RIO group

Research in Imagery and Observation

10th Anniversary Meeting

6th – 7th April 2016

http://riogroup.weebly.com

The University of Manchester

Manchester Metropolitan University

Venue and travel information

The meeting will be held at the School of Psychological Sciences, University of Manchester, Zochonis Building, Brunswick Street, Manchester, M13 9PL.

A map of the University campus will be provided in the conference pack. Further travel information (including parking and directions) can be found online:
http://www.manchester.ac.uk/discover/maps/

New RIO organising committee

We would like to thank the founding committee for all their work over the past 10 years:

- Nichola Callow (Bangor University, UK)
- Jennifer Cumming (University of Birmingham, UK)
- Martin Edwards (Université Catholique de Louvain, Belgium)
- Paul Holmes (Manchester Metropolitan University, UK)
- Dave Smith (Manchester Metropolitan University, UK)

…and we welcome the new organising committee who will be taking the group forward:

- Adam Bruton (University of Roehampton, UK)
- Daniel Eaves (Teesside University, UK)
- Cornelia Frank (Bielefeld University, Germany)
- David Wright (Manchester Metropolitan University, UK)

10th Anniversary Prize

We are pleased to announce the introduction of the RIO 10th Anniversary Prize for best student paper. The winner will have their name engraved on a trophy, which will be passed on to the prize winner at each subsequent annual meeting.

RIO newsletter

The RIO organising group are planning to implement an annual newsletter to provide important announcements and provide updates on research conducted by RIO group members. The newsletter will be published around November or December each year and so a call for contributions to the first edition will be made around September 2016.

We would like to thank the following who have contributed to funding for catering and prizes:

School of Psychological Sciences, University of Manchester

Manchester Metropolitan University

Call for Papers for a Special Issue of Imagination, Cognition and Personality:

Imagery Ability

Jennifer Cumming and Daniel Eaves

Guest Co-Editors

We are pleased to announce a special issue of Imagination, Cognition and Personality focused on the conceptualization, measurement, and development of imagery ability within different contexts (e.g., sport, exercise, dance, music, rehabilitation) across the lifespan. We are particularly interested in papers relating to the application of cutting-edge techniques, for example, which could be tailored to specific populations. We also welcome a broad range of original research that falls within this scope.

Authors are encouraged to direct queries to Dr Jennifer Cumming (J.Cumming@Bham.ac.uk) or Dr Daniel Eaves (d.eaves@tees.ac.uk).

Submission guidelines

Submission guidelines are available on the journal website (https://uk.sagepub.com/en-gb/eur/imagination-cognition-and-personality/journal202395#submission-guidelines) and online submission system Manuscript Central (https://mc.manuscriptcentral.com/icap). The cover letter that accompanies the manuscript should clearly state that the submission is for consideration in the special issue.

Key dates

Deadline for submitting manuscript: January 31, 2017

Completion of blind review process: July 2017

Publication of accepted papers: December 2017

We would strongly encourage authors to submit their papers as far ahead of this deadline as possible.

RIO group 10th anniversary meeting

University of Manchester and Manchester Metropolitan University
6-7 April 2016

Lecture Theatre A (LTA) and Lecture Theatre B (LTB)

Wednesday 6th April

9:00 Registration (The Hub)

9:15 Welcome and introduction (LTB)

Session 1: Sport (LTB)

9:30 M. Blake, A. M. Bruton and D. A. Shearer (University of Roehampton and University of South Wales)
Visual gaze of team sports athletes when viewing team performance: The influence of familiarity on collective efficacy perceptions

10:00 B. Marshall and D. J. Wright (Manchester Metropolitan University)
Layered stimulus response training imagery vs. combined observation and imagery: The effects on golf putting performance and imagery ability

10:30 M. Scott , S. Taylor , P. Chesterton , S. Vogt and D.L. Eaves (Teesside University and Lancaster University)
Motor imagery during action observation increases eccentric hamstring force: An acute non-physical intervention

11:00-11:30 Tea/coffee (The Hub)

11:30 E. McNeill, T. MacIntyre and D. Harrison (University of Limerick).
Implementation of the MIIMS model using a case study approach

12:00 J. Barr, T. MacIntyre, E. Igou, and D. Harrison (University of Limerick)
Motor Imagery as an adjunct to typical injury protocols: A case study perspective

12:30 Lunch (The Hub)

Session 2: Neuroscience (LTB)

13:30 G. D'Innocenzo, C. C. Gonzalez, A. Nowicky, A. M. Williams and D. T. Bishop (Brunel University)
The effects of visual fixation location on motor resonance during observation of thumb adduction/abduction

14:00 M. Riach, P. S. Holmes and D. J. Wright (Manchester Metropolitan University)
Transcranial magnetic stimulation in action observation: A comparison of single versus paired pulse techniques

14:30 S. Vogt, S. Higuchi, M. Ziessler, and K. Sakreida (Lancaster University, Iwate Medical University Japan, Liverpool Hope University and RWTH Aachen University)
Motor imagery engages an insula-centered tactile network more than action observation: An fMRI study

15:00-15:30 Tea/coffee (The Hub)

15:30 W. Stadler, R. I. Schubotz, M. A. Giese, P. Wefstaedt, A. Wohlschläger, M. Brandy, W. Prinz and J. Hermsdörfer (Technical University of Munich, Westfälische Wilhelms-Universität Münster, University Clinic Tübingen, University of Veterinary Medicine Hannover and Max Planck Institute of Human Cognitive and Brain Sciences, Leipzig)

Like master like dog: Brain correlates of action and shape discrimination in humans and dogs

16:00 **Keynote 1** (LTA). Beatriz Calvo Merino (City University London).

Exploring action observation and embodiment mechanisms using expertise

17:00 **Group photograph**

Poster session 1 (The Hub)

18:00 **Pre-dinner drinks** (Sandbar, 120 Grosvenor Street, Manchester, M1 7HL)

19:30 **Conference dinner** (Don Giovanni, Peter House, 1-2 Oxford St, Manchester, M1 5AN)

Thursday 7th April

Session 3: Cognition and Clinical (LTB)

9:00 B. Toovey, E. Seiss and A. Sterr (University of Surrey, University of Bournemouth and University of São Paolo)

Motor imagery shows enhanced priming effects compared to motor preparation: A cognitive hierarchy?

9:30 E. Gowen, E. Bolton and E. Poliakoff (University of Manchester)

Believe it or not: Moving non-biological stimuli believed to have human origin can be represented as human movement

10:00 N. Brady, M. Campbell and S. Pierce (University College Dublin and University of Limerick)

Sex differences in the mental rotation of cubes and hands: A comparison of motor and visual imagery

10:30 S. Humphries, J. Holler, T. Crawford and E. Poliakoff (University of Manchester, Max Planck Institute for Psycholinguistics, Nijmegen and Lancaster University)

The influence of high and low motor content on the way actions are depicted with hand gestures in Parkinson's disease

11:00- 11:15 Tea/coffee (The Hub)

11:15 S.A. McCormick and P.S. Holmes (University of Manchester and Manchester Metropolitan University)

iPad-based simulation therapy in stroke survivors with mild to moderate impairment: A feasibility study

11:45 V. Montedoro, S. Grade, F. Coyette, C. Prairial, A. Ivanoiu and M. Edwards (Université Catholique de Louvain and Cliniques Universitaires St-Luc)

Using combined action observation and imagination to reduce lateralised attention bias in hemineglect: A multiple-case study

12:15 M. Alsamour, M. Gilliaux, A. Renders, G. Stoquart, T. Lejeune, C. Taymans, P. Berteau and M. G. Edwards (Université Catholique de Louvain and Cliniques Universitaires Saint-Luc)

The use of action observation therapy in children with cerebral palsy: A possible implication of motor repertoire

12:45 **Lunch and poster session 2** (The Hub)

14:00 **Keynote 2** Giovanni Buccino, Università Magna Graecia, Catanzaro (LTA)

Mirror mechanisms in the brain: A role for basal ganglia

15:00 **Panel discussion** (LTA)

15:45 **Prize giving and close of meeting**

Poster presentations

Session 1: Wednesday 6th April

1. R. Kenny, S.L. Hood, D. J. Wright and D.L. Eaves (Teesside University and Manchester Metropolitan University).
Does motor imagery during action observation enhance motor learning of a martial arts front kick?

