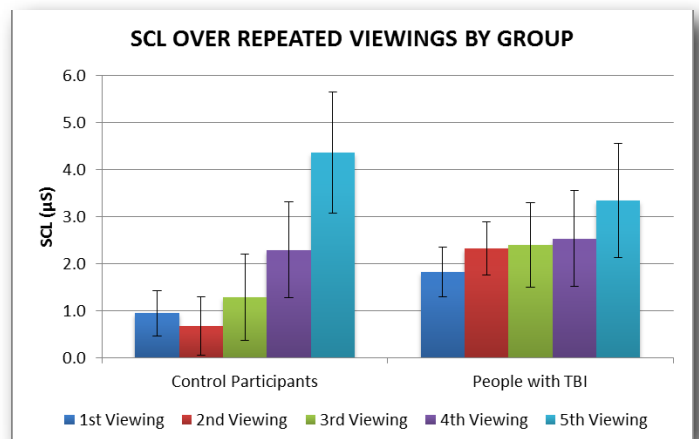


Figure 3.



# A new test of social decision making for people with Traumatic Brain Injury

*Michelle Kelly, Skye McDonald & David Kellet*

## What the study was about:

People with a traumatic brain injury (TBI) often have problems making decisions in everyday life. It is possible that the difficulties experienced when making decisions about everyday things, like what to eat and what to wear are very different to difficulties experienced when making decisions about things that affect us emotionally or socially. Decisions that involve our emotions include whether to start or end a relationship, whether to confront a friend about a disagreement or whether to spend all your savings. It is also possible that different areas of the brain are responsible for these two types of decisions and thus damage to one area may only affect one type of decision-making. Additionally, it is possible that there are a number of reasons why people with a brain injury might not do well in social situations. One of the possibilities is that they are not using cues, or feedback, from the social environment to guide future decisions and behaviours. This project aimed to: 1) develop a test that will investigate decision-making in a social situation where our emotions are involved; 2) examine the ability of adults with TBI to make good social decisions on this task; 3) determine whether adults with TBI have the same physiological response when making social decisions as adults without brain injury; 4) determine whether adults with brain injury know when they are being socially excluded, i.e., can recognise the social cues; 5) determine whether adults with brain injury have the same psychological response to ostracism as adults without brain injury; and, 6) determine whether adults with brain injury have the same physiological response to ostracism as adults without brain injury. Four studies were conducted to address these aims.

## What we did:

Participants were asked to complete a number of different tasks. The card game asked participants to choose cards from 4 decks. With each card choice, the participant would win some money, but could also lose some. By looking at the choices made we can see if participants were able to learn which decks would win them the most money in the end (everyday decision-making). The new task that was developed to test decision making in a social situation asked participants to play a game of 'catch and throw' with other participants on the internet. Participants were asked to try to 'win' as many throws as they could. A second game of 'catch and throw' was used to determine whether participants could recognise when other people were not playing fairly, i.e., when they were being left out of the game.

Also, sometimes we feel as though we are not having an emotional response to a situation yet our body says differently. Using small electrodes attached to the fingertips, we are able to measure very small changes in heart rate and perspiration that represent emotional responses. This may tell us whether an injury to certain parts of the brain may stop people being aware of the changes that are happening in their body when they are making emotionally charged decisions.



## What we found:

All of the data has now been analysed. The studies demonstrated that, as a group, the brain-injured participants were less able to determine which players would return the ball the most, and therefore ended up winning less throws in the new social decision making task. However, those with a brain injury were just as good at making decisions on the non-social card game as those without a brain injury.

The data also demonstrated that, as a group, those with a brain injury were less hurt by ostracism than those without a brain injury. Preliminary evidence suggests that this may be due to not having the same physiological response to the social cue of ostracism.

Together these studies suggest that people with a brain injury may be having more difficulty in social situations because they are less able to use the feedback, or cues from the environment to guide future decisions and behaviours.

We would like to say a big thank you to all the very generous people in Newcastle and in Sydney who have kindly volunteered for our research. This important work would not be possible without them.

## To find out more about this study:

Kelly, M., McDonald, S., Kellet, D.  
(Submitted) Development of a Novel Task for Investigating Decision Making in a Social Context Following Traumatic Brain Injury

Contact Michelle Kelly:  
Michelle.Kelly@hnehealth.nsw.gov.au

# Emotion in voice matters

*Jaimi Iredale, Jacqueline Rushby, Skye McDonald  
& Joshua Swift*

**What the study is about:**

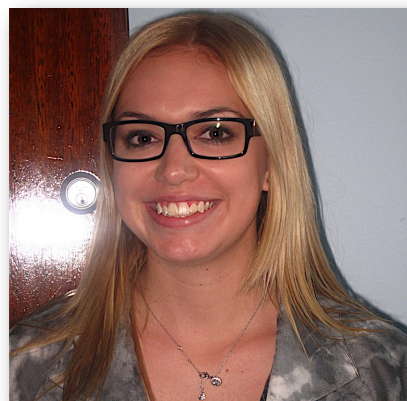
The ability to perceive emotions is important for successful social functioning. The aim of this research was to examine participants' ability to perceive emotion in voices, and to determine the neural characteristics involved.

**What we did:**

To effectively achieve these aims, we conducted an electroencephalogram (EEG), where we placed electrodes on the participant's scalp to measure their brain electrical activity. Participants were presented with 120 word pairs and they had to decide whether the words in the pair were spoken in the same (e.g. Happy/Happy) or different (e.g. Happy/Angry) emotional tone. We then analysed their brain activity in the form of event-related potentials (ERPs), which are small sections of continuous EEG data that are time-locked to each word pair presentation.

