

Newsletter

2017-18

12th Edition



Brain Sciences
UNSW

In this issue:

- 1 Our Lab**
Get to know our research and team from page 3
- 2 Studies in progress**
See what studies are in progress and find out what's currently happening in our lab from page 7
- 3 Research collaborations**
Get an insider look into some of the work we are doing with colleagues nationally and from page 12
- 4 Completed studies**
Read about our completed studies in 2017 from page 14
- 5 Publications**
Read more about our research from page 24

CONTACT DETAILS

Attn: Skye McDonald
School of Psychology
University of New South Wales
NSW 2052

Tel: 02 9385 3029
Email: s.mcdonald@unsw.edu.au

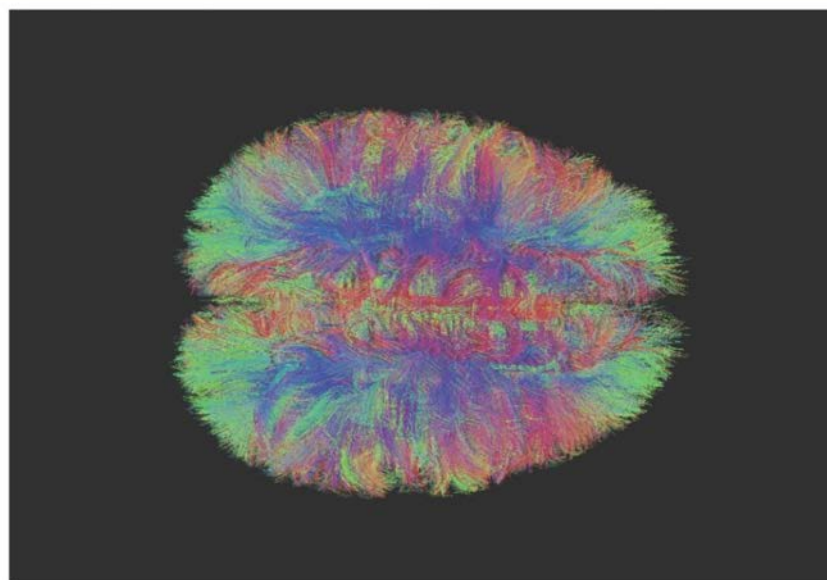


Image of white matter connections within the human brain

Hello! All of us at the University of New South Wales' Clinical Neuropsychology Research Team hope you are having a wonderful start to 2018! Again, it is my pleasure to present you with our annual newsletter, detailing our research activities in brain injuries and other disorders over the past year.

The aim of our newsletter is to provide you with an overview of what has been happening - the kind of research we do, the people involved, the projects we conduct and who has assisted us. However, most importantly, we want 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 trialing.

Any feedback that you wish to provide is always most welcome. We hope you enjoy our newsletter. Thank you for making our research possible!

Best wishes,

Professor Skye McDonald
Clinical Neuropsychology Research Team Leader
School of Psychology, UNSW



CONTENTS

THIS EDITION

Welcome to the 12th edition of our annual newsletter! In this edition, you will read about our studies in progress, those we are collaborating in and completed over the past 12 months. Each study is described in terms of what the study is about, what we did, what we found and, where applicable, what our findings mean.

For studies that have been submitted for publication, the reference to the article and target journal has been provided so you can read more detail 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 we have published over the last 12 months from page 24.

STUDIES IN PROGRESS

'SIFT IT' The Social Thinking Therapy! Is it possible to treat social cognitive difficulties after brain injury?..7	
Can non-invasive brain stimulation improve memory following traumatic brain injury?.....8	8
Investigating the neural basis of empathy: The link between empathy and the mirror neuron system.....9	9
Biofeedback as a way of modulating emotional regulation for individuals with traumatic brain injury..... 10	10
Heart rate variability as an index of emotion regulation following traumatic brain injury..... 11	11

COLLABORATIVE RESEARCH

This Way Ahead..... 12	12
A pilot project for standardised assessment tool (Systematic Assessment for Brain Injury Rehabilitation - SABIR) for patients after a traumatic brain injury and its correlation with functional outcome measures 13	13

COMPLETED STUDIES

Assessing emotion perception difficulties following moderate-to-severe traumatic brain injury: The role of facial expressivity and subjective emotional experience 14	14
Examining Physiological Regulation in Dyadic Conversations and the Effect of Emotional Empathy 15	15
Investigating the relationship between anxiety-related cognitions and autonomic output during psychosocial stress..... 16	16
Does emotional processing change after a traumatic brain injury?..... 17	17
Where is the Best Region to Stimulate the Brain to Improve Short-Term Memory 20	20
More than meets the eye: A neurophysiological investigation of the influences of social cognition on visuospatial attention..... 21	21
Cognitive control processes underpin amplified sex differences in self-report measures of empathy:..... 22	22
I see what you feel: An investigation of affective facial mimicry..... 23	23



Our Research

We conduct research into disorders that arise from brain dysfunction due to organic (e.g., stroke) or acquired structural damage (e.g., traumatic brain injury) or developmental conditions (e.g., autism spectrum disorders). Our research investigates: (1) social cognition and communication (2) emotional disorders and (3) remediation. We also have a particular interest in psychophysiology, allowing us to measure bodily reactions (e.g., changes in heart rate and skin temperature) to external events (e.g., stress). Through combining these measures, we aim to take a holistic approach in piecing together a clearer understanding of how people with brain dysfunction respond emotionally to significant events.

We are also interested in what causes problems that interferes with everyday function, with an emphasis on why these problems occur in interpersonal interactions and everyday communication. This type of research is particularly important because many people who have a brain disorder find social interaction difficult. These difficulties often reduce self-esteem, mood and confidence in social situations.

Our research aims to increase the understanding of how social and emotional functioning may be disrupted by brain injury. We are interested in improving rehabilitation techniques to provide practical support for those people with brain disorders. We believe that our research is important because positive social interaction is pivotal to being a friend, student, workmate, family member and a life partner, as well as providing a meaningful and fulfilling quality of life, both personally and within the community.



Our Research Team



Professor Skye McDonald

Leading our dedicated research team is Professor Skye McDonald, with the assistance of Dr Jacqueline Rushby (Research Fellow) and Dr Travis Wearne (Post-Doctoral Fellow). Jacqui consults and oversees the various psychophysiological techniques we use to conduct our research, as well as supervising honours and PhD



Dr Jacqueline Rushby

students who come through our lab. Travis also supervises Honours students, teaches within the university and is the primary neuropsychological consultant for much of the research we

conduct. We also have Dr Emily Trimmer (part-time Post-Doctoral Research Fellow) who is currently working collaboratively with iCare, managing the development of an online intervention program for families regarding education about challenging behaviours that may occur after traumatic brain injury.