2. K. Markland and D. J. Wright (Manchester Metropolitan University).
The effect of motivational imagery on perceived exertion and endurance cycling performance

3. F. Jones, P.J. Wilson and T. MacIntyre (University of Limerick).
A multidisciplinary approach to applying imagery in injury recovery in a professional sports setting

4. S. Abad-Hernando, R. M. Joly-Mascheroni, B. Forster and B. Calvo-Merino (City University London).
How your body tells you the rhythm to perceive multisensory information

5. C. Frank, I. Senna, F. Hülsmann, M. Ernst, M. Botsch, S. Kopp and T. Schack. (Bielefeld University).
Imagery and observation research in virtual reality environments

6. R. Joly-Mascheroni, B. Forster and B. Calvo-Merino (City University, London).
Beyond humans: Contagious yawning in primates elicited by a non-human agent, an android

7. V. Schroder, B. Read, K. Kessler and C. McAllister (University of Birmingham and Aston University).
Exploring the neural correlates of automatic imitation using magnetoencephalography recordings

8. M. Manawer Alenezi, A. H. Al Gamod, A. E Hayes, G. Lawrence and N. Callow (Ministry of Health Saudi Arabia, Arar and Bangor University).
Translation, cross-cultural adaption, and validation of the Vividness of Movement Imagery Questionnaire 2 (VMIQ-2) to classical Arabic language

9. J. Bek, E. Gowen, S. Vogt, T. Crawford, E. Stack, J. Dick and E. Poliakoff (University of Manchester, Lancaster University, University of Southampton, Salford Royal NHS Foundation Trust).
Online and offline imitation of hand movements in Parkinson's disease

10. J. Pickering, E. Poliakoff, J. McBride, A. Conroy and I. Leroi (University of Manchester).
Reducing impulsively in Parkinson's disease through action observation

Session 2: Thursday 7th April

11. G. Linstromberg, L. Hennig, T. Heinen, T. Schack and C. Frank (Bielefeld University and Hildesheim University).
Joint action imagery: Enhancing tactical skill representations in futsal players by way of a cognitive general imagery intervention

12. D. Lloyd, D.J. Wright and S. A. McCormick (Manchester Metropolitan University and University of Manchester).
The effects of visually-guided PETTLEP imagery on skating performance and imagery use in young, female figure skaters

13. C. Gaudissart, N. Callow and M. Edwards (Université Catholique de Louvain).
Effects of stress on action-priming

14. M. Dowson, D. Grant, T. Jefferies, J. Bek and E. Poliakoff (University of Manchester).
Exploring individual differences in imitation, motor imagery and social cognition

15. A. Galvez-Pol, B. Forster, and B. Calvo-Merino (City University London).
Motor encoding of sensorimotor information in visual working memory: Electrophysiological dynamics of functional body representations

16. P. M. J. Pollux (University of Lincoln).
Age-congruency effects in body expression recognition

17. N. Azlina Mohammed Suberi, N. Callow and R. Razman (University of Malaya and Bangor University).
The moderating role of visual imagery perspectives on the accuracy of a target aiming task

18. A. Zabicki, B. de Haas, K. Zentgraf, R. Stark, J. Munzert and B. Krüger (Justus Liebig University Giessen, University of Muenster and University College London).
Imagined and executed actions in the human motor system: Revising the concept of functional equivalence between imagining and executing via MVPA and RSA

19. P. Forbes, X. Pan and A. Hamilton (University College London and Goldsmiths, University of London).
Reduced mimicry to virtual reality avatars in autism

20. J. Webb, J. Bek and E. Poliakoff (University of Manchester).
Action observation therapy in Parkinson's: A feasibility study

21. R. Yaidoo, M. Bartlett, J. Bek, E. Gowen and E. Poliakoff (Bassajamba, Afrocats and University of Manchester).
Imitation, dance and understanding: An outreach project with women asylum seekers

Workshop: Action observation and imitation in Parkinson's disease

Friday 8th April 2016

University of Manchester

Lecture Room E

The Body, Eyes and Movement (BEAM) lab is hosting this one-day workshop as part of our ESRC-funded project on imitation in Parkinson's.

9:15 **Registration**

9:45 **Welcome and introduction**

10:00 **Guest speaker:** Dr Emma Stack, University of Southampton

Physiotherapy techniques and cueing in Parkinson's

11:00 Coffee break (The Hub)

11:15 Dr Ellen Poliakoff and Dr Jude Bek, BEAM lab, University of Manchester

Imitation in Parkinson's

12:15 **Lunch, posters and discussion** (The Hub)

13:45 **Guest speaker:** Dr Will Young, Brunel University

Learning to walk… using your ears! Auditory observation of action can cue both spatial and temporal characteristics of gait

14:15 **Guest speaker:** Dr Peter Lovatt, University of Hertfordshire

Exploring the feasibility and benefits of dance as an intervention for people with Parkinson's disease

14:45 Coffee break (The Hub)

15:00 **Keynote speaker:** Prof Giovanni Buccino, Università Magna Graecia, Catanzaro, Italy

Action observation treatment: A novel tool in neurorehabilitation

16:00 **Panel discussion**

16:30 **Close of meeting**

M. Blake[1], A. M. Bruton[1] and D. A. Shearer[2]
[1]University of Roehampton. [2]University of South Wales.

Visual gaze of team sports athletes when viewing team performance: The influence of familiarity on collective efficacy perceptions

This study compared the influence of the content familiarity (own v unfamiliar sport) of an observation intervention upon individual collective efficacy perceptions and eye movements. Participants were interactive team-sports players from a UK university (N = 60). Competitive video footage of the sports teams was collected over an 8-week period. 11 x 12sec video clips of positive footage were produced for all sports teams' familiar observation intervention. Participants from each sports team were randomly allocated another sports teams' intervention as their unfamiliar intervention. Participants recorded individual collective efficacy perceptions before and after viewing their respective intervention. Preliminary analysis shows increased collective efficacy for both familiar (Mdiff = 1.00) and unfamiliar conditions (Mdiff = 0.29) post-intervention, with the largest increase for the familiar condition. Additional preliminary analysis indicates no differences in team sports athlete's fixations for familiar and unfamiliar conditions. For both conditions, the athletes recorded the greatest number (familiar M = 22%, unfamiliar M = 24%) and duration of fixations on the recorded team (familiar M = 29%, unfamiliar M = 30%). Follow up social validation interviews only partially supported the findings obtained through eye-tracking analysis, with participants indicating that their attention was directed towards teammates during the familiar intervention and the ball during the unfamiliar intervention. The findings provide further support for the use of observation interventions as a means to enhance collective efficacy. This increase appears to be facilitated by an attentional bias towards focal team members, further stressing their importance towards the development of collective efficacy beliefs. This abstract represents work that is currently 'in-progress'. It is predicted that full analyses will be complete by the date of the conference.