**What we found:**

From this information, we were able to provide evidence for three main stages involved in processing emotion in voice. The first processing stage was depicted by an early negative ERP waveform (N1; illustrated by the left column of head maps in Figure 1), which was found to be largest in the right side of the brain, and largest for emotional word pairs compared to neutral word pairs. The second stage was represented by a positive ERP waveform (P2; illustrated by the middle column of head maps in Figure 1) which was activated in frontal areas of the brain, and was found to be largest for happy words in the left hemisphere, and angry words in the right hemisphere. This showed that different emotions are processed in different regions of the brain. Finally, a third processing stage was illuminated by a late negative ERP waveform (N3; illustrated by the right column of head maps in Figure 1), which occurred largely in the frontal areas, demonstrating that this stage involves more complex cognitive processing. The N3 was largest for happy words which were found to be more difficult for participants to determine. Overall, the results of this study support a three-stage model of vocal emotion perception, and provide evidence for the functions and brain regions involved in each stage. We are currently examining the effect of severe traumatic brain injury on these processing stages, during several vocal emotion detection tasks.



Jaimi Iredale, Research Assistant and Graduated Honours Student

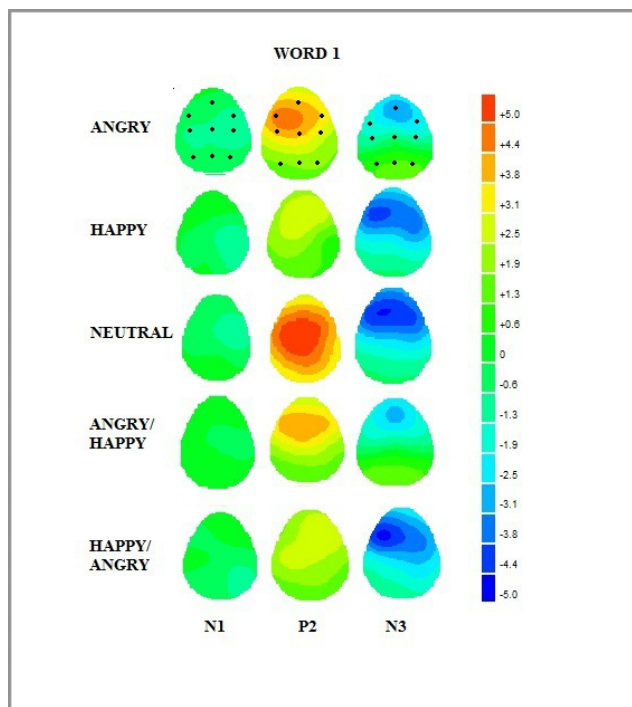
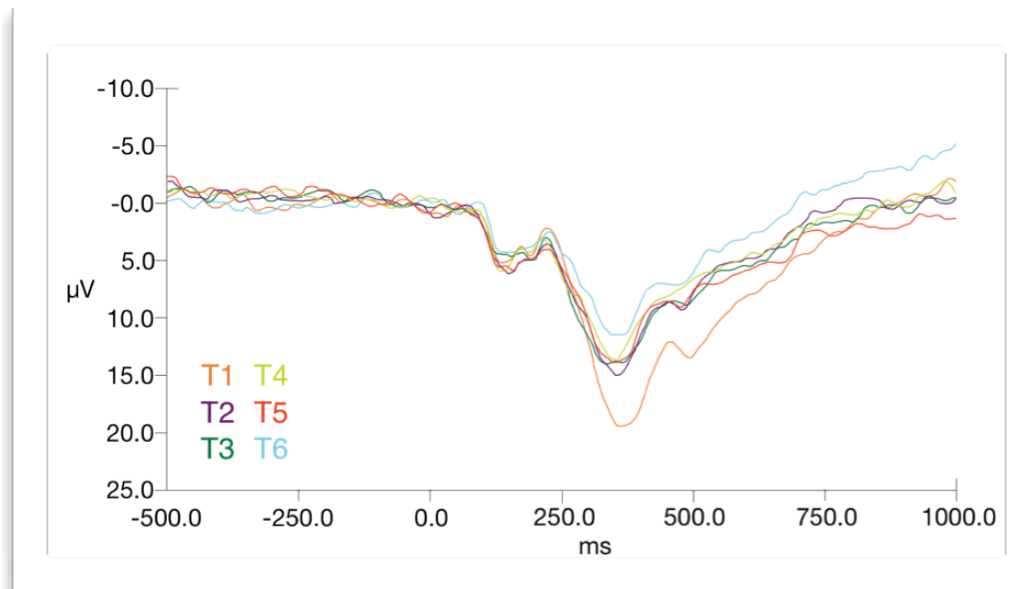


Figure 1. Topographic head maps of each ERP component for all conditions, illustrating electrical brain activity.



# Habituation to emotional facial expressions from an OR perspective

*Olivia Schollar-Root, Jacqueline Rushby, Skye McDonald & Joshua Swift*



*Figure 1. Across group grand average ERPs at the posterior site, demonstrating a response decrement over trials one to six, illustrating the effect of habituation to stimuli.*

**What the study was about:**

The Orienting Reflex (OR) serves to facilitate basic interactions of an organism with its environment via the involuntary projection of attention towards a novel stimulus. Over repetition or prolonged exposure, the novelty of this stimulus declines, and as a result the OR diminishes through a process called habituation. The methodology provided by electroencephalography (EEG) allows for observation of habituation by measuring electrical potentials in the brain over stimulus repetition and change. Thus far, these observations have been limited to experiments using stimuli of soft and loud auditory tones. The current study expands on this existing research by using stimuli of happy and angry facial expressions, thus working to investigate how the OR functions in human responses to emotional expression.