Dr Travis Wearne

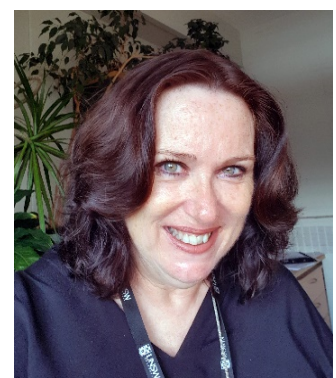


Dr Emily Trimmer

In regards to research assistants, Emily Wilson (full-time) and Poss Logan (part-time) both manage recruitment and data collection for our current projects investigating heart rate variability, transcranial Direct Current Stimulation (tDCS) and the role of emotion and social communication in individuals following stroke. Emily is also involved in establishing new and updated normative data for various social cognition measures and assisting our PhD students with data collection while Poss is



Emily Wilson



Poss Logan

involved with ethics applications, amendments and reporting, and newsletters. Our other part-time research assistant, Frances De Blasio, provides technical and statistical support for the psychophysiological measurements for both our team and projects undertaken by Honours and PhD students within the lab.



Frances De Blasio



Michaela Filipčíková

Assisting our lab this year as volunteer research assistants was Suzana Djukic, a neuroscience student at UNSW, and, Michaela Filipčíková, who has recently arrived in Australia from Slovakia and is planning to complete a PhD while she is here. Suzana collected data for our heart rate variability study by testing our non-brain injured participants. Michaela, will be taking over this role in the coming weeks. Michaela has also been helping us with getting our heart rate variability data ready for analysis and assisting with the preparation of this newsletter.



Christopher Sufani

The end of 2017 saw Edward Ho, Abbie Lucien, Wendy Chen, Rebecca El-Helou, Grace Wei and Nicolas Chand successfully complete their Honours theses with us. Much excitement is building, as 2018 will see Matt Gerathy, Christopher Sufani and Melinda Hickey all submit their PhDs while Anneli Cassel and Emma Kornfeld aim to submit in 2019.



Emma Kornfeld

Our lab is unique in that we are part of the Moving Ahead Centre of Research Excellence in Brain Recovery. This means we collaborate with many leading and well-known academics in the field of brain injury in our quest for developing effective social cognition treatments that will raise the quality of life for people suffering brain injuries and disturbance.



Anneli Cassel

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 17 different studies. Each study is described in terms of what it was about, what we did, and what we found. Where studies published, the reference to the journal 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 will not be available but will be in the next year or so. We have also detailed articles and conference presentations that are accepted for publication



Get involved in Our Research

Our research would not be possible without the generosity of all the people with traumatic brain injuries and stroke, their families, as well as our control participants who so kindly offer their time and energy to participate in our studies.

The Clinical Neuropsychology Research Team at UNSW is currently conducting research on emotion regulation and processing, and social cognition following brain injury and stroke. We are looking for individuals who have suffered a moderate to severe brain injury; a stroke, particularly in the right Middle Cerebral Artery; and healthy controls to participate in our research projects.

If you are interested in getting involved in any of the following studies, please contact Emily Wilson or Poss Logan, our Lab Research Assistants, on (02) 9385 9074 or email emily.j.wilson@unsw.edu.au or poss.logan@unsw.edu.au and provide the following information: your name, date of birth, level of education, and nature of your brain injury (if applicable). We look forward to hearing from you!



‘SIFT IT’ The Social Thinking Therapy! Is it possible to treat social cognitive difficulties after brain injury?

By Anneli Cassel and Skye McDonald

What the study is about:

Understanding emotions, understanding that other people think or feel things differently to ourselves, and thinking and feeling from another’s perspective are all skills associated with social cognition. There are many reasons why some people find it more difficult to do these things, and having a brain injury is one of them: The regions in the brain that can be damaged through injury often affect the areas we know are important for social cognition. What is less understood is whether it is possible to treat these social cognitive deficits after such an injury, in order to help people socialise more easily. We have, therefore, recently developed a treatment called *SIFT IT: The Social Thinking Therapy* to see if it is possible to treat and improve these skills.

What we are doing:

We are looking at whether *SIFT IT* therapy works in a couple of trials. The first trial is a group program, with about four participants in each group. The second trial is a 1:1 treatment. We want to investigate if people with brain injuries benefit from a treatment that focuses on understanding other peoples’ thoughts and feelings and how other peoples’ perspectives can be similar or different to their own. Ultimately, we want to see if this has any impact on peoples’ “normal lives” and whether it helps peoples’ relationships with their family, friends, work colleagues, and whomever else they interact with day to day

What are our next steps:

We are currently looking at the therapy in a group program. We have completed two rounds of recruitment and have two more to go. We think we will be running this trial for another year. We will soon start looking for people to take part in the individual therapy trial. Once we have collected this data, we will be able to see whether this kind of treatment shows promise at treating social cognitive difficulties in this population. If it does, it will one day help clinicians use this knowledge in rehabilitation settings so that more people can have the opportunity to benefit from social cognition treatment.

To read more about this study:

Cassel, A., McDonald, S., Kelly, M. & Togher, L. (2016). Learning from the minds of others: A review of social cognition treatments and their relevance to traumatic brain injury. *Neuropsychological Rehabilitation*. doi: <http://dx.doi.org/10.1080/09602011.2016.1257435>.

We are currently looking for people who are having difficulties or misunderstandings in social situations. If you think you might be interested to take part in the study, or want to stay in the loop, please contact Anneli Cassel at: anneli.cassel@unsw.edu.au



Can non-invasive brain stimulation improve memory following traumatic brain injury?

By Frances De Blasio, Jaqueline Rushby, Travis Wearne, Emily Wilson, Jodie (Poss) Logan and Skye McDonald

What the study is about:

People who have a traumatic brain injury often report they are more forgetful. Research suggests that brain stimulation might provide a relatively safe and cost-effective way to treat some kinds of memory problems. We are currently assessing a type of brain stimulation for its effectiveness in improving working memory, the ability to hold and manipulate information in one's mind. The type of brain stimulation we are assessing is called transcranial direct current stimulation, or tDCS for short. This stimulation involves the application of a weak direct electrical current to the scalp as shown in the picture below. By applying this stimulation over the brain areas involved in working memory processes we expect that the electrical activity in these brain areas will increase, improving the person's performance in a working memory task.

What we are doing:

Recruitment for this study started in 2017 and each participant attends two testing sessions, approximately 1 week apart. During each session, participants receive 20 minutes of brain stimulation while completing a computer based working memory task. To better determine the effects of brain stimulation, participants receive real stimulation in one session and fake stimulation in the other, although they are not told which type they receive at each session. Before and after receiving brain stimulation, sweat gland and heart rate activity are recorded while participants rest with their eyes-open and eyes-

closed to provide resting baselines. Participants also answer questions about their mood by completing a few short questionnaires.