B. Marshall and D. J. Wright
Manchester Metropolitan University

Layered stimulus response training imagery vs. combined observation and imagery: The effects on golf putting performance and imagery ability

Use of imagery can enhance motor skill performance, although its efficacy is mediated by an individual's ability to image. It is therefore important to identify optimal imagery techniques for enhancing both performance and imagery ability. This study aimed to test two such techniques: layered stimulus response training (LSRT) and combined action observation and movement imagery (AO+MI). Twenty-four novice golfers were assigned to LSRT imagery, AO+MI or reading (control) training groups (n = 8). Putting performance and self-report measures of ease of image generation (MIQ-3) and imagery vividness (VMIQ-2) were recorded at pre-test (day 1), post-test (day 5) and retention (day 7). Self-reported task specific imagery ability was also measured over four consecutive training days. Each day during the intervention the LSRT imagery group imaged 20 trials in four blocks of five whilst the AO+MI group observed 20 trials in four blocks of five whilst simultaneously imaging the kinaesthetic sensations associated with performing the task. All participants also physically performed 20 putts each day. The results showed a significant improvement in golf putting performance and ability to image a specific golf putting task for the LSRT imagery group, but no such improvements were found in either the AO+MI or control groups. In addition, no significant improvements were found for general ease of image generation or vividness of imagery in any group. These findings indicate that LSRT imagery can be used as an effective tool for improving performance and skill specific imagery ability in novice athletes.

M. Scott [1], S. Taylor [1], P. Chesterton [1], S. Vogt [2] and D.L. Eaves [1]
[1]Teesside University. [2] Lancaster University.

Motor imagery during action observation increases eccentric hamstring force: An acute non-physical intervention

The benefits of motor imagery (MI) practice on isometric force production are well-known. However, the extent to which MI synchronised with action observation ('AO+MI') can enhance eccentric force generation has not previously been studied. We assessed maximal voluntary eccentric contraction (MVEC) in the right and left hamstrings before and after a 3-week MI intervention. Participants imagined performing a Nordic hamstring exercise in both the MI (n = 9) and AO+MI (n = 9) groups, which involved mental simulation of a powerful eccentric hamstring contraction simultaneously in both legs. In the AO+MI group participants additionally synchronised their MI with a demonstration of this action. In contrast, the control group (n = 8) imagined performing a task-irrelevant upper-limb action. ANOVAs revealed MVEC increased significantly in the right but not in the left leg, indicating MI benefits had been predominantly (and spontaneously) lateralised in this dual-limb task. Magnitude-based inference analyses further showed that MVEC change scores in the right leg were possibly beneficial for AO+MI (d = 0.72) and (less so) for MI (d = 0.39), relative to the control. Moreover, the within-groups MVEC change scores were likely beneficial for AO+MI (d = 0.36), and only possibly beneficial for MI (d = 0.23), and the control (d = 0.13). As such, these results identify a practical advantage for AO+MI training. Since reduced eccentric hamstring strength is associated with the proliferation of hamstring injuries across sports, our findings point to the benefits of an acute AO+MI intervention for sports performance, injury prevention and rehabilitation.

E. McNeill, T. MacIntyre and D. Harrison
University of Limerick

Implementation of the MIIMS Model using a case study approach

Motor Imagery's effectiveness as a psychological intervention for improving sporting performance has been widely demonstrated. This research will seek to apply the Motor Imagery Integrative Model of Imagery in Sport (MIIMS; Guillot & Collet, 2008) to a case study with a professional golfer. The purpose of the study is to translate theory to practice in ecologically valid settings with an elite athlete. Case study research is required to translate theory to practice in an ecologically valid way, and this research design has come to the fore with specific journals in sport science and sport psychology dedicated to this approach. Moreover, it has been demonstrated that there is a paucity of research focusing on elite athletes another issue that this study will attempt to redress. The case study procedure will employ Thomas' (1990) Model of Performance Enhancement over twelve weeks, during which MIIMS will be integrated as part of the case study process. It is hypothesised that the effective implementation will have a role in improving performance, motor learning and performance and strategy and problem solving over the duration of the intervention. A number of innovations are also being applied including the use of movement during imagery, both aysnchronous (flight of the ball) and synchronous (simulating the action of the golf swing) based on prior research in which imagery has been coupled with movement (Guillot et al., 2013). Furthermore, imagery abilities will assessed both pre and post intervention using the Motor-imagery index (Collet et al., 2013).

J. Barr, T. MacIntyre, E. Igou, and D. Harrison
University of Limerick

Motor Imagery as an adjunct to typical injury protocols: A case study perspective

A number of psychological interventions are successfully applied to the recovery from a sports injury, including goal setting (Evans & Hardy, 2002) and relaxation (Cupal & Brewer, 2001). Despite existing evidence supporting the use of motor imagery for injury rehabilitation (Cupal, 1998; Johnson, 2000), there is a dearth of research into the actual application of motor imagery interventions within a rehabilitation setting, particularly within elite sport contexts. In order to address these glaring gaps in the literature, a case study will be conducted with an injured professional rugby player, drawing from the Motor Imagery Integrative Model of Imagery in Sport (MIIMS; Guillot & Collet, 2008). This single participant case study will seek to translate theory into practice in an ecologically valid setting with a professional rugby player over a twelve week period. A number of peer-reviewed academic journals attest to the benefits of using the case study design within applied sport psychology research, i.e. Case Studies in Sport and Exercise Psychology (CSSEP).

It is hypothesized that the effective implementation of a motor imagery intervention to complement the player's rehabilitation program will improve their physical and psychological recovery from injury. MI may positively influence their adherence to a rehab program, build resilience against setbacks (Heil, 1993; Morris et al., 2005) potentially speeding up the recovery process. MI may even help to limit loss of physical strength and improve the athlete's ability to manage pain (Yue & Cole, 1992; Ranganathan et al., 2004).

G. D'Innocenzo[1], C. C. Gonzalez[1], A. Nowicky[2], A. M. Williams[1] and D. T. Bishop[1]
[1] Department of Life Sciences, Brunel University. [2]Department of Clinical Sciences, Brunel University.

The effects of visual fixation location on motor resonance during observation of thumb adduction/abduction

Introduction and aims: Action observation (AO) is a key mechanism through which individuals acquire novel motor skills. Research has shown that observing an action activates the same areas in the brain that are involved in the execution of that action, an effect known as motor resonance. Motor resonance is modulated by the observer's familiarity with the observed action, and it can be regarded as an index of expertise and motor learning. Consequently, AO is increasingly being adopted as a complement to traditional rehabilitation programmes. However, it is unknown whether visual information extraction during AO can be optimised by adopting specific gaze strategies. The present study aims to explore the notion of an optimal fixation location for the pickup of visual information during AO. Methods: The relationship between point-of-gaze and motor resonance during observation of thumb movements was examined using single-pulse transcranial magnetic stimulation (TMS). Participants watched videos of thumb adduction/abduction and a video of a static hand while 1) being allowed to move their eyes freely; or 2) maintaining their eyes on predetermined locations. Results and conclusions: Motor resonance was affected by fixation location. Fixating on an area which maximised the amount of motion across the fovea elicited greater motor resonance as compared to viewing the action with the eyes moving freely, suggesting that there may indeed be an optimal fixation point that facilitates extraction of motion information during AO. This may have important implications for AO-based perceptual training and rehabilitation programmes.

M. Riach, P. S. Holmes and D. J. Wright
Manchester Metropolitan University

Transcranial magnetic stimulation in action observation: A comparison of single versus paired pulse techniques

Action observation (AO) has been reported to be a useful adjunct to compliment traditional therapies in motor rehabilitation. One of the techniques used to explore the variables mediating the effects on cortical activity involved in AO is transcranial magnetic stimulation (TMS). Despite extensive work in the area, additional research is still required to refine and validate the TMS methods that are typically used in this field.