**What we did:**

EEG was used to measure the responses of 48 student participants to happy and angry facial expression stimuli in a dishabituation paradigm. This was constructed of six similar stimuli (either happy or angry faces) leading to a change stimulus (of the alternate facial expression), followed by a stimulus of the original expression. The EEG data was averaged over multiple trials to derive event-related potentials (ERPs), which allowed for observation of specific brain responses to individual stimuli. Two components of the ERPs were examined, the P3 and the CNV, in order to gain an understanding of both rapid and slow responses to stimuli.

**What we found:**

The results demonstrate that habituation occurred to repeated stimuli (see Fig 1) and also revealed evidence of differential activation towards happy and angry facial

expressions. This was most clearly seen in a slower habituation to angry expressions, an effect attributed to the greater salience and threatening nature of this stimulus. These findings provide novel insight into the basic mechanisms that drive everyday responses to facial expression. This holds promise for furthering understanding of a number of social impairments affecting clinical populations, and comparable data has already begun to be collected from participants with traumatic brain injury.



Olivia Schollar-Root, Graduated Honours Student

# Can training on an inhibitory task influence alcohol consumption?

*Bronwyn Hegarty, Jacqueline Rushby, Stuart Johnstone, Peter Kelly & Janette Smith*

**What this study was about:**

Response inhibition refers to our ability to suppress unwanted or inappropriate actions. Impairment in this form of inhibitory control is associated with alcohol abuse and dependence. It is possible that techniques designed to improve inhibitory control may lead to better treatments or help in the prevention of alcohol use disorders. A recent study (Jones et al., 2011) found that participants drank less beer directly after having performed a task designed to practice response inhibition. In this study, we wanted to test the effect of training on a different inhibitory task – called the Go/NoGo task – and to see if any effects on alcohol consumption lasted for up to a week afterwards.



Bronwyn Hegarty, Graduated Honours Student



**What we did:**

Participants performed a Go/NoGo task in which they were required to rapidly press a button when a 'Go' stimulus (the letter 'P') was presented to them, but to suppress that response upon presentation of a 'NoGo' stimulus (the letter 'F'). Participants were split into three groups: one group (the 'Restraint' Group) were told that the most important aspect of the task was the accurate inhibition of the response upon NoGo cues. A second group (the 'Disinhibition' group) were told to respond to Go cues as quickly as possible, and not to worry too much about accurate response inhibition. Alcohol consumption was assessed in a pretend "taste-test" carried out directly following the task. Alcohol intake during the weeks before and after the task was also compared. We expected that participants in the Restraint group would drink less beer than participants in the Disinhibition group in a pretend taste-test of beer

and soft drink that was performed directly after the task. We also expected that Restraint participants would drink less beer in the week after the Go/NoGo task compared to before the task, and the opposite for Disinhibition participants.

**What we found:**

As expected, participants in the Restraint group responded more slowly to Go trials during the Go/NoGo task than the Disinhibition group (see Figure 1), demonstrating a more cautious approach. However, the groups did not differ the number of erroneous responses made to NoGo trials – the index of inhibitory control. The groups also showed similar alcohol consumption measured straight after the task, and in the following week. These results indicate that this type of Go/NoGo task may not be appropriate for training inhibitory control.

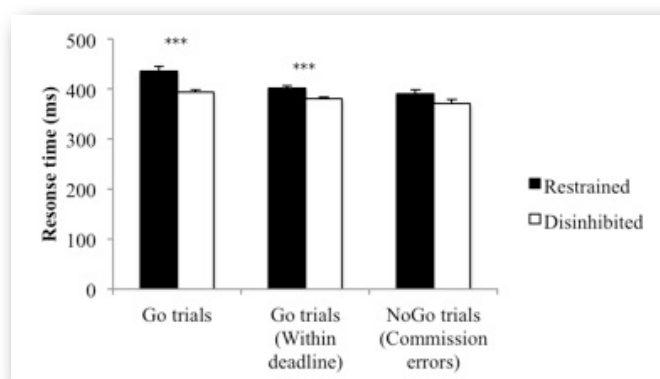


Figure 1. Comparison of response times for Restraint and Disinhibited groups on different stimuli in the Go/NoGo task.

## Emotion recognition abilities in alexithymia

*Sucheta Gorolay, Skye McDonald & Hannah Rosenberg*

### What this study was about:

Alexithymia is characterised as the inability to perceive, comprehend and express one's own emotion. It is primarily assessed through self-report measures and considered to be a dimensional personality trait, with high alexithymia being associated with lower awareness of internal states. Alexithymia is a relatively common dysfunction that has been found to be associated with a number of psychiatric disorders including panic disorders, eating disorders and developmental disorders. What is of interest is whether levels of alexithymia affect the ability to recognise emotional expressions in others.

### What we did:

Based on scores on the TAS-20 measure of alexithymia, 26 high-scoring individuals and 26 low-scoring individuals took part in this study. Participants viewed 52 still photographs followed by 52 audio-visual vignettes of actors depicting one of 14 different emotions. For each item, participants were asked to circle the emotion label that best defined the stimuli they had just viewed.

### What we found:

Audio-visual dynamic displays of emotion yielded better accuracy of emotion recognition than recognising emotions from still photographs. However, no group differences were found between high and low alexithymia in emotion recognition. This latter finding is in contrast to the hypothesis



Sucheta Gorolay, Graduated Honours Student

that individuals with difficulty identifying and describing their own emotions would have similar difficulty in identifying emotions in others. It therefore brings into question whether the alexithymia construct bears any real detriment for social interactions - a debate that remains in contention.