What are our next steps:

Data collection is continuing in 2018. If you are interested in participating or would like to find out more information, please contact Emily Wilson at: emily.j.wilson@unsw.edu.au or Poss Logan at: poss.logan@unsw.edu.au or phone them on (02) 9385 9074.



Investigating the neural basis of empathy: The link between empathy and the mirror neuron system

By Emma Kornfeld, Jacqueline Rushby and Skye McDonald

What is this study about:

How do I know how are people are feeling? Why is it that if a close friend or family member cries I cry too, even if I don't really feel sad? Empathy is how we understand someone else's emotional state and part of how we do this is our ability to feel how they do, like crying when someone else is crying. This 'catching' of someone else's emotions has been called the *chameleon effect*, which is a type of motor resonance where one passively and unintentionally mimics the postures, mannerisms, facial expressions and other socially important behaviours of another. This mimicry increases feelings of safety and trust and so is thought to act as a sort of 'social glue'.

Currently, there is no clear neural model that links motor mimicry and empathy, however, recent studies have begun to look at the function of motor areas of the brain in empathy. Mirror neurons are a type of motor neuron in the brain that fire not only when you see someone else doing an action but also when you do the same action. For example, if you see someone kick a ball, there is a similar, though smaller, activation of the same mirror neurons that fire when you kick the ball yourself. Mirror neuron activity is thought to be reflected in electroencephalographic (EEG) and electromyographic (EMG) activity, however, very few studies have examined the best parameters for these measures.

What are we doing:

There are two overarching aims of the current study: First, to look at how we measure mirror



neuron activity using EEG and EMG, and second, to examine how this activity is related to empathy. To do this, we are looking to see whether participants have similar brain and muscle activity when they are watching someone else move their hands or face compared to when they are doing that same action themselves. Participants in this study are shown several different hand and face movements and asked to either watch the movement or imitate it. During these movements, we record EMG activity from their hands and faces as well as EEG. Participants also complete several empathy questionnaires which we will look at in relation to the physiological measures.

What are our next steps:

We are still recruiting but expect to finish this in the first half of 2018. After that, the data will be broken down into several smaller studies that will each be published as individual, but related, papers.

To find out more about this study contact Emma Kornfeld at:
emma.kornfeld@student.unsw.edu.au.



Biofeedback as a way of modulating emotional regulation for individuals with traumatic brain injury

By Travis Wearne, Emily Trimmer, Jodie (Poss) Logan, Emily Wilson, Jacqueline Rushby, Skye McDonald

What the study is about:

Emotions are a normal aspect of everyday life but following a brain injury, an individual may lose the capacity to control their emotional behaviour or their emotions may be out of proportion to the situation. Heart rate variability (HRV) is thought to reflect a person's capacity to regulate their emotions and behaviour. HRV can be improved by biofeedback, a method that teaches individuals how to control their physiological output with breathing techniques. This study aims to examine whether multiple sessions of heart rate variability biofeedback can alter emotional and behavioural output for people with TBI.

What we did:

Individuals with severe traumatic brain injury recruited to the study undergo 6 sessions of HRV biofeedback training. Both before and after the treatment phase, participants complete cognitive tests related to drive and control, mood questionnaires and have their heart rate variability recorded: (a) at rest, (b) in response to emotional stimuli (angry & sad films) and (c) during a cognitive task, the paced auditory serial addition test (PASAT). We do this to elicit emotional responding.



What we expect to find:

We anticipate that repeated biofeedback training to regulating HRV for individuals with TBI can directly improve:

- (a) Initiation and drive
- (b) Emotional and cognitive control
- (c) Emotion regulation to anger-inducing material
- (d) Symptoms of depression and anxiety

For more information about this study:

So far, we have recruited over half of our requirement of people with TBI to the study, with many already completed! We are still recruiting and are looking forward to see what the results reveal! If you are interested in participating, please contact Emily at emily.j.wilson@unsw.edu.au or Poss at poss.logan@unsw.edu.au.

Heart rate variability as an index of emotion regulation following traumatic brain injury

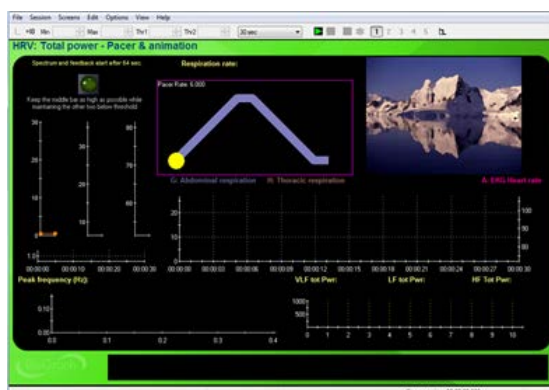
By Travis Wearne, Emily Trimmer, Jodie (Poss) Logan, Emily Wilson and Skye McDonald

What this study is about:

Heart-rate variability (HRV) has been used as a measure of emotional control across a range of disorders, with higher HRV related to emotional resilience and reduced risk of mental health problems. Previous studies have shown that individuals with traumatic brain injury (TBI) have difficulty regulating their emotions and have reduced HRV, but none have linked the relationship between autonomic output (heart rate, heart rate variability, skin conductance and respiration) and emotional regulation for individuals with TBI. In this study, we hope to determine whether individuals with TBI show altered autonomic output in response to emotional stimuli, specifically those related to anger, by comparing these responses to healthy non-injured controls.

What we did:

Participants with TBI and healthy controls will complete cognitive tests, mood questionnaires and have their heart rate variability recorded: (a) at rest, (b) in response to emotional stimuli (angry & neutral films) and (c) during a cognitive task, the paced auditory serial addition test (PASAT).



What we expect to find:

We expect to find that individuals with TBI will show altered autonomic response to emotional material (anger induction videos and the PASAT). Specifically:

- 1) TBI will be associated with reduced HRV compared to controls
- 2) Individuals with TBI will show reduced autonomic output to anger inducing material
- 3) Cognitive measures of control and drive will be associated with autonomic output for control subjects but not for individuals with TBI
- 4) Higher HRV will be associated with reduced symptoms of anxiety, stress and sleep disturbances for controls but not for individuals with TBI

For more information about this study:

This project may offer the first evidence that autonomic variables can be used to index altered emotional response for individuals with TBI.

We are currently recruiting and collecting data from individuals with TBI and control participants that match our TBI sample.

We anticipate that we will have this study finalized within the New Year. If you would like more information, please contact Travis at t.wearne@unsw.edu.au.

COLLABORATIVE RESEARCH

@UNSW

This Way Ahead

By Emily Trimmer

What the program is about:

Families face a number of challenges in caring for a loved one after a traumatic brain injury. While there can be physical changes and changes to thinking (such as memory problems), families tell us that what they need most help with is dealing with behaviour changes of the brain injured person. iCare lifetime care are funding a project to develop a web-based support program to help families better manage these behaviour challenges.