The aim of this experiment was to investigate the use of single-pulse (SP) and paired-pulse (PP) TMS techniques in AO. SPTMS motor evoked potentials (MEPs) were compared to those obtained from inhibitive and facilitative PPTMS during observation of a finger-thumb ball squeeze action and a static hand holding a ball using the optimal stimulation site for the FDI muscle. The PPTMS parameters were set using participants' resting motor thresholds with an 80% sub-threshold conditioning stimulus followed by a 110% supra-threshold stimulus either 3ms (inhibitive) or 12ms (facilitative). In line with previous findings, it was predicted that higher amplitude MEPs would be demonstrated following facilitative PPTMS and SPTMS compared to inhibitive PPTMS. It was also predicted that both the SPTMS and inhibitive PPTMS results would demonstrate higher amplitude MEPs during action observation compared to static hand observation, whilst the facilitative PPTMS results would show no difference. The findings from this experiment will help to confirm whether the established facilitation in MEP amplitude during AO from SPTMS experiments is due to changes at a corticocortical or corticospinal level.

S.Vogt[1], S. Higuchi[2], M. Ziessler[3], and K. Sakreida[4,5]
[1]Department of Psychology, Lancaster University. [2]Division of Ultrahigh Field MRI, Institute for Biomedical Sciences, Iwate Medical University, Japan. [3]Department of Psychology, Liverpool Hope University. [4]Department of Neurology, RWTH Aachen University. [5]Department of Neurosurgery, RWTH Aachen University.

Motor imagery engages an insula-centered tactile network more than action observation: An fMRI study

Introduction: Action observation (AO) and motor imagery (MI) are two forms of action simulation which involve the motor cortical system and can facilitate motor skill acquisition. It is often stated in the literature that AO and MI share the same neural substrate, but studies directly contrasting these two simulation states are rare. Here we demonstrate clear-cut differences between the neural networks of AO and MI, suggesting a complementarity rather than 'neural redundancy' of the two. Furthermore, these differences were consistent across two imitation tasks with contrasting task networks.

Conclusions: SEQUENCING and RHYTHM imitation tasks recruited distinct task networks. At the same time, both tasks provide convergent evidence for a partial dissociation between regions activated during AO and MI: During AO, the respective task network tended to be more strongly activated than during MI. In contrast, during MI of both SEQ and RHY tasks, a network comprising a more posterior sector of IPC (PF), posterior insula, and SII was found activated, most likely reflecting complex tactile-kinaesthetic processing. This network showed only moderate overlap with AO, and strong overlap with action execution. Based on these findings we reject the common view of 'largely overlapping neural substrates of AO and MI'. Rather, motor imagery appears to engage tactile-kinaesthetic simulation to a larger extent than AO, which gives MI a privileged role in bridging perception and action. These complementary strengths of AO and MI further underline the value of simultaneous AO and MI in motor learning and rehabilitation applications.

B. Toovey[1], E. Seiss[2], and A. Sterr[1, 3].
[1]Brain and Behaviour Group, University of Surrey. [2]School of Psychology, University of Bournemouth. [3]Department of Neurology, University of São Paolo.

Motor imagery shows enhanced priming effects compared to motor preparation: A cognitive hierarchy?

Preparation (MP) and imagery (MI) can modulate subsequent movement. A congruent prime leads to faster response time to an imperative stimulus and fewer errors, while incongruent primes lead to the opposite. MI contains additional processes and simulated information over MP although this hasn't been assessed in the same study. The research question asks if MP or MI priming effects are equivalent and how it can be explained theoretically. In a single protocol, priming effects of MI and MP were compared to understand this relationship. In 4 behavioural experiments, priming tasks were used in a repeated measures design. In each task the 'prime' stimulus instructed participants to prepare or imagine (dependent on session) foot movements (left; right; both) that were congruent, incongruent or neutral with the informative 'imperative' stimulus (L or R movement). Similarly to MP, congruent MI resulted in better performance than neutral, while incongruent MI/MP performance was poorest. Interestingly the MI costs, benefits and congruency effects appeared stronger than MP. This congruency effect was stronger for short MI and presented in hand and foot responses and cannot be explained with cognitive load. We suggest unique contributions from MI specific processes towards priming upcoming action, and implicate a hierarchical organisation of MI and MP processes that may be explained using existing motor control concepts, and the internal model theories within the motor control context.

W. Stadler[1], R. I. Schubotz[2], M. A. Giese[3], P. Wefstaedt[4], A. Wohlschläger[1], M. Brandy[1], W. Prinz[5], and J.Hermsdörfer[1]
[1]Technical University of Munich. [2]Westfälische Wilhelms-Universität Münster. [3]University Clinic Tübingen. [4]University of Veterinary Medicine Hannover. [5]Max Planck Institute of Human Cognitive and Brain Sciences, Leipzig.

Like master like dog: Brain correlates of action and shape discrimination in humans and dogs

The action observation network (AON) in the human cortex is reliably activated when humans observe actions of others, especially those they are familiar with. To what extent the AON is involved in the observation of non-human agents (e.g., robots) or actions the observers have no experience with is controversial. Here, fMRI was recorded while participants observed actions performed by a human and a dog. By using point-light animations to keep the body surfaces constant, we were interested in how task instructions highlighting either action or agent characteristics modulate activation in the AON. Twenty-four participants observed animation videos that were generated from motion capture recordings of a dog and a human. The clips lasting about 2.5 sec each were presented in pairs. Two task-conditions alternated randomly. In the "WHO" condition participants decided whether both clips showed the same agent. The "WHAT" condition asked whether both clips showed the same actions, irrespective of who performed them. Observing the dog's actions activated all classical areas of the AON. Pronounced activation of visual areas during dog observation suggested detailed stimulus analysis, possibly due to less detailed memory representations. Premotor areas were activated stronger when the human was observed, resulting from the access of stored action representations. Attending to action details (WHAT-task) drew on occipital and temporal areas of visual association and on parietal areas associated with sensorimotor integration. Discriminating humans from dogs (WHO-task) activated regions in the cerebellum possibly due to resonance of networks maintaining internal models of sensorimotor control.

E. Gowen, E. Bolton and E. Poliakoff
University of Manchester

Believe it or not: Moving non-biological stimuli believed to have human origin can be represented as human movement

Does our brain treat non-biological movements (e.g. moving abstract shapes or robots) in the same way as human movements? The current work tested whether the movement of a non-biological rectangular object, believed to be based on a human action is represented within the observer's motor system. A novel visuomotor priming task was designed to pit true imitative compatibility, due to human action representation against more general stimulus response compatibility (SRC) that has confounded previous belief experiments. SRC effects were found for the object. However, imitative compatibility was found when participants repeated the object task with the belief that the object was based on a human finger movement, and when they performed the task viewing a real human hand. These results provide the first demonstration that non-biological stimuli can be represented as a human movement if they are believed to have human agency and have implications for interactions with technology and robots.

N. Brady[1], M. Campbell[2], and S. Pierce[1]
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Sex differences in the mental rotation of cubes and hands: A comparison of motor and visual imagery

Mental rotation is unique among spatial abilities in showing a male advantage marked by large effect sizes. However, the evidence for this sex difference derives mainly from studies using the Mental Rotations Test which relies on a single metric of performance, namely accuracy. Here we compare male and female performance on two mental rotation tasks and analyse performance in terms of reaction time (RT) and sensitivity, d'. In Study 1, which used a Shepard & Metzler paradigm, 15 males and 15 females judged whether a series of test images - images of cube figures or of human hands shown at 7 orientations ranging from 45° to 315° - were the same as or different than a standard 0° image. In both tasks males showed a slight but non-significant RT advantage at the more difficult angles of rotation whereas females showed a slight but non-significant advantage in sensitivity across all angles. Male and females showed similar mental rotation strategies as indexed by distinct RT profiles for the cubes and hands tasks, and by similarly distinct chronometric profiles for same and different trials. In Study 2, 28 males and 32 females completed a 'hand laterality task' judging whether images of human hands – shown in 8 orientations ranging from 0° to 315° - were left or right hands. Males showed a slight but non-significant RT advantage across all angles of rotation coupled with comparable sensitivity to females. These findings suggest that male and female performance in the mental rotation of 3D objects is characterized more by similarity than difference and we caution against the sole use of accuracy rates in the measurement of sex differences in cognition.