## Empathy deficits in alexithymia

*David Straton, Skye McDonald, Emily Trimmer & Jacqueline Rushby*

### What this study was about:

This was a study looking into the empathy responses of people with alexithymia. Alexithymia is a personality trait (thought to be present in about 10% of the general population) which involves a weakness in people's ability to understand and analyse their own emotions and why they are feeling them, and to differentiate their emotions from bodily sensations of arousal. Since understanding emotions in the self is thought to be necessary before one can recognise emotions in other people, it stands to reason that people with alexithymia should demonstrate lower levels of empathy in response to the pain of others.

### What we did:

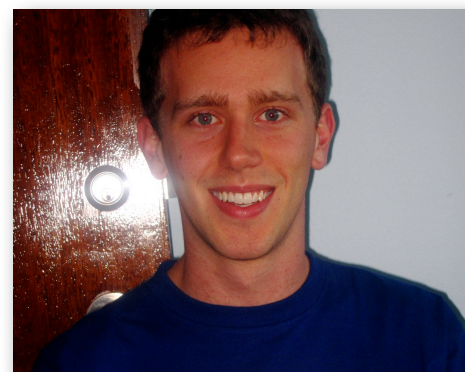
We tested this idea with a sample of first year psychology students, and measured their levels of empathy via physiological indicators of arousal: heart rate, skin

conductance, and facial EMG (the movement of the facial muscles involved in smiling and grimacing/frowning). Students completed the standard questionnaire used to measure alexithymia (the TAS-20), and participants were then selected in two groups: those scoring highly on alexithymia (poor emotional understanding), and low-scoring controls. They were then invited to the study, and fitted with the electrodes and equipment necessary to measure their heart rate, skin conductance and facial EMG. They were then shown a series of pictures depicting other people in a variety of painful (for example, fingers stuck in doors or being cut with a knife) and non-painful situations, and their reactions were measured. It was expected that alexithymic participants would become less aroused in response to the painful stimuli than the controls would, reflecting lower levels of empathy to the pain shown in the pictures.

### What we found:

Unfortunately, the results of this study were inconclusive. There were no significant differences detected between the responses of the alexithymics and the controls in response to the painful stimuli. Furthermore,

the physiological responses to painful and non-painful stimuli were indistinguishable as well, suggesting that perhaps the stimuli used weren't painful enough to evoke a sufficiently strong reaction to be measured. Overall, there were some slight trends observed suggesting that alexithymic participants may display lower levels of empathy, however no conclusions could be reached. One interpretation of these results is that there is really no difference between the two groups in their empathy responses. However it could also be the case that such a difference exists and we failed to detect it, for reasons such as insufficient sample size and poor choice of stimuli.



David Straton, Graduated Honours Student

## STUDIES IN PROGRESS AND NEW RESEARCH STARTING IN 2013

### Can elderly people with Mild Cognitive Impairment improve their cognitive functioning by doing regular computer-based brain exercises?

*Skye McDonald & Maurice Finn*

#### What the studies are about:

A series of studies is underway looking at the impact of computerised cognitive training on cognitive functioning in older people diagnosed with Mild Cognitive Impairment (MCI). Unfortunately there are no effective means of ameliorating cognitive decline for this group at present. Many studies that have been conducted have focussed on teaching older people with cognitive impairment how to improve their recall by using memory strategies. The results to date have been disappointing, possibly because the learning processes required to learn and implement these strategies in daily life are compromised. Another problem with this approach is that a narrow focus on memory neglects other cognitive functions (for example, attention and processing speed) that play an important role in new learning and that are required for successful completion of everyday activities. Some researchers have suggested that cognition can be improved via the use of targeted computer-based

exercises to stimulate brain plasticity processes. Studies in other clinical populations such as people with schizophrenia and preliminary studies in older people have indicated there may be some merit in this approach.

#### What we are doing:

The research is being conducted as part of a Ph.D in the School of Psychology at UNSW in conjunction with the Geoff and Elaine Penney Ageing Research Unit in the Department of Aged Care & Rehabilitation at Royal North Shore Hospital. An initial RCT pilot study was conducted in 2008 and 2009 with 16 participants recruited from the Memory Clinic and Geriatric specialty outpatient clinics. The results were published in the journal *Brain Impairment* in 2011. A secondary single-case study was completed in 2011 and the results were presented as a poster at the International Psychogeriatric Association International Meeting in Cairns in 2012. The results will be submitted for publication shortly. The third study using an RCT design will commence in late 2012.

#### What we found:

The first study indicated that the sample of elderly clients with MCI were able to improve on the trained tasks, with some evidence of improvement on an untrained

measure of visual sustained attention. A single case study was designed to explore this finding in more depth and found that functions such as attention and reasoning may respond to training. The participants in the single case study also reported less frequent cognitive failures in daily life as well as improved mood, suggesting that the more intensive approach to training has wider benefits.

#### Next phase of research:

For the third study, the focus of our research now shifts back to memory, in particular the ability to learn and recognise auditory information. We are using a learning paradigm called repetition-lag training that has been used in healthy elderly in previous research with evidence of gains on untrained tasks. It is hoped that this form of focussed memory training will result in improvement on measures of auditory recognition memory.



Maurice Finn, PhD Candidate

### Perception of emotions in voice after Traumatic Brain Injury

*Christopher Sufani, Jacqueline Rushby & Skye McDonald*

#### What the studies are about:

Previous studies have shown that a significant proportion of individuals who have sustained traumatic brain injury have greater difficulty in recognising negative emotions than positive emotions in voice. However little is known about the processes and structures in the brain responsible for the perception of emotions in voice. Hence, this study will firstly look at which processes and structures of the brain are recruited during the processing of positive and negative emotions in voice. A second study will then investigate whether the processes and structures associated with the perception of negative emotions in voice are more greatly affected than those associated with perception of positive emotions in individuals who have sustained traumatic

brain injury. Using electroencephalogram (EEG), it is hoped that this study will contribute to a greater understanding of emotion perception in voice and more importantly, the neural basis of traumatic brain injury.