What we are hoping to find:

We will be trialing the program with a few select families in the beginning of 2018. Based on feedback from these families, the program will be reviewed and a final version made available to all families later in the year. We are also hoping to post videos of family members who have completed the program, discussing how they found it.

The logo for iCare, featuring the word "icare" in a bold, lowercase, teal-colored sans-serif font. A small "TM" trademark symbol is positioned to the upper right of the "e".

What we are doing:

We are developing an online intervention program that covers education about challenging behaviours that may occur as a result of the brain injury, as well as strategies to reduce the frequency and intensity of these behaviours. The program covers irritability and aggression; difficulties in social situations; difficulties with motivation and “getting going”; acting without thinking; and also a module that helps you, the carer, care for yourself. Each module is presented in cartoon form with characters from four families receiving help from a Clinical Psychologist.

What this means:

Families who are caring for or supporting a person with brain injury will have access to an online program to help them gain skills and learn strategies to help support their family member with brain injury, especially when challenging behaviours are present. This program will also provide additional information about services and supports available.



A pilot project for standardised assessment tool (Systematic Assessment for Brain Injury Rehabilitation - SABIR) for patients after a traumatic brain injury and its correlation with functional outcome measures

By Tram Bui, Stuart Browne, Clayton King, Skye McDonald, Travis Wearne

What the study is about:

A challenge facing clinicians working with individuals following mild to moderate brain trauma is how to identify those at risk of problems and to implement appropriate assessment that can inform patient management. Although detailed assessment techniques exist, the resources, time constraints and restricted availability of staff and patients make them unsuitable for guiding clinical decision-making. Nevertheless, there are many existing cognitive screening tests that have been designed for patients with mild cognitive impairment in dementia, and even though brief cognitive screening tests are likely to have greater application because of their accessibility, their usefulness has not been examined in TBI. The aim of this study is to determine whether early brief cognitive screening tests can predict long-term outcomes for individuals following TBI and whether they show the same benefit as formal neuropsychological testing (the “gold standard” of cognitive assessment).

What we did:

Individuals aged 18 to 65 and within 6 months of sustaining a traumatic brain injury (TBI) of sufficient severity are invited to participate in the study. A range of cognitive screening tests and outcome measures are administered at baseline and at 3 and 6 months. A comprehensive neuropsychological assessment is also administered within 12 months. We plan to recruit a total of 40 participants in the study.

What we expect to find:

Primary Aim is to:

- To determine whether early brief cognitive tests correlate with functional outcomes after a traumatic brain injury

Secondary Aim is to:

- Assess validity of cognitive screening tests by comparison with formal neuropsychological testing (i.e. Gold Standard).

For more information about this study:

We are still recruiting people with TBI to this study. If you would like more information, please contact Travis at t.wearne@unsw.edu.au.



Assessing emotion perception difficulties following moderate-to-severe traumatic brain injury: The role of facial expressivity and subjective emotional experience

By Travis Wearne, Katie Osborne-Crowley, Hannah Rosenberg, Marie Dethier, Skye McDonald

What the Study is about:

The ability to recognise how other people feel is crucial in a variety of social situations. Difficulty in recognising other people's emotion is commonly reported after traumatic brain injury. In this study, we tested whether problems identifying emotion in others is related to problems expressing or feeling emotion in oneself. This relates to theories of emotion perception that suggest we simulate someone else's expression in ourselves as a means to understand it.

What we did:

Individuals with a moderate-to-severe brain injury ($n = 27$) and controls ($n = 28$) were tested on an emotion recognition task of happy, sad and angry faces. Participants also adopted facial expressions according to the presentation of happy, sad and angry stimuli (word & photos) and asked to relay a past personal event that they considered to be of happy, sad or anger in nature. After each trial, subjects were asked to self-report their subjective feelings of emotion while blind judges' rated their facial expressivity.

What we found:

We found the same pattern of results for happy, sad and angry emotions. The ability to identify emotion in others depends on the subjective experience of that emotion and not on the ability to express that emotion in oneself (i.e. your ability to identify happiness in others depends on your ability to *feel* happiness rather than *express* happiness). Interestingly, difficulties in recognising emotion for individuals with TBI were no longer evident after their cognitive ability and experience of emotion were accounted for in the analyses.

What our findings mean:

When we identify an emotion in someone else, we rely on our ability to experience that emotion within ourselves. These findings also suggest that emotion perceptual difficulties following TBI may stem from an inability to experience the affective states of others and may tie in with the idea that emotion recognition relates to alexithymia (i.e. failure to identify and describe emotion) in clinical conditions.

Examining Physiological Regulation in Dyadic Conversations and the Effect of Emotional Empathy

By Wenting Chen, Skye McDonald and Travis Wearne

What the study was about:

In our day-to-day lives, conversations are inevitable and ever-present. Despite how natural and unspectacular conversations seem, interacting with others is actually a complex, active and informative process. Many of the facets associated with human sociability are reflected in physiological responding (e.g. heart rate, skin conductance and breathing rate). While many studies have examined physiological output in response to experimental manipulations, no studies have examined how these responses are regulated in normal everyday conversations. The aim of this study was to investigate physiological regulation to conversational behaviours within a natural social interaction.

What we did:

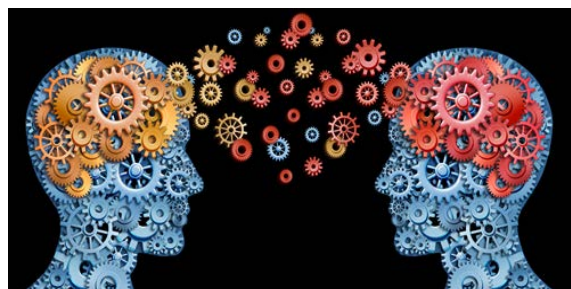
Participants were asked to have an unrestricted thirty-minute conversation with an unknown member of the opposite sex while their heart rate and skin conductance were recorded. Following this, videos were analysed for various conversational behaviours including: when one person was talking or listening; when the two people were talking over each other; awkward silences; and, when the speaker or other person smiled or laughed. We then analysed how heart rate and skin conductance changed across each of these behaviours.

What we found:

We found that participants had increased heart rate when they were listening to another person during the conversation. Smiling and laughing were also associated with increased heart rate and skin conductance for both the talker and listener. Furthermore, we found some evidence that emotional empathy (i.e. the ability to feel what another person feels) was positively associated with physiological changes. Specifically, we found that those who had greater changes in heart rate while watching another person laugh also appeared to have greater emotional empathy.

What our findings mean:

We are constantly changing our physiology in response to our own output and the responses of others during everyday conversations. Physiology may therefore, regulate our ability to send and receive social cues in conversations, with those altering their output the greatest likely to be better empathisers. Importantly, this is the first study to measure autonomic measures in a natural conversation, and also the first to investigate whether emotional empathy could be involved in these changes. Therefore, given its novelty, findings in this study has a wide scope for future directions.