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The influence of high and low motor content on the way actions are depicted with hand gestures in Parkinson's disease

Parkinson's disease (PD) is a movement disorder characterised by tremor, stiffness and slowness, and patients also exhibit impairments in cognition and language which relate specifically to action. For example, patients are less able to generate lists of verbs (Signorini & Volpato, 2006) and are slower to name actions, particularly those with high motor content (e.g. run, swim) compared to low motor content (e.g. sleep, read) (Herrera, Rodriguez-Ferreiro & Cuetos, 2012). Co-speech gestures are the spontaneous hand and arm movements produced when people speak. They embody a link between action and language: two core cognitive domains affected in PD. We have previously shown that when people with PD use their gestures to describe the action of others, they prefer to depict the action from a third-person perspective (e.g. using their finger to represent an entire person moving through space) whereas controls prefer to do so from a first-person perspective (mimicking acting out the action as though performing it themselves). This may be because patients have more difficulty in cognitively representing the action from a first-person perspective. Currently, we are investigating whether the amount of motor content in the viewed action affects the degree to which people gesture about it and whether it influences the viewpoint they use when doing so. 38 PD patients and 35 controls were filmed as they described a cartoon featuring high and low motion scenes of action. We predict that patients will have more difficulty producing first-person gestures when describing high motor content scenes. Analysis is currently ongoing and results will be presented at the meeting.

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iPad-based simulation therapy in stroke survivors with mild to moderate impairment: A feasibility study

Introduction: See, Imagine, Move; Upper Limb Action Therapy (SIMULATe) is a novel, iPad-based programme aimed at (re)learning activities of daily living after stroke. The study determines the feasibility of SIMULATe.

Method: Stroke survivors (N=13) with mild upper limb impairment, 3 - 60 months post stroke were recruited. Participants used SIMULATe to mentally and physically practice functional activities for 90 minutes a day for 18 consecutive days. Primary outcome measures included adherence, retention, System Usability Scale (SUS) and adverse effects. Secondary measures included the Action Research Arm Test (ARAT), 9 hole peg test (9HPT), Grip Strength (GS), and the Positive and Negative Affect Scale. Results are reported as median (IQR).

Results: The intervention proved feasible; there was > 80% retention, participants completed > 33% of the target time, the SUS (0-100) was 91.2 (87.5 - 92.5) and there were no adverse effects. For secondary measures, the ARAT (0-57) increased from 43.0 (39.5 – 54.0) to 45.0 (39.0 – 53.0); GS (N=11*) increased from 28.3 (26.0 - 44.3) to 35.7 (30.2 – 49.2); 9HPT (N=7*) decreased from 81.1 (38.2 –132.83) to 39.9 (33.51 – 55.7); Positive Affect (10 - 50; N=10*) increased from 34.2 (29.5 – 38.0) to 36.0 (32.5 – 47) and Negative Affect (10 - 50; N=10*) decreased from 22.0 (13.2 – 29.2) to 16.5 (11.5 – 23.25). *Some participants could not complete all measures.

Conclusion: Technology-dependent therapy appears to be feasible to stroke survivors. Level of use is variable and may not meet recommendations. Further development and investigation in a randomized controlled trial is warranted.

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Using combined action observation and imagination to reduce lateralised attention bias in hemineglect: A multiple-case study

Hemineglect is a condition that significantly hinders functional daily activities through patients having difficulties to perceive objects in contralesional space. Although treatments exist, none are completely effective. In the present study, we evaluated a new rehabilitation method based on Mirror Neuron System theory and the finding that hemineglect patients have preserved actions. Here we investigated whether combined action observation and imagination that should show normal activity in patients, could prime attention (in the direction of the action) and reduce hemineglect. We tested five case-patients with hemineglect using a double-baseline and counterbalanced manipulation design. The experimental manipulation involved forty movie clips of daily first-person perspective actions starting in the centre and moving to the contralesional hemifield. The control condition featured the same movie clips, but flipped so that actions were made to the ipsilesional hemifield. Each movie was followed by a white screen during which the patients imagined the previously observed actions. Results were analysed using case analyses, and these showed that all patients showed some reduction in hemineglect on at least one measure following the experimental compared to control condition. Moreover, patients having the most hemineglect-related difficulties in daily life showed the greater benefits from the rehabilitation. The results will be discussed in terms of follow-up studies that use robot evaluation of pre and post treatment changes, for different types of hemineglect.

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The use of action observation therapy in children with cerebral palsy: A possible implication of motor repertoire

Action observation therapy (AOT), based on mirror neuron system theory, has been demonstrated to improve patient's planning and execution of motor actions (thought to rely on common observation and execution neural processes). In the present research, we will report a study that used AOT in children with cerebral palsy (CP) in order to rehabilitate upper limb movement function. Seven children with hemiplegic congenital CP were tested. Assessment consisted of body structure and function (force, fine / gross manual dexterity and quality of movement measured with a robotic device), activity limitation and participation restriction measures. Participants viewed videos showing a first person perspective of a child's daily living activities with a narrative combined with standard treatments, or received standard treatments alone (using a single blind cross over design). The results showed significant action improvements in four of seven cases for body structure and function, and activity limitation measures. Furthermore, the initial level of action ability appeared to predict the efficacy of the AOT. In some follow-up studies that we will discuss, we aim to better understand the link between motor repertoire and AOT efficacy by manipulating the quality of actions in the AOT and presenting the video to both healthy and various levels of CP children. To end the presentation, we will discuss the possible association between manual ability and mirror neuron system functioning, underlying a possible mechanism for AOT, and suggesting criteria that could be used to select patients and/or actions for AOT.

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Does motor imagery during action observation enhance motor learning of a martial arts front kick?

Martial arts practitioners traditionally use action observation (AO) and motor imagery (MI) separately to teach motor skills. While these two techniques are effective in generating sub-forms of motor simulation, which can improve motor learning, a more promising technique might be to perform MI during AO (i.e., 'AO+MI'). Recent neuroimaging studies have demonstrated stronger activations of motor areas for this dual-action simulation state, relative to the two single states. However, the effect of AO+MI instructions on behavioural outcomes is little understood. In the present study four novice groups (n = 29) learned a 'front kick' that is common across martial arts via either pure AO or AO+MI, in which training was either with or without physical practice. On each trial participants observed videos of an expert's punch-punch-kick combination. Imitation was not explicitly instructed so that implicit learning effects on kicking performance could be assessed on Day 1, both before and after 6 blocks of 10 trials, and in a 24 hour retention test. Expert martial arts trainers evaluated these actions from 2-D videos, but an ANOVA revealed no significant effects. Presently a large-scale analysis of the 3-D lower-limb kinematic data is underway, assessing group mean angular positions, velocity and relative timings compared to the expert. Learning advantages are predicted for AO+MI compared to pure AO, particularly when coupled with physical practice. If so, these data will provide the first empirical validation that dual-action simulation states are more advantageous for motor learning than traditional methods.

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The Effect of motivational imagery on perceived exertion and endurance cycling performance

Introduction: There is increasing evidence to suggest that rating of perceived exertion (RPE) plays a significant role in the regulation of endurance fatigue (Marcora et al., 2010). In a recent study motivational self-talk was found to significantly reduce RPE and significantly increase endurance performance (Blanchfield et al., 2014). However, the effect of motivational imagery on RPE and endurance performance is yet to be investigated. Therefore, the aim of this study was to assess the effect of motivational imagery on RPE and endurance cycling performance.