#### Volunteers Welcome:

Currently we are looking for individuals who have sustained traumatic brain injury and also individuals without any history of brain injury to help us with this study. If you are interested in participating or know someone who may be suitable and interested in participating in this study, Christopher Sufani can be contacted on: [christopher.sufani@student.unsw.edu.au](mailto:christopher.sufani@student.unsw.edu.au)

## Understanding mistake recognition in adults with Attention Deficit/Hyperactivity Disorder

Matthew Gerathy, Skye McDonald & Jacqueline Rushby

### What the studies are about:

This study looks into sparsely investigated neural abnormalities that have been associated with people who continue to exhibit the symptoms of Attention Deficit/Hyperactivity Disorder (ADHD) into adulthood. In brief, we are investigating differences in neurological responses between adults with ADHD and healthy populations when these individuals make a mistake on a difficult prediction task.

Additionally, we hope to contribute to the current understanding of the roles of these neural components (i.e. event-related potentials) in error-monitoring in both clinical and healthy populations.

In the future we aim to determine whether known differences between these groups suggest that adults with ADHD cannot perceive they have made a mistake or whether they cannot understand the meaning of the mistake, or both, compared to their healthy peers.



Matthew Gerathy, PhD Candidate

### By the way ... Volunteers Welcome:

Currently we are looking for adults who have been diagnosed with ADHD as children and also individuals without any history of ADHD to help us with this study. If you are interested in participating or know someone who may be suitable and interested in participating in this study, Matthew Gerathy can be contacted on: [m.gerathy@gmail.com](mailto:m.gerathy@gmail.com)

## Investigation of complex emotion recognition in adults with Traumatic Brain Injury and Parkinson's disease – Development of Complex Audio-Visual Emotion Assessment Task (CAVEAT)

Hannah Rosenberg, Skye McDonald & Fred Westbrook

### What the study is about:

People suffering from a range of psychiatric and neurological disorders often experience difficulties interpreting social situations and understanding the emotions portrayed by others. The ability to accurately recognise how other people are feeling is very important in a variety of everyday social situations. Two conditions where emotion recognition deficits are often reported are traumatic brain injury (TBI) and Parkinson's disease (PD).

Emotion research to date has mostly focussed on recognition of six emotions (termed 'basic'), namely happiness, surprise, sadness, anger, fear and disgust, and has revealed that recognition deficits are more robust for negative than positive emotions. This study aims to investigate emotion recognition in adults with TBI and PD using a new measure of emotion recognition, the Complex Audio-Visual Emotion Assessment Task (CAVEAT). This measure was developed as part of Hannah Rosenberg's PhD project and consists of video vignettes in which the observer is asked to judge what emotion is experienced by the person in the scene. It includes a wider array of emotions than are included in the conventional measures, such as contempt, amusement, pride, and relief. This allows the investigation of subtle emotion recognition deficits in clinical populations and re-evaluation of the commonly reported findings

that recognition of negative emotions is more impaired following a range of neurological conditions than positive emotions.

### What we are doing:

The research is being conducted as part of a Ph.D in the School of Psychology at the University of New South Wales. We are in the process of collecting data for this project, and have so far tested 5 control participants and 9 people in the TBI group. We are looking for more people to complete this study, so if you are interested in participating, please see our contact details below. Data collection with Parkinson's disease participants is scheduled to start later this year.

### Did we mention that volunteers are welcome?

We are currently in the processes of collecting data for this project, and are looking for people with a traumatic brain injury, Parkinson's disease, and control participants (that do not have a brain injury or Parkinson's disease) to participate in our research.

Please contact us on 9385 3590 or email [hannah.rosenberg@unsw.edu.au](mailto:hannah.rosenberg@unsw.edu.au) if you are interested in taking part in our research.

## Autonomic and neural correlates of dysregulated arousal in severe Traumatic Brain Injury

Jacqueline Rushby, Alana Fisher, Skye McDonald, Nicklas Parks & Robert Barry

### What the study is about:

Traumatic brain injury (TBI) is associated with abnormalities in arousal, emotional responsivity and processing. These abnormalities can be observed via responses on physiological and self-report measures to emotionally-evocative pictures and films, as well as via everyday behaviour. Our research suggests that alpha band activity, recorded via electroencephalogram (EEG), represents a novel way of measuring arousal. Alpha activity is enhanced when someone is relaxed or asleep and suppressed when stimulated, agitated or aroused. Alpha activity also relates to a well-known measure of physiological arousal, skin conductance level (SCL): with eyes-closed, there is increased alpha activity and reduced SCL; with eyes-open, there is an increase in SCL and decrease in alpha power. In this study, we are hoping to discover the mechanisms which might contribute to disturbances in arousal following a TBI.

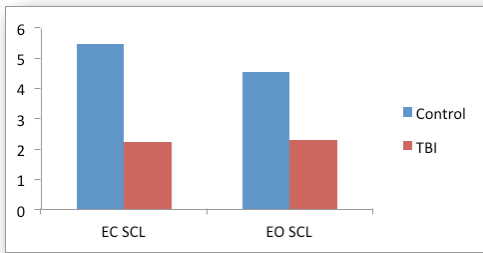


Figure 1. Skin conductance levels (SCL) in TBI and non-brain-injured (control) groups across eyes-closed (EC) and eyes-open (EO) resting states. Note that the TBI group has lower SCLs, indicating lower arousal levels.