Investigating the relationship between anxiety-related cognitions and autonomic output during psychosocial stress

By Abbie Lucien, Emily Trimmer, Emily Wilson, Jodie (Poss) Logan, Skye McDonald and Travis Wearne

What was the study about:

Social evaluation by others represents a primary source of threat and requires significant emotional control in order to handle appropriately. If experienced in chronic forms or interpreted in negative ways, stress can lead to anxiety-related mental health problems. Physiological systems, such as heart rate, are involved in the experience, production and regulation of emotion, and studies have previously looked at the relationship between physiology and stress. What is not known, however, is whether beliefs and interpretations about anxiety and stress (i.e. anxiety-related cognitions) contribute to these responses. In this study, we determined whether physiological measures can measure stress and whether anxiety sensitivity (i.e. intolerance to the body sensations associated with anxiety) and worry changed these responses.

What we did:

46 participants completed self-report questionnaires assessing anxiety sensitivity and worry, and had several measures of their physiology (heart rate, skin conductance, respiration and heart rate variability) recorded during four stages of a widely-used psychosocial stress induction procedure; the Trier Social Stress Test (TSST). In this task, participants are told they have 10 minutes to prepare a 5-minute speech as a job applicant pitching themselves to two managers.

What we found:

We found that heart rate and skin conductance (i.e. sweat gland activity) increased through the anticipation and experience of psychosocial stress, while respiration and two measures of heart rate variability showed various changes throughout the procedure. Additionally, anxiety sensitivity was associated with skin conductance changes during the TSST.

What our findings mean:

This study showed that we could quantify and study how a person reacts to stressful situations by examining their physiology, specifically in regard to their heart rate and skin conductance. We also found that those who have greater fear of the cognitive consequences of anxiety have smaller increases in skin conductance during stress. This may suggest that those who have higher sensitivity to anxiety may use strategies in the hope of avoiding threat. Importantly, this study represents the first to simultaneously study all these physiological variables in response to the TSST and was able to clarify some confusion amongst previous research with clarified methodology.



Image source: https://commons.wikimedia.org/wiki/File:Trier_01.jpg

Does emotional processing change after a traumatic brain injury?

By Katherine Osborne-Crowley, Skye McDonald, Emily Wilson, Travis Wearne and Jacqueline Rushby

The ability to empathize with others is critical to successful social interactions as it allows an individual to understand and respond appropriately to the emotional states of others. A significant proportion of people with severe traumatic brain injury (TBI) self-report low levels of emotional empathy. Since emotional empathy is critical for forming and maintaining social relationships, deficits may contribute to social isolation and ostracism reported by many within the TBI community. The following two studies aimed to examine the mechanism behind the discrepancy in empathic abilities.

Study I

What the study is about:

One theory suggests that individuals empathise more with others who have similar past experiences to them as individuals find it easier to understand and resonate with others who have gone through comparable or familiar experiences. The current study aimed to investigate whether individuals with and without a TBI *empathise more* when told stories similar to their own experiences compared to dissimilar stories.

What we did:

Individuals with and without TBI were asked to attend two sessions. In the first session, participants were asked to recount three personal experiences that made them feel happy, sad and angry. One-week later, participants came back and were presented with six stories: Three stories were structured around their own personal experiences and the other three were not. The six stories were read aloud to participants while they looked at a picture of a person's face who they were told that the event had happened to. The faces were matched to each of the participants on gender and race for similar stories only. Participants were asked to rate each story-and-face presentation how intensely the person in

the story would be feeling (happy, sad or angry), how they felt about the person in the story, and how relatable the story was to them. We also measured participants facial muscle activity, skin conductance (sweat activity) and heart rate.

What we found:

Those with and without a TBI rated having greater empathy for faces paired with similar stories compared to faces paired with dissimilar stories. We are still analysing the physiological data (heart rate and skin conductance) and look forward to sharing these results later this year.

What our findings mean:

The findings suggest that similarity and familiarity in shared past experiences is one way in which individuals empathise with others. As individuals with a TBI empathised more with those with similar past experiences, it suggests that there is no impairment in the emotional processing of one's own past experiences to impart empathy and thus, is unlikely to be a mechanism underlying decreased emotional empathy in those with a TBI.

Study 2

What the study is about:

This study investigated differences between individuals with and without a TBI in the EmoStroop task. The EmoStroop task involves categorising emotional adjectives, as happy, sad or angry, when superimposed on an emotional face (refer to the pictures below). The emotional words are presented over an emotional face that is congruent to the emotional word (e.g. happy word superimposed on a happy face) or incongruent to the emotional word (e.g. happy word superimposed on an angry face). When asked to respond only to the emotional word, researchers have found that people without a TBI are slower to categorise words in the incongruent condition compared to the congruent condition. This finding is called the EmoStroop effect and suggests that the brain rapidly processes facial expressions before processing the meaning of words. This study aimed to test whether the EmoStroop effect occurs in individuals who have experienced a TBI, as differences in emotional processing may explain lower levels of self-reported empathy exhibited within the TBI population.

What we did:

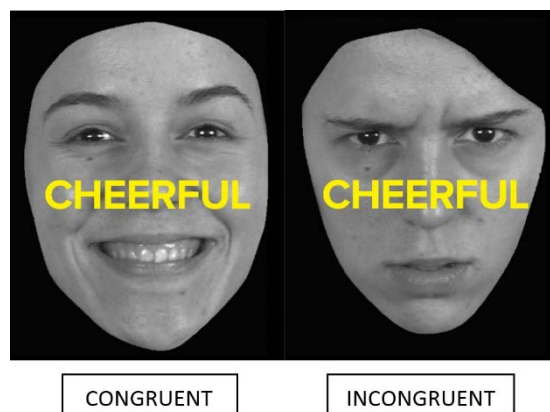
Individuals with and without a TBI were asked to complete the EmoStroop task. We also measured participants facial muscle activity, skin conductance (sweat activity) and heart rate.

What we found:

Individuals with and without a TBI were found to demonstrate the EmoStroop effect: Both groups were slower to categorise emotional words in the incongruent trial (e.g. happy word on an angry face) compared to the congruent trial. We are still analysing the physiological data and look forward to sharing these results later this year.

What our findings mean:

As the EmoStroop effect also occurred in those with a TBI, deficits in conceptual emotional processing is unlikely to be the mechanism underlying decreased emotional empathy in those with a TBI.