Methods: Ten male recreational athletes completed an incremental ramp test on a cycling ergometer to establish peak power output (PPO). Following this, participants completed a pre-test time to exhaustion (TTE) cycling test at 70% PPO, before being randomly assigned to either imagery or control groups. The imagery group were provided with a personalised cycling imagery script and instructed to image three times per week for two weeks, whilst the control group completed a reading task. A post-test TTE test was then completed. Throughout each TTE test both RPE and heart rate were recorded at two minute intervals until exhaustion, where blood lactate was also recorded.

Results: Motivational imagery significantly increased TTE by 11% in the imagery group, with no significant difference observed in the control group. Furthermore, motivational imagery significantly reduced RPE in the imagery group, with no significant difference observed in the control group.

Conclusion: Motivational imagery appears to be an effective psychological strategy to reduce RPE and increase endurance cycling performance.

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A multidisciplinary approach to applying imagery in injury recovery in a professional sports setting

Multidisciplinary approaches, although often advocated, are rarely optimally implemented in high performance. An example from professional rugby is used to elucidate the issues, challenges and effects of this model. The role of stakeholders beyond the sport science and medicine community are highlighted to convey the importance of wholesale implementation of the model. Social support from family, team mates and leaders within the sporting group are key to enabling the recovery process. The timing of the interactions between these people, termed entourage, and the sport science and medicine practitioners with the athlete are discussed. A case study is employed to elucidate how a multi-disciplinary approach can become potentially interdisciplinary. Our example, focuses on the use of imagery as a strategy by different personnel, ranging from the consultant, to the rehabilitation specialist, to the coach. The commensurate benefits to the athlete in terms of recovery, performance and well being are discussed. Moreover, the challenges across practitioners in terms of their knowledge, skills and attitudes towards the application of mental imagery are outlined.

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How your body tells you the rhythm to perceive multisensory information

We are constantly involving multimodal neural mechanisms, which we implement for interpreting events in the world around us. The way we process information from different senses in order to perceive something as simultaneous does not rely only on the naturally occurring lags in arrival or processing times of each sense. In this study we examined the effects of biological attributes (Experiment 1), and effects of congruency (Experiment 2) on perceived simultaneity in a visuotactile task. We used a psychophysical method to measure the differences in point of subjective simultaneity (PSSs) in visuo-haptic events. In experiment 1, visual stimuli could be either biological (two hands suggesting a clapping movement) or non-biological (geometrical shapes performing the same apparent movement). Results showed the PSS increased significantly in the biological condition. In order to dissociate biological appearance from effect of congruency we compare two types of visual biological stimuli: hands (highly congruent with the tactile stimuli) and ears (a biological stimulus non-congruent with the tactile event to be judged for simultaneity). Despite the difference was not significant, it follows the same trend with an increase in the PSS for the biologically congruent condition. Overall results suggest that biological congruency between tactile and visual events modulates the delay on the perception of simultaneity. The size of this delay increases with the level of biological congruency between the visual and tactile stimuli, suggesting that embodiment mechanisms modulate multisensory processing.

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Imagery and observation research in virtual reality environments

Feedback is known to be essential for promoting motor learning. Virtual reality (VR) provides an ideal environment to augment the learning process. As a highly controllable environment it allows to systematically manipulate variables and to create new types of interactions as compared to a real-world setting. In a first study, we examined the influence of different types of augmented feedback during observational learning in a VR environment. Specifically, we were interested in the impact of online visual feedback on participant's motor performance and cognitive representation structure of the squat. Novices were assigned to one of two groups, an 'own avatar' group, and an 'own avatar plus ghost' group. Whilst executing the squat, participants in the 'own avatar' group observed their own avatar performing their own movement in a virtual mirror. Participants in the 'own avatar plus ghost' group observed also the avatar of a skilled person, superimposed on their own avatar, performing a correct squat. Participants were tested prior to and after the acquisition phase as well as after a retention interval of one day. Preliminary results showed a trend for the 'own avatar plus ghost' group to outperform the 'own avatar' group in several biomechanical parameters, as well as in their cognitive representation structure of the squat. Based on these initial results, an outlook is given on the potential benefits that VR environments might provide for future research in imagery and observation.

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Beyond humans: contagious yawning in primates elicited by a non-human agent, an android

The main function of yawning remains disputed (Wilkinson et al 2011). The contagious aspect of yawning, has been demonstrated within species, (e.g. between humans: Provine 1986; chimpanzees, Pan troglodytes: Anderson et al 2004, Campbell & de Waal 2011, budgerigars, Melopsittacus undulatus: Miller et al. 2011). Joly-Mascheroni et al (2008) found that domestic dogs, (Canis lupus familiaris), catch human yawns, in the first study to explore the contagiousness of yawning across species. This re-confirmed there is transference of communicative signals between species. In line with evidence that humans are more susceptible to yawn contagiously from those whom they are familiar, Chimpanzees yawn contagiously in response to videos of yawning in-group but not out-group members. Here we explored the contagiousness of yawning between chimpanzees and an inanimate agent. We used an android. Results show, that not only chimpanzees yawn contagiously, but they also lay down, and displayed a behaviour that resembled a state of drowsiness, suggesting the interpretation of a communicative signal produced by an unfamiliar model that was humanlike in appearance, but ultimately an android. Findings warrant further explorations of android action perception and interaction

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Exploring the neural correlates of automatic imitation using magnetoencephalography recordings

Automatic imitation, the unconscious tendency to imitate another person's actions, is proposed to result from mirror-system networks specialised for the direct matching of observed and executed actions. The current study explored the pattern of neural oscillations within frontal-parietal areas associated with automatic imitation effects.

Twenty-one participants were first tested on a stimulus-response compatibility paradigm (Boyer et al. 2012). Participants observed a hand performing a movement of either the middle or index finger and were instructed to respond with a movement with the middle or index finger of their right-hand according to the left-right spatial position of the stimulus finger. By presenting the stimuli as either left or right hands we manipulated whether the participants' actions were biologically compatible (index/index) or incompatible (index/middle) with the observed action. Results revealed an automatic imitation effect as response-times were 29 ms faster when the participants' actions were biologically compatible with the observed action ($p < 0.001$).

In a second study, the oscillatory neural activity associated with this effect was examined using magnetoencephalography recordings. Preliminary analysis revealed that the participants' responses were associated with prominent reductions in the power of the alpha-beta band (10-25Hz) in central and anterior sensors. Notably, the power reduction recorded in the biologically-congruent condition was stronger than that of the biologically-incongruent condition from 250-500 ms of the onset of the observed movement. These findings support the notion that automatic imitation is facilitated by oscillatory activity in fronto-parietal area, yet, further investigations, particularly at source level will be required for final conclusions.

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Translation, cross-cultural adaption, and validation of the Vividness of Movement Imagery Questionnaire 2 (VMIQ-2) to classical Arabic language

Movement imagery (MI) has been introduced in physiotherapy as a promising intervention technique after considerable evidence supported its role in varied motor tasks and physical functions (Dickstein & Deutsch, 2007). The benefit of imagery interventions can be affected by many factors, including level of the individual's imagery ability. Consequently it has been recommended that a measure of imagery ability should be included when designing any imagery practice in the research setting or as a treatment intervention (Malouin, Jackson, and Richards, 2013). This project aimed to translate and validate a questionnaire that measures imagery ability, the Vividness of Movement Imagery Questionnaire 2 (VMIQ-2), to be used in rehabilitation or sport settings in the Arabic-speaking population. The VMIQ-2 was translated to Arabic following guidelines developed by the International Society for Pharmacoeconomics and Outcomes Research (ISPOR; Wild et al., 2005). The translated questionnaire was tested with 7 native Arabic speakers residing in the UK to ensure that the participants understood the translated version of the questionnaire in the same way as the original version would be understood. Then 142 native Arabic speakers residing in the UK completed the VMIQ-2-Arabic; 44 completed the questionnaire a second time after one week. Analyses examining test-retest reliability, internal consistency, and construct validity provided preliminary evidence that the VMIQ-2-Arabic is a valid and reliable measure for Arabic speakers residing in the UK. Ongoing research is testing validity of the VMIQ-2-Arabic in a larger sample using confirmatory factor analysis, and testing validity in specific patient populations in Saudi Arabia.