### What we are doing:

We are investigating the relationship between EEG alpha activity and SCL in eyes-closed and eyes-open resting states. To find out which brain structures may contribute to the arousal disturbances seen in TBI, we also examined the insula and amygdala which are known to play a role in the regulation of arousal, emotional responsivity and processing. We are recruiting adults with and without a brain injury to have a diffusion tensor imaging scan (similar to fMRI) so that we can establish insula and amygdala volume. In a follow-up session of EEG, participants are instructed to close their eyes for two minutes and then open their eyes for two minutes. While doing this, we record activity in the alpha wave band, as well as SCL, to measure arousal levels during the experiment across the brain.



### What we have found so far:

Smaller amygdala and insula volumes were found in TBI patients compared to people without a brain injury. Compared to people without a brain injury, TBI patients showed lower levels of physiological arousal (SCL; see Figure 1) and smaller changes in their arousal levels (alpha power; see Figure 2). TBI patients also showed lower levels of arousal in brain regions where non-brain-injury people showed higher arousal levels, and vice-versa.

Our findings so far suggest that EEG alpha power is a sensitive new method of assessing changes in arousal after a TBI. These include lowered arousal (hypoarousal), diminished arousal changes during resting states, and changes to the organisation of arousal levels in regions of the brain. This is consistent with the global (whole brain) and focalised (specific region) damage that characterises TBI.

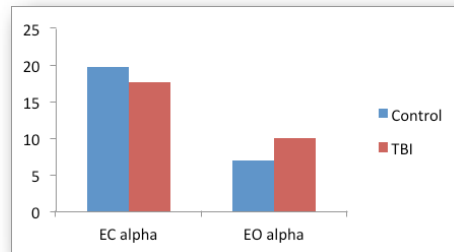


Figure 2. Alpha activity levels in TBI and non-brain-injured (control) groups across eyes-closed (EC) and eyes-open (EO) resting states. Note that the TBI group show smaller decreases in alpha activity compared to the non brain-injured group, indicating diminished arousal changes or responsivity.

If you are interested in participating in this study, please contact Alana on [alana.fisher@unsw.edu.au](mailto:alana.fisher@unsw.edu.au).



Alana Fisher, Research Assistant

## Alumni - Life After the Lab



### Arielle de Sousa

Arielle is a mother of three and has been busily taking care of her young family since she left the lab in 2011. She did recently publish her third paper however; de Sousa, A., McDonald, S., & Rushby, J. (2012). Changes in emotional empathy, affective responsivity, and behavior following severe traumatic brain injury. *Journal of Clinical and Experimental Neuropsychology*, 34, 606-623.



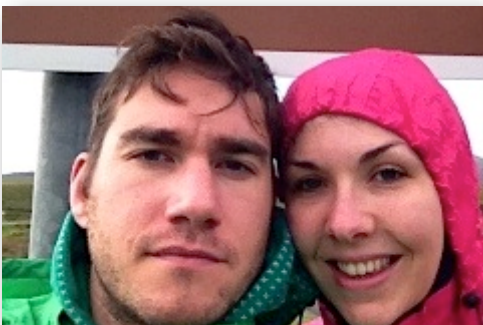
### Marie Dethier

Marie was an international student from Belgium who joined us between January and November 2011. She is now back in Belgium and has finished writing her thesis called "Emotional facial expression in the heart of interpersonal relationships: An investigation of the nonverbal communication skills of people with alcohol dependence and people with traumatic brain injury". She is currently preparing to defend it in public.



### Matt Davidson

After leaving the lab mid-2011, Matt has become a full-time backpacker. Fifteen months and twenty-two countries later, he is now studying French while residing in Montréal, Quebec. He is in the process of submitting his honours thesis for publication and applying for post-graduate programs in North-America and Europe.



### Alison Gowland

Ali got married recently and has just started as a third year medical student at King's College London. For the next few months she is on a neurology rotation, and looking forward to learning more about brain injury from this perspective. She misses Australia and working at UNSW, and hopes to return one day!



### Thea Longman

Thea is currently in her first year of the Doctorate of Clinical Psychology/Master of Science at the University of Sydney, training to becoming a clinical psychologist while completing her research thesis.

## Alumni - Life After the Lab



### Emilie Andersson

Emilie was an exchange student at UNSW and did her bachelor thesis for her Bachelor Degree in Medical Science with a Major in Biomedicine at Skye McDonald's Lab during spring 2011. After completing her degree, she decided to take a year off and work in the health care for elderly people. She is now back at university, studying a Masters Program in Entrepreneurship in Life Science at Sahlgrenska Academy at University of Gothenburg in Sweden.



### Nicole Pesa

Nicole is currently working in health services research as a Research Officer for the Pharmacoepidemiology and Pharmaceutical Policy Research Group at the University of Sydney. Her current research interests involve the quality use of medicines in cancer patients with a focus on symptom management and mental health care.



### Therese English

Therese is currently completing the combined Master of Clinical Psychology/PhD program here at UNSW. Her PhD research is investigating the efficacy of Emotional Engagement Treatment in reducing disruptive behaviour in young children with behavioural problems.



## Books and Book Chapters

### In Press

- McDonald, S. & Bornhofen, C. (In Press) Neuropsychology of emotions. In A. Fernandez (Ed.), *Undergraduate textbook of Neuropsychology*.
- McDonald, S., Honan, C., Kelly M., Byom, L. & Rushby, J. (In Press) Disorders of cognitive-communication, social cognition and emotional behaviour in adults with TBI. In S. McDonald, L. Togher & C. Code (Eds.), *Communication and social disorders following traumatic brain injury (2nd Edition)*. Hove, UK: Psychology Press.
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- McDonald, S., Turkstra, L. & Togher, L. (2012). Pragmatic Language Impairment after brain injury: Social Implications and treatment models. In V. Anderson & M.H. Beauchamp (Eds.), *Developmental Social Neuroscience: Contributions to Childhood Brain Disorders* (pp 325-349). Guilford Press, ISBN: 978-1-4625-0429-9.