Study 3

What the study is about:

Individuals with TBI may have difficulty empathising with others. That is, they may have decreased ability to feel what another person is feeling. Research suggests that people automatically and unconsciously mimic other people's emotions, and that mimicked expression sends feedback signals to the brain to enable individuals to feel what another is feeling. Previous research, however, suggests that this feedback mechanism may be impaired in people with a TBI. For example, one study found that when asked to pose emotional expressions in the face and body (e.g. a happy, sad, and angry posture), participants with a TBI did not report feeling the associated emotion to the same extent as participants without a TBI (Dethier, Blairy, Rosenberg & McDonald, 2013). This study aimed to further these results by investigating the mechanism of this impairment. This study used the same posture task with the addition of measuring physiological activity (i.e. heart rate and skin conductance [sweat activity]) to explain differences in subjective reporting. For example, we expected that people without a TBI would have detectable changes in heart rate and skin conductance (sweat activity) when posing an emotional expression and these changes may play an important role in generating the feeling of the associated emotion. Thus, we aimed to determine whether participants with a TBI also exhibited these physiological changes when they posed an emotional expression and if these changes related to subjective reporting of feeling the emotion.

What we did:

Individuals with and without a TBI were asked to move muscles in their face and body to create various emotional expressions (e.g. an angry expression involved a furrowed brow, clenched teeth and clenched fists). While the participant held the various postures, their

heart rate and skin conductance were recorded, and they were subsequently asked to report how the various postures made them feel on a variety of different scales, including trait empathy.

What we found:

Preliminary results indicate that there are no differences in feeling the associated emotions in individuals with and without a TBI when holding facial and bodily poses of happy, sad, and angry posture. That is, people with a TBI reporting feeling the associated emotion to the same extent as people without a TBI. Participants with a TBI, however, scored lower than controls on measures of empathy. We are still analysing the physiological data (heart rate and skin conductance) and look forward to sharing these results later this year.

What our findings mean:

Our findings indicate that the feedback mechanism is likely to not be impaired in individuals with a TBI, as they did not rate feeling differently to individuals without a TBI. If we find that individuals with a TBI have impaired physiology (heart rate and skin conductance) in turn with the current findings, it is strong evidence that physiological changes are not important in the subjective experience of emotions.

To Add VFAT: Participants were presented a series of images showing either a person or an object, and asked to pull their eyebrows down (frown) or pull their cheeks up (smile) in response to the person or object.

Reference: Dethier, Blairy, Rosenberg & McDonald. (2013). Emotional Regulation Impairments Following Severe Traumatic Brain Injury: An Investigation of the Body and Facial Feedback Effects. *Journal of the International Neuropsychological Society*, 19, 367-379. doi:<https://doi.org/10.1017/S1355617712001555>.

Where is the Best Region to Stimulate the Brain to Improve Short-Term Memory

By Jacqueline A. Rushby¹, Frances M. De Blasio¹, Travis Wearne¹, Katie Osborne-Crowley¹, Heather Francis¹, Skye McDonald¹ and Colleen Loo²

¹School of Psychology, University of New South Wales, Sydney, Australia.

²Black Dog Institute, School of Psychiatry, University of New South Wales, Sydney, Australia.

What the study was about:

Applying a small electrical current to the brain has been shown to improve short-term memory (STM), however, which region of the brain results in the best improvement is not clear. While it is known that this type of brain stimulation leads to excitability of the brain's neurons, it is ambiguous whether the mechanism is dependent upon stimulation of a specific region of the brain.

What we did:

Seventy-two healthy young adults completed a two-part study in which they received a real stimulation session and a pretend stimulation session, one week apart, while they completed a simple STM task. Participants were split into three groups, which received stimulation to either a small part of the left frontal brain, a large part of the frontal brain, or a large part of the posterior brain. In addition we measured the brain's electrical activity to see which region became more activated.



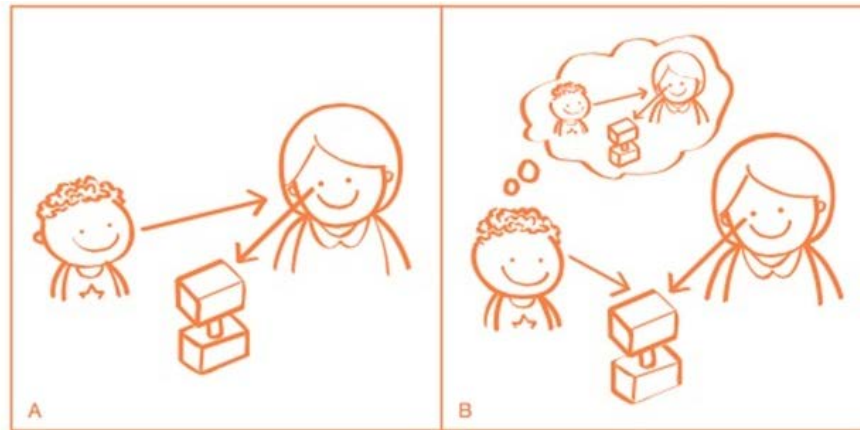
Figure A. shows an example of brain stimulation over a large part of the frontal brain. Figure B. shows an example of how we measured the brain's electrical activity after stimulation.

What we found:

Real stimulation to both the small left frontal and the large posterior region of the brain caused an improvement in accuracy during the working memory task, but only stimulation to the posterior region increased excitability of the brain's neurons, and this excitability made participants respond faster. We concluded that stimulation of the broad posterior region of the brain leads to the most efficient performance in short-term memory.

More than meets the eye: A neurophysiological investigation of the influences of social cognition on visuospatial attention

By Grace Wei, Jacqueline Rushby, Christopher Sufani and Frances De Blasio



What this study was about:

As babies, the ability to follow eye gaze initially helps us to learn about our physical and social environment. From this age, eye gaze is central in helping us to understand what other people are thinking and feeling, playing a crucial role in forming and maintaining relationships. In Autism, a lack of eye contact and gaze following is known to be related to difficulties in social interactions. To date, studies in eye gazing have found that people without autism are quicker to respond to eye gazing cues of others compared to non-social cues, such as mouth movement. People with autism, however, have been found to respond to others using any movement cue, such as eye gazing, mouth movements or gesturing, just to name a few.

What we did:

This study considered both social (e.g. eye gaze) and non-social (e.g. motion) cues. We used electroencephalography (EEG), a non-

invasive measure of electrical activity in the brain, to examine processing that might otherwise appear behaviourally identical between cues. We then investigated whether different patterns of attention corresponded with social functioning abilities in healthy adults examining levels of autistic-like traits, social anxiety and alexithymia (the inability to recognise emotions in others).

What we found:

Reduced attention to eye gaze to social cues corresponded with higher autistic-like and alexithymic traits and social anxiety. Whilst unimpaired at a basic perceptual level (i.e., non-social cues), not being able to prioritise the social meaning behind eye gaze would explain difficulties in social interactions. Ultimately, the more we can understand gaze processing, and where things go wrong, the closer we get to developing effective interventions.

Cognitive control processes underpin amplified sex differences in self-report measures of empathy:

By Rebecca El-Helou, Dr Jacqueline Rushby, Frances De Blasio, Christopher Sufani, Janette Smith, Grace Wei

What the study was about:

Females consistently self-report higher levels of emotional empathy than males. This study was interested in investigating how males and females differ whilst reporting on an empathy questionnaire.