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Online and offline imitation of hand movements in Parkinson's disease

Action observation and imitation have shown some benefits in neurorehabilitation. However, imitation may be compromised in PD, and previous studies have not compared the effects of imitation and other visual cues on movement. Our previous work did not show a clear benefit of imitation over spatial cues; however, cues differed in predictive information, and concurrent observation and execution may have been attentionally demanding.

In the present study we compared movements in response to imitative and matched non-imitative cues in people with PD and age-matched controls, following prior observation to reduce cognitive demands. PD participants (N=29) and controls (N=25) observed videos of short movement sequences shown by a human hand or spatial-temporal targets. Participants then executed the sequence from memory (offline) or while viewing the stimulus again (online) while kinematics were recorded. Modulation of movement in response to changes in the speed or amplitude of stimuli, and accuracy relative to the stimulus, were analysed.

Participants showed greater modulation of timing and speed with imitative cues in both tasks, whereas in the online task, amplitude was modulated more with non-imitative cues. The PD group showed larger amplitude with online action observation than with non-imitative cues; however, speed and smoothness were increased with non-imitative cues in the offline task. Controls were faster and smoother with non-imitative cues in both tasks. Duration accuracy was increased with imitative cues in the online task.

People with PD are able to imitate hand movements, but imitative cues may affect timing while online spatial cues may have greater effects on amplitude. Online imitation with prior observation of the action to be performed may be particularly beneficial.

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Reducing impulsively in Parkinson's disease through action observation

A subset of Parkinson's disease patients develop Impulse Control Disorders (ICDs), characterised by impulsive behaviours (e.g. gambling, compulsive shopping, hobbyism, and hypersexuality; Voon, 2015). These patients have difficulty inhibiting responses compared to healthy controls (Wylie et al., 2012).

Much of the research into inhibitory control focuses on tasks performed alone, however many of one's actions take place in a social context, and Parkinson's patients have a particular reliance on external cues compared to internal. The Stop Signal Task directly measures inhibitory control by requiring participants to suppress an initial cognitive response to a ""Go"" signal on the appearance of a ""Stop"" signal on a proportion of trials (Logan & Cowan, 1984). Studies of the Stop Signal Task with healthy participants have shown that the simple observation of another person successfully inhibiting a response leads to better inhibitory control in the observer (Schuch & Tipper, 2007).

This project aims to use action observation and social cueing to assess whether similar after effects can be seen in Parkinson's disease patients with and without ICDs. If successful, this will be examined over a period of several weeks to establish feasibility of a future training intervention, which may help to improve quality of life in Parkinson's disease patients who have problems with impulse control.

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Joint action imagery: Enhancing tactical skill representations in futsal players by way of a cognitive general imagery intervention

While research on imagery and motor skill learning is vast, research on the use of imagery for tactical skill learning is scarce. The present study investigated the impact of a four-week cognitive general imagery intervention on athlete's cognitive representations of tactics in futsal. Futsal players were assigned to one of two groups: a mental practice group practicing mentally in addition to regular futsal practice, and a control group, not partaking in additional mental practice. Players in the mental practice group practiced four team-specific tactics (i.e., counter-attack, play making, pressing, transitioning) by way of imagery three times a week over the course of four weeks. Athletes were tested prior to and after the intervention for their cognitive representations of futsal tactics, employing structural dimensional analysis of mental representations. Results revealed well-structured representations for both groups of skilled athletes prior to and after the intervention, reflecting well all four team-specific tactics. Interestingly, after the intervention, the mental practice groups' representations were more similar to that of an expert representation as compared to the control group. This study indicates that mental practice of tactics can have a significant impact on players' representations in long-term memory. Future research should look at both changes on the cognitive representation level and changes on the motor performance level, as well as their relation.

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The effects of visually-guided PETTLEP imagery on skating performance and imagery use in young, female figure skaters

Introduction: A growing body of research supports the use of PETTLEP imagery to improve performance of motor skills in adult athletes (for a review see Wakefield & Smith, 2012). In contrast, limited PETTLEP interventions have been conducted with children (Quinton et al., 2014). This study tested the efficacy of a seven day, visually-guided PETTLEP imagery intervention on skating performance and frequency of imagery use in young, female figure skaters.

Method: 10 figure skaters (age = 13.2 ± 1.23 years) from two ice skating clubs in Western England were age and skill matched and then randomly allocated to either a PETTLEP imagery intervention group or a nutritional knowledge control group. Pre- and post-testing consisted of the Sport Imagery Questionnaire for Children and skating performance, assessed using an extended National Ice Skating Association Grade of Execution Scale. A sport-specific nutrition test was also administered to both groups at post-test.

Results: Interim results indicate that the experimental group improved skating performance and engaged in more frequent use of cognitive and motivational imagery. Certain skating-specific skills (e.g. telegraphing) appeared more sensitive to the intervention than others (e.g. single axle). The nutritional knowledge control group scored higher than the experimental group on the nutrition test.

Discussion: The findings suggest visually guided PETTLEP imagery interventions can improve performance of motor skills in young, female figure skaters and help develop their use of functional imagery. The study also demonstrates the potential for control groups to include educational tasks to enhance the sport-related knowledge of younger athletes.

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Exploring individual differences in imitation, motor imagery and social cognition

Factors such as gender, age and experience have been shown to influence action representation, but little is known about how imitation relates to individual differences in motor imagery (MI), social cognition and empathy, which are proposed to involve motor simulation. MI ability may be an important factor in imitation, with stronger neural activations and behavioural effects when action observation and MI are combined. Additionally, automatic imitation has been empirically associated with social cognition and empathy, and social cues can influence automatic imitation. However, relationships between automatic and voluntary imitation, motor imagery and empathy are yet to be explored.

The present study explores automatic and voluntary imitation in relation to measures of motor imagery, social cognition and empathy. We will also explore the relationship with object personification (the tendency to attribute human-like characteristics such as age, gender and warmth to inanimate objects).

We are carrying out a battery of measures in young healthy participants. Voluntary imitation is examined for hand movements with typical vs. atypical trajectories, analysing modulation and kinematic accuracy. Automatic imitation is tested using a visuomotor priming task, analysing compatibility effects for a task-irrelevant hand or object movement. In an additional condition, participants are informed that the moving object represents human movement.

We will examine how voluntary and automatic imitation, and susceptibility to the belief manipulation, relate to implicit and explicit measures of MI, social cognition, empathy and object personification. Relationships among these measures will also be explored.

Data collection is ongoing. Preliminary results will be presented and discussed.

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Motor encoding of sensorimotor information in visual working memory: electrophysiological dynamics of functional body representations

New perspectives in working memory suggest similar neural processes underlying memory encoding and perception mechanisms. This provides sensory cortices with a determinant role in memory storage and cognition. In a previous study we showed that visual working memory of sensorimotor information (e.g. encoding hand postures) recruited cortical sensory regions functionally engaged with processing this sensorimotor information, beyond the already described visual cortices. Here, we test the involvement of motor cortices during visual encoding of sensorimotor information using a novel paradigm that combines lateralized readiness potentials (LRP) evoked with a task-irrelevant motor task, during a visual working memory task of hand postures and control condition (shapes). Visual evoked potentials (VEPs) showed a significant contralateral enhancement of mean amplitudes when memorizing increasing number of stimuli over occipital electrodes, suggesting the presence of mnemonic activity over visual regions similar to what has been previously shown. Importantly, analysis of the LRPs locked to the motor response at the end of the encoding phase shows a lateralized enhancement of neural activity depending on the amount of information to be held in visual memory (load) only for the hand condition, and not for the control condition over frontal electrodes. These results provide evidence for a double dissociation between type of stimuli encoded, memory load, and neural location of the corresponding elicited response. Such activity suggests a functional specific underlying motor contribution to maintain in visual working memory sensorimotor information.