### 2011

- McDonald, S. & Togher, L. (2011). Traumatic Brain Injury. In K. Hilari, K. & N. Botting (Eds.), *The impact of communication disability across the lifespan*. J&R Press. ISBN 978-1-907826-03-0.

## Publications in Refereed National and International journals

### Submitted

- Green, M.J., Singh, P., Sparks, A, Lino, B.J. McDonald, S., Mitchell, P.B. (Submitted) Determining the relative contributions of neurocognition and social cognition to functional outcome in schizophrenia and bipolar disorder.
- Kelly, M., McDonald, S., Kellet, D. (Submitted) The Psychological Effects of Ostracism Following Traumatic Brain Injury.
- Kelly, M., McDonald, S., Kellet, D. (Submitted) Development of a Novel Task for Investigating Decision Making in a Social Context Following Traumatic Brain Injury.
- Mathersul, D., McDonald, S., & Rushby, J. A. (Submitted) Automatic facial responses to briefly presented emotional stimuli in autism spectrum disorder.
- Mathersul, D., McDonald, S., Rushby, J.A. (Submitted) Understanding advanced theory of mind and empathy in high-functioning adults with autism spectrum disorder.
- McDonald, S., English, T., Randall, R., Longman, T., Togher, L. & Tate, R.L. (Submitted) Assessing social cognition and pragmatic language in adolescents with brain injuries.
- Rushby, J, McDonald, S., Gowland, A., English, T., Longman, T. Tate, R.L. (Submitted) Impaired arousal to masked angry faces following severe traumatic brain injury.

### In Press

- Dethier, M. Blairy, S., Rosenberg, H. & McDonald, S. (In Press) Deficits in processing feedback from emotional behaviours following severe TBI. *Journal of the International Neuropsychological Society* (Accepted 12/06/2012).
- Dethier, M., Blairy, S., Rosenberg, H. & McDonald, S. (In Press) Spontaneous and Posed Emotional Facial Expressions Following Severe Traumatic Brain Injury. *Journal of Clinical and Experimental Neuropsychology* (Accepted 23 April, 2012).
- Mathersul, D., McDonald, S, & Rushby, J. (In Press) Automatic facial responses to affective stimuli in high-functioning adults with autism spectrum disorder. *Physiology and Behaviour* (Accepted 5/10/12).
- Mathersul, D., McDonald, S., Rushby, J. (In Press) Psychophysiological correlates of social judgement in high-functioning adults with autism spectrum disorder. *International Journal of Psychophysiology* (Accepted 13/11/2012).
- McDonald, S. (In Press) Social cognition following severe Traumatic Brain Injury: A review. *Journal of the International Neuropsychological Society* (Accepted 4/10/12). \* Used for Continuing Education credits for USA based neuropsychologists 2013.
- McDonald, S., Darke, S., Kaye, S. & Torok, M. (In Press) Deficits in social perception in opioid maintenance patients, abstinent opioid users and non-opioid users. *Addiction* (Accepted 18/10/12).
- McDonald, S., Togher, L., Tate, R., Randall, R., English, T. & Gowland, A. (In Press) Trialing a brief intervention for deficits in recognising emotional prosody following severe Traumatic Brain Injury. *Neuropsychological Rehabilitation* (Accepted 14/11/2012).
- Weickert, T.W., Leslie, F., Rushby, J.A., Hodges, J.R., Hornberger, M. (In Press) Probabilistic association learning in Frontotemporal dementia and schizophrenia. *Cortex* (Accepted 28/9/2011).

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- Darke, S., McDonald, S., Kaye, S. & Torok, M. (2012). Comparative patterns of cognitive performance amongst opioid maintenance patients, abstinent opioid users and non-opioid users. *Drug and Alcohol Dependence*, 126(3), 309-315. doi: 10.1016/j.drugalcdep.2012.05.032
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- De Sousa, A., McDonald, S. & Rushby, J. (2012). Changes in emotional empathy, affective responsivity and behaviour following severe traumatic brain injury. *Journal of Clinical and Experimental Neuropsychology*, 34(6), 606-623. doi: 10.1080/13803395.2012.66706
- Henderson, L., Stathis, A., James, C., McDonald, S. & Macefield, V.G (2012). Real-time imaging of cortical areas involved in the generation of increases in skin sympathetic nerve activity when viewing emotionally charged images. *NeuroImage*, 62(1), 30-40.
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- MacDonald, B., Barry, R.J., Rushby, J.A. (2012). Single-trial event-related potentials and autonomic measures of the orienting reflex. *International Journal of Psychophysiology*, 83(1), 79-86.
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- Togher, L., Power, E., Rietdijk, R., McDonald, S. & Tate, R. (2012). An exploration of participant experience of a communication training program for people with traumatic brain injury and their communication partners. *Disability and Rehabilitation*, 34(18), 1562-1574.