What we did:

We recorded electrical activity in the brain whilst male and female participants completed a computerised empathy questionnaire. From this electrical activity, we can see how individuals monitor and evaluate their responses on this task. We compared this electrical activity to a cognitive (non-empathy) monitoring task, called the “Eriksen Flanker Task”, in which females have shown greater monitoring compared to males.

What we found:

Although there were no sex differences found in empathy scores, we found that males monitor their responses more closely compared to females when self-reporting empathy. We concluded that it is likely that males think more about providing a more socially acceptable response compared to females.



I see what you feel: An investigation of affective facial mimicry

By Edward Ho, Jacqueline Rushby, Christopher Sufani, Frances De Blasio and Skye McDonald

What the study is about:

Facial expressions play an important role in helping us to recognise another person's emotions. When we see another's expression, our face automatically mimics that expression and this is accompanied by an increase in physiological arousal. These physiological changes help us to feel and understand another's emotional state, however, it is unknown if these changes improve emotion recognition.

What we did:

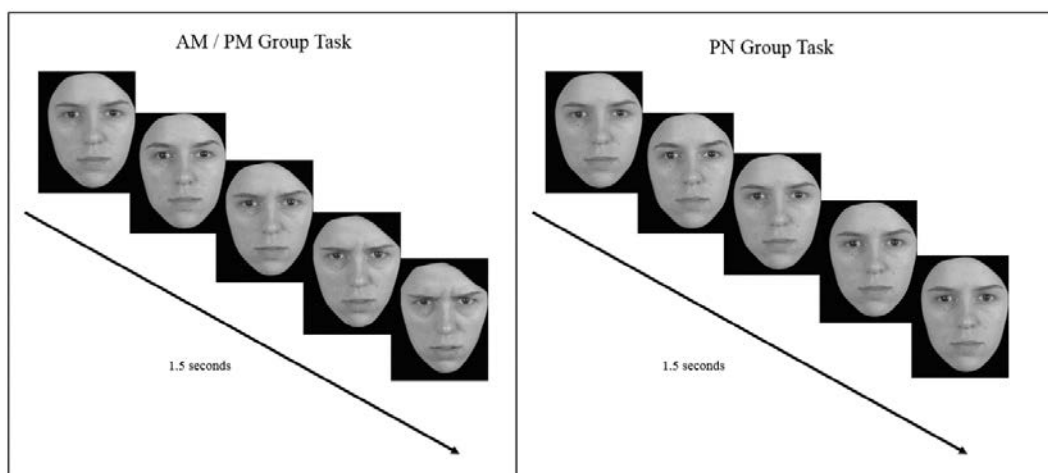
We randomly allocated healthy adults and into one of three groups where participants were asked to either mimic angry expressions, observe angry expressions, or observe non-emotional faces. During the experiment, we monitored their physiological arousal. After completion of these tasks, participants completed an emotion recognition task in which they had to identify the emotions of happy, angry, surprise and disgust.

What we found:

The mimicry group performed better at recognising angry expressions compared to the observation and neutral groups, and these effects were related to an increase in arousal.

What our finding means:

These findings showed that active facial mimicry leads to an increase in arousal and better performance in emotion recognition. We hope to investigate and ultimately incorporate these findings in developing future treatments for people with emotional recognition impairments to enhance their social function.



PUBLICATIONS

FROM OUR LAB

Books and Chapters

McDonald, S., & Cassels, A. (2017). Rehabilitation of social cognition In B. A. Wilson (Ed.), *International Handbook of Neuropsychological Rehabilitation* (pp. 261-288). New York: Routledge.

Tests

McDonald, S., Flanagan, S. & Honan, C. (2017) *The Awareness of Social Inference Test- Short* [Measurement instruments]. Sydney: ASSBI Resources.

McDonald, S., Flanagan, S. & Rollins, J. (2017) *The Awareness of Social Inference Test (3rd Edition)* [Measurement instrument]. Sydney: ASSBI Resources.

Publications in Refereed National and International Journals

Avramović, P., Kenny, B., Power, E., McDonald, S., Tate, R., Hunt, L., ... Togher, L. (2017). Exploring the relationship between cognition and functional verbal reasoning in adults with severe traumatic brain injury at six months post injury. *Brain Injury*, 31(4), 502-516. doi:10.1080/02699052.2017.1280854

Francis, H.M., Osborne-Crowley, K.L., & McDonald, S. (2017). Validity and reliability of a questionnaire used to assess social skills in traumatic brain injury. *Brain Injury*, 31(3), 336-343. doi:10.1080/02699052.2016.1250954

Honan, C., Allen, S., Fisher, A., Osborne-Crowley, K., & McDonald, S. (2017). Social disinhibition: Piloting a new clinical measure in individuals with traumatic brain injury. *Brain Impairment*, 18(1), 74-87. doi:10.1017/Brlmp.2016.27

Honan, C.A., McDonald, S., Tate, R.L., Ownsworth, T., Togher, L., Fleming, J., ... Ponsford, J. (2017). Recommendations for the use of Psychosocial Outcome Measures in Traumatic Brain Injury Research. *Neuropsychological Rehabilitation*, 1-21. doi:10.1080/09602011.2017.1339616

Kelly, M., McDonald, S., & Frith, M.J.H. (2017). Assessment and rehabilitation of social cognition impairment after brain injury: Surveying practices of clinicians. *Brain Impairment*, 18(1), 11-35. doi:10.1017/Brlmp.2016.34

Kelly, M., McDonald, S., & Frith, M.J.H. (2017). A survey of clinicians working in brain injury rehabilitation: Are social cognition impairments on the radar?. *Journal of Head Trauma Rehabilitation*, 32(4), E55-E65. doi:10.1097/HTR.0000000000000269