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Age-congruency effects in body expression recognition

Own-age bias has been observed in face identity recognition, reflected in longer viewing and better recognition of own-age faces. Previously we investigated own-age bias in emotion expression recognition based on whole body motion cues by presenting Point Light Displays (PLDs) of older adults (>70), young adults and children expressing six basic emotions to participants of the same three age-groups. The predicted age-congruency effect, which was based on the assumption that processing of whole body motion for emotion recognition may involve the mirror neurons system and may be influenced by the similarity in motor skills between actor and viewer, was not found. In the current study we aimed to investigate if explicit knowledge of the actor's age (now provided before presentation of each PLD) would enhance age-congruency effects in a new group of young adults (N=36) and children (N=94). The pattern of results remained unaltered. Instead, both studies demonstrated a clear developmental pattern in expression categorization in children and a strong influence of contact with older adults for the youngest age-group (6 yeas), supporting the role exposure and experience on rapid judgements about emotional state of others from body motion cues.

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The moderating role of visual imagery perspectives on the accuracy of a target aiming task

Research has demonstrated that imagery can enhance accuracy of performance (e.g., Malouff et al., 2008). However, this imagery research has failed to explore possible differential effect of visual imagery perspectives on accuracy during target aiming task. Consequently, the aim of this study was to determine the possible moderating role of imagery perspective on the accuracy of a target aiming task. It was hypothesised that internal visual imagery (IVI) would produce significantly more accurate performance than external visual imagery (EVI), and both perspectives would produce significantly more accurate performance than a control group.

Thirty-six participants completed the Vividness of Movement Imagery Questionnaire-2 (Callow & Roberts, 2010) and were randomly assigned to three groups: EVI, IVI and a Maths-control group (M age = 20.83 years, SD = 1.05). In a seated position, with their elbow bent at 90 degrees, participants performed a no-vision right handed pullback aiming task on a sliding tracker. The target distance was set at 250mm and Absolute Error used as the dependent variable. Both imagery groups received a relevant imagery script from the third block onwards, with the control group answered a set of math questions.

Data have been collected on 14 participants. The complete data set will be analysed using a two way ANOVA 3(Group) x 8(Block) with repeated measures on block. A significant interaction between group and block is expected, with follow-up tests indicating that the EVI and IVI groups to significantly different from each other, and the control group, from the third block onwards.

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Imagined and executed actions in the human motor system: Revising the concept of functional equivalence between imagining and executing via MVPA and RSA

Motor execution (ME) and imagery (MI) both evoke BOLD activity in a fronto-parietal motor network. This anatomical overlap has been interpreted as evidence for functional equivalence – ME and MI are assumed to rely on the same motor representations. However, it is unclear to what extent execution and imagery use the same neural code. Here we use multivoxel pattern analysis (MVPA) and representational similarity analysis (RSA) to describe the neural representations of imagery and execution within the fronto-parietal motor network in more detail. During fMRI-scanning, 20 right-handed volunteers imagined or executed three different types of right-hand actions. The identity of action states and action types could be decoded significantly above chance from the spatial patterns of BOLD signals they evoked in premotor and posterior parietal cortices using MVPA. This was also true for crossmodal decoding, i.e. the decoding of imagined actions based on spatial BOLD patterns evoked by executed hand actions, and vice versa. Furthermore, RDMs (representational dissimilarity matrices) of frontal and parietal areas show that MI and ME representations form separate clusters, but the representational organisation of action types within these two clusters is identical. For most ROIs, this pattern of results best fits a mixed model that assumes a low to moderate degree of similarity between the neural pattern associated with MI and ME. These results challenge the assumption of functional equivalence between imagined and executed actions.

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Reduced mimicry to virtual reality avatars in autism

Upon entering a busy market or restaurant, one is confronted by the ubiquity of mimicry, the unconscious imitation of other people's behaviour. Research in both social psychology and cognitive neuroscience has demonstrated that mimicry is not only ubiquitous but is also a powerful and versatile tool in everyday social interactions (Chartrand & van Baaren, 2009). Individuals with a diagnosis of autism spectrum condition (ASC) have significant impairments in social communication and interaction (American Psychiatric Association, 2013) which may include differences in mimicry behaviour (Edwards 2014). Using a novel virtual reality paradigm the study aimed to test whether there are any differences in the implementation and social modulation of mimicry in adults with a diagnosis of ASC. It was found that people with a diagnosis of ASC tended to mimic the avatars but to a lesser extent than neurotypicals. Whether the avatar was socially engaged or disengaged failed to modulate mimicry in either the neurotypical or ASC sample. The findings are discussed in terms of the social top-down response modulation (STORM) model of mimicry (Wang and Hamilton, 2012).

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Action observation therapy in Parkinson's: A feasibility study

Existing therapeutic techniques involving external cues can improve movement initiation and control in Parkinson's. Action observation may offer a more effective form of cueing, and positive effects have been found in stroke rehabilitation, but such therapies have received less attention in Parkinson's.

The aim of this study is to explore the feasibility of a new home-based personalised therapy for Parkinson's, combining observation, imagery and imitation of meaningful actions from videos viewed on a tablet computer. The proposed therapy has been designed through multidisciplinary collaboration (psychology, neuroscience, physiotherapy, neurology), as well as by consultation with people with Parkinson's.

A focus group will be conducted with people with Parkinson's and carers or companions. Participants will be invited to offer their general views on the proposed therapy, and to discuss potential actions to include, aspects of movement to target, and action complexity (e.g., single-step versus multi-step). Practical issues for therapy implementation will also be discussed, such as intensity and timing of training and personalisation options. Focus group discussions will be analysed using thematic analysis to identify key themes, particularly relating to feasibility and acceptability. Results will contribute to the development of a Parkinson's specific action observation therapy prototype.

The proposed therapy represents a new approach to rehabilitation for Parkinson's, combining observation and imagery to maximise potential efficacy, and offers an individualised and flexible alternative which may be more engaging, effective and economical than existing approaches.

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Imitation, dance and understanding: An outreach project with women asylum seekers

The project introduced a group from Women Asylum Seekers Together (WAST) to research on imitation, exploring themes creatively through cultural dance and drama. WAST is a network for women asylum seekers, providing a forum for support and raising awareness. Imitation is an important process in learning, social interaction and understanding, and is a relevant topic for women experiencing social isolation and exclusion. The project was designed to facilitate access to science and increase knowledge about research, including the impact of different conditions on movement and understanding, and was supported by social enterprise Bassajamba.

In a visit to the BEAM lab, participants were introduced to imitation research topics and methods, with demonstrations of eye and motion tracking equipment. Through a series of workshops with a choreographer, the group then developed drama and dance pieces based on their learning. The project culminated in an interactive performance at a local Arts venue to a diverse audience including academics and local community and Arts organisations representatives. The performance demonstrated how imitation influences movement and social interaction, incorporating traditional story-telling and dance.

WAST members reported increased learning and benefits of their participation. The audience reported enjoyment of the performance and interactive elements, and increased understanding of imitation. The performance offered a new perspective on imitation to both academics and non-academics.

The project offered a creative and meaningful experience for participants, increasing understanding of the relevance of science to everyday life. It also highlighted potential new avenues of research for the BEAM lab.

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