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- De Sousa, A., McDonald, S., Rushby, J., Li, S., Dimoska, A. & James, C. (2011). Understanding deficits in empathy after Traumatic Brain Injury: The role of affective responsivity. *Cortex*, 47, 526-535. doi: 10.1016/j.cortex.2010.02.004
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- Finn, M. & McDonald, S. (2011). Computerised Cognitive Training for Older persons with Mild Cognitive Impairment. A pilot study using a randomised controlled trial design. *Brain Impairment*, 12, 187-199.
- Kangas, M. & McDonald, S. (2011). Is it Time to Act? The potential of Acceptance and Commitment Therapies for psychological problems following acquired brain injuries. *Neuropsychological Rehabilitation*, 21, 250-276. doi: 10.1080/09602011.2010.540920
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- McDonald, S., Rosenfeld, J., Henry, J.D. & Bornhofen, C., Tate, R.L. & Togher, L. (2011). Emotion perception and alexithymia in people with severe traumatic brain injury: One disorder or two? A preliminary investigation. *Brain Impairment*, 12, 165-178.
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- McDonald, S., Saad, A., & James, C. (2011). Social dysdecorum following severe traumatic brain injury: Loss of implicit knowledge or loss of control? *Journal of Clinical and Experimental Neuropsychology*, 33, 619-630.
- Rushby, J.A., Vercammen, A., Loo, C., Short, B., Weickert, C.S., Weickert, T.W. (2011). Frontal and parietal contributions to probabilistic association learning. *Cerebral Cortex*, 21(8), 1879-1888.
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## Refereed Conference Proceedings and Abstracts

### 2012

- Evers, H.J., Visser-Keizer, A.C., Schönherr, M.C., Spikman, J.M., Mc Donald, S. (2012). Social cognition and the awareness of social inferences test: Dutch translation. 7th World Congress for Neurorehabilitation, Melbourne, May 2012.
- Gerathy M, Rushby J, McDonald S, Dimoska A, Ho W, Andersson E. (2012). An ERP investigation into gender differences in affective prosody processing and its relationship to empathy. *Clinical EEG and Neuroscience*, 43(3), 231.
- Li J, McDonald S, Rushby, J. (2012). The Role of Attention in Rapid Presentations of Facial Expressions: An Investigation using the Repetition Blindness Paradig. *Clinical EEG and Neuroscience*, 43(3), 236.
- Mathersul, D., McDonald, S, & Rushby, J. A. (2012). Psychophysiological correlates of empathy in adults with Asperger's. Poster to be given at the 52nd Annual Meeting for the Society for Psychophysiological Research (SPR), New Orleans, Louisiana, USA. *Psychophysiology*.
- Mathersul, D., Rushby, J. A., McDonald, S. (2012). Conscious and Non-conscious Judgements of Trustworthiness in Adults with Asperger's. *Clinical EEG and Neuroscience*, 43(3), 239.
- Mathersul, D., Rushby, J. A., McDonald, S. (2012). Psychophysiological correlates of empathy in adults with Asperger's. Proceedings of the 16th World Congress of Psychophysiology of the International Organization of Psychophysiology (IOP), Pisa, Italy. *International Journal of Psychophysiology*.
- Rushby, J.A., McDonald, S., Parks, N., Iredale, J., Randall, R., Piguët, O. (2012). Amygdala volume predicts arousal and empathy deficits after severe traumatic brain injury Proceedings of the 16th World Congress of Psychophysiology of the International Organization of Psychophysiology (IOP), Pisa, Italy. *International Journal of Psychophysiology*.
- Trimmer, E., Rushby, J.A., McDonald, S., Randall, R., de Sousa, A. (2012). Facial mimicry and arousal to repetitions of affective movie clips. Proceedings of the 16th World Congress of Psychophysiology of the International Organization of Psychophysiology (IOP), Pisa, Italy. *International Journal of Psychophysiology*.

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- Kangas, M., McDonald, S., Williams, J. & Smeë, R. (2011). A case study evaluation of the behavioural and acceptance based therapy (BABT) program for the treatment of anxiety and depression following ABI. Abstracts of the 4th Pacific Rim meeting of the International Neuropsychological Society and the Australian Society for the Study of Brain Impairment, Auckland, 2011. *Brain Impairment*, 12, 73.
- Kelly, M., McDonald, S., Rushby, J. & Kellett, D. (2011). Evidence for the construct validity of a new social decision making task. Abstracts of the 4th Pacific Rim meeting of the International Neuropsychological Society and the Australian Society for the Study of Brain Impairment, Auckland, 2011. *Brain Impairment*, 12, 43.
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- Mathersul, D., McDonald, S, & Rushby, J. A. (2011). Conscious and non-conscious judgements of trustworthiness in adults with Asperger's. (Abstract), Poster given at the 51st Annual Meeting for SPR, Boston, Massachusetts, USA. *Psychophysiology*, 48, S25-6.
- McDonald, S., Rushby, J., Pearson, T. & English, T. (2011). Impaired automatic processing of emotional faces following severe traumatic brain injury: A backward masking paradigm. Abstracts of the 4th Pacific Rim meeting of the International Neuropsychological Society and the Australian Society for the Study of Brain Impairment, Auckland, 2011. *Brain Impairment*, 12, 42.
- Rushby, J., McDonald, S. & de Sousa, A. (2011). Insight into the absence of empathy after severe traumatic brain injury. *Clinical EEG and Neuroscience*.
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- Tate, R., Togher, L., Perdices, M., McDonald, S., Rosenkoetter, U., Godbee, K., Sigminsdottir, L., Hunt, L., Wakim, D. Doubledya, J. (2011). Rehabilitating neuropsychological impairments using single participant research designs: A survey of methodological quality of withdrawal/reversal (A-B-A), multiple baseline, A-B, and other designs. Abstracts of the 4th Pacific Rim meeting of the International Neuropsychological Society and the Australian Society for the Study of Brain Impairment, Auckland, 2011. *Brain Impairment*, 12, 70.

# Our Lab



## Thank you

Once again, we would like to thank everyone who has been involved in our research studies and extend a warm welcome to any future volunteers.

We are always keen to hear from people who would like to participate in our research. Please don't hesitate to contact us for future information.

Until next year,

**MERRY CHRISTMAS!**

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