- Kelly, M., McDonald, S., & Rushby, J. (2017). Ostracism and physiological arousal following Traumatic Brain Injury. *Brain Injury*, 31(4), 550-559. doi:10.1080/02699052.2016.1271457
- Kumfor, F., Honan, C., McDonald, S., Hazelton, J., Hodges, JR., & Piguet, O. (2017). Assessing social cognition: Application of the TASIT-S in dementia. *Cortex*, 93, 166-177. doi:10.1016/j.cortex.2017.05.022
- McDonald, S. (2017). Emotions are rising: The growing field of affect neuropsychology. *Journal of the International Neuropsychological Society*, 23(9-10), 719-731. doi:10.1017/S1355617717000844
- McDonald, S. (2017). What's new in the clinical management of disorders of social cognition? *Brain Impairment*, 18(1), 2-10. doi:10.1017/Brlmp.2017.2
- McDonald, S., Fisher, A., Flanagan, S., & Honan, C. (2017). Impaired perception of sincerity after severe traumatic brain injury. *Journal of Neuropsychology*, 11(2), 291-307, doi:10.1111/jnp.12086
- McDonald, S., Honan, C., Allen, S.K., El-Helou, R., Kelly, M., Kumfor, F., ... Keage, H.A. (2017). Normal adult and adolescent performance on TASIT-S, a short version of The Assessment of Social Inference Test. *The Clinical Neuropsychologist*. doi:10.1080/13854046.2017.1400106
- McDonald, S., Rushby, J., Dalton, K., Landin-Romero, R., & Parkes, N. (In press). The role of the corpus callosum in social cognition deficits after severe traumatic brain injury. *Social Neuroscience*, doi:10.1080/17470919.2017.1356370
- Stubbs, E., Togher, L., Kenny, B., Fromm, D., Forbes, M., MacWhinney, B., ... Power, E. (2018). Procedural discourse performance in adults with severe traumatic brain injury at 3 and 6 months post injury. *Brain Injury*, 32(2), 167-181. doi:10.1080/02699052.2017.1291989
- Thompson E.J., Beauchamp, M.H., Darling, S.J., Hearps, S.J.C., Brown, A., Charalambous, ... Anderson, V.A. (in press). Protocol for a prospective school-based standardization study of a digital social skills assessment tool for children: The Paediatric Evaluation of Emotions, Relationships, and Socialisation (PEERS) Study. *BMJ Open*.
- Trimmer, E., McDonald, S., & Rushby, J. (2017). Not knowing what I feel: Emotional Empathy in Autism Spectrum Disorder. *Autism*, 21(4) 450-457. Doi:10.1177/1362361316648520
- Trimmer, E., McDonald, S., Rushby, J., & Kelly, M. (2017). The psychophysiological and psychological effects of ostracism in adults with ASD. *Journal of Autism and Developmental Disorders*, 47(80), 2326-2335. doi:10.1007/s10803-017-3146-9

Refereed Conference Proceedings and Abstracts

- Chen, W., McDonald, S., & Wearne, T. (2017, November-December). Examining Physiological Regulation in Dyadic Conversations and the Effect of Emotional Empathy [abstract]. *Paper presented at the 27th Annual Meeting for the Australasian Society for Psychophysiology conference*, Parramatta, Australia. doi:10.3389/conf.fnhum.2017.224.00017



- El-Helou, R., Rushby, J.A., De Blasio, F., & Sufani, C. (2017, November-December). Cognitive Control Processes Underpin Sex Differences in Self-Report Measures of Empathy [abstract]. *Paper presented at the 27th Annual Meeting for the Australasian Society for Psychophysiology conference*, Parramatta, Australia. doi:10.3389/conf.fnhum.2017.224.00015
- Ho, E.M.F., Rushby, J.A., Sufani, C., De Blasio, F., & McDonald, S. (2017, November-December). An Exploratory Study on the Psychophysiological Relationship Between Active Facial Imitation and Emotion Perception [abstract]. *Poster presented at the 27th Annual Meeting for the Australasian Society for Psychophysiology conference*, Parramatta, Australia. doi:10.3389/conf.fnhum.2017.224.00027
- Kumfor, F., Hazelton, J., Rushby, J., Hodges, J., & Piguet, O. (2017, November-December). Abnormal psychophysiological responses to emotional stimuli in dementia [abstract]. *Paper presented at the 27th Annual Meeting for the Australasian Society for Psychophysiology conference*, Parramatta, Australia. doi:10.3389/conf.fnhum.2017.224.00029
- Rushby, J.A., De Blasio, F., Dalton, K., Kornfeld, E., & McDonald, S. (2017, July). Impaired alpha responsivity to angry facial expressions is related to volume loss in limbic structures in severe traumatic brain injury. *Abstract presented at the International Neuropsychological Society Mid-Year Congress 2017*, Cape Town, South Africa. doi:10.1017/S1355617717001394
- Rushby, J.A., De Blasio, F., Wearne, T.A., Osborne-Crowley, K., Francis, H., McDonald, S., & Loo, C. (2017, November-December). tDCS electrode Montage differentially affects autonomic arousal and working memory performance [abstract]. *Paper presented at the 27th Annual Meeting for the Australasian Society for Psychophysiology conference*, Parramatta, Australia. doi:10.3389/conf.fnhum.2017.224.00007
- Wearne, T.A., Osborne-Crowley, K., Rosenberg, H., Dethier, M., Kessels, R., Westbrook, F., & McDonald, S. (2017, July). Understanding the emotions of others: evaluating the unique contribution of facial expressivity and subjective emotional experience in the recognition of emotion. *Abstract presented at the International Neuropsychological Society Mid-Year Congress 2017*, Cape Town, South Africa. doi:10.1017/S1355617717001394
- Wei, G., Rushby, J.A., Sufani, C., & De Blasio, F. (2017, November-December). Influences of Social Cognition on Visuospatial Attention: A Neurophysiological Investigation [abstract]. *Paper presented at the 27th Annual Meeting for the Australasian Society for Psychophysiology conference*, Parramatta, Australia. doi:10.3389/conf.fnhum.2017.224.00008
- Wei, G., Rushby, J.A., Sufani, C., & De Blasio, F. (2017, November-December). Neurophysiological correlates of gaze processing [abstract]. *Poster presented at the 27th Annual Meeting for the Australasian Society for Psychophysiology conference*, Parramatta, Australia. doi:10.3389/conf.fnhum.2017.224.00004

THANK YOU

FROM ALL OF US

Once again, many people and organisations have been involved in coordinating and assisting us with our research studies. We would especially like to thank:

- Dr Fiona Kumfor in the School of Psychology, University of Sydney
- Professor Olivier Piguet in the School of Psychology, University of Sydney
- Dr Cynthia Honan in the School of Medicine, University of Tasmania
- Dr Hannah Keage in the School of Psychology, Social Work and Social Policy, University of South Australia.

We would also like to acknowledge and thank the Brain Injury Rehabilitation Unit at Westmead Hospital, the Brain Injury Community Rehab Team at Royal Ryde, the Neurology Department at Liverpool Hospital, the Rehabilitation & Spinal Medicine Department at the Prince of Wales Hospital, the Department of Rehabilitation Medicine at St George Hospital, iCare and Brain Injury Australia.

Finally, and with our deepest appreciation, we want to thank everyone who has given up their time and energy to participate in our studies. This includes people who have suffered traumatic brain injuries and stroke, as well as people from various “walks of life” in the community who willingly contribute as our control participants. Without you all, we cannot do our work to try and progress effective treatments for those who suffer injuries to their brain. We sincerely appreciate your involvement and look forward to working with you all again in the future.

We are always keen to welcome any future volunteers who would like to participate in our research. Please do not hesitate to contact either Emily or Poss on 9385 9074 for further information.

Warmest regards

Professor Skye McDonald's Research Team



CLINICAL NEUROPSYCHOLOGY

