KENT MEETING

15-17 April 2020
Open exchange of new ideas is central to EPS meetings. To foster up-to-date discussion, presenters are mandated to report work that is not yet published. We ask that attendees respect this mandate. Please do not record or publish presented material (e.g. via Twitter or Facebook) without the presenter's permission. To remove any ambiguity regarding permission, this programme now includes a symbol next to every abstract (the hashtag shown on this page), where the presenter has agreed permission for their work to be shared on social media. Where no symbol is shown for a given presentation, there should be absolutely no filming, pictures, or social media of any kind. For explicit guidance on reporting at EPS meetings, please refer to the EPS handbook.
A scientific meeting will be held at the School of Psychology, Keynes College, University of Kent, Canterbury, CT2 7NP between 15 - 17 April 2020.

The local organiser is Heather Ferguson and Sam Hurn.

**18th Mid-Career Prize Lecture**

*Thursday 16th April, 6:00pm*

  Frontal cortical interactions during decision making.
  Matthew Rushworth, University of Oxford

**Mid-Career Prize Symposium**

*Thursday 16th April, 3:00pm - 5:00pm*

  Inference of others’ minds.

**Poster session and drinks reception**

Keynes College Foyer 5:00pm until 7:00pm.
Delegates may put up posters from 3:00pm and should take them down by the end of the session.

**Platform presentations**

Sessions will be held in Keynes Lecture Theatre 1 and Keynes Lecture Theatre 4. Both theatres have data projectors available for PowerPoint presentations. Presenters may provide their own laptops and connector leads, or bring USB keys for the on-site computers. Any queries about facilities in the theatres should be sent to Sam Hurn at expsychsoc@kent.ac.uk.
EPS Pub Quiz Social Event
Wednesday 15th April, starting at 7:15pm in K Bar, Keynes College

Getting into teams:
Teams of 6 (maximum, minimum of 3)
Each team can have only one team member with the title of (Emerita/us) Professor
Each team must have one PhD student team member
Each team must be representative of at least two institutions (not from the same city/town)

The EPS invites you to team up and show us how your brains work! We are devising questions to test your knowledge on experimental psychology, general knowledge and the ever popular picture round.

The Pub Quiz will be held in K-Bar in Keynes College, a two-minute walk from the conference rooms / poster session and wine reception.

Food will be available until 9.30 pm. Please find the menus below, although the prices listed do not include VAT, so may be slightly higher for non-students.


You can send advance notice of your team to expsyschsoc@kent.ac.uk or simply sign up on the day!

Conference Dinner

The conference dinner will be held on Thursday 16th April at 8:00pm (arrival from 7:30pm) at The Drapers Arms, which is just a 30-minute walk from the meeting into Canterbury city centre. The restaurant address is 1 - 2 Sun Street, Canterbury, CT1 2HX.

The standard dinner cost for EPS members is £24.95 for this meeting. Please note that postgraduates can book at a reduced fee of £12.50, but must provide evidence of their postgraduate status by emailing a letter from their supervisor (or a direct email from the supervisor) to Sam Hurn at expsyschsoc@kent.ac.uk.

For full information, including menu choices and how to book, please see page 68.
START OF PARALLEL SESSIONS

Session A
Keynes Lecture Theatre 1

1:30  Sue Lynn Mah* and Mark Haselgrove (University of Nottingham) (Sponsor: Mark Haselgrove) Individual and cultural differences in learned predictiveness.

2:00  Wen Wen* (University of Tokyo, Japan) (Sponsor: Patrick Haggard) The categorical perception of control.

2:30  Daniel Yon, Carl Bunce* and Clare Press (Goldsmiths, University of London, Birkbeck, University of London) Illusions of control without delusions of grandeur.

3:00  Tea / Coffee

3:30  Moataz Assem*, John Duncan and Sneha Shashidhara* (University of Cambridge) (Sponsor: John Duncan) Shared and distinct brain activity for diverse executive functions.

4:00  Mengya Zhang*, Joseph Rennie*, Joe Bathelt*, Erin Hawkins* and Duncan Astle (University of Cambridge) (Sponsor: John Duncan) Mapping differential responses to cognitive training using machine learning.

4:30  David Shanks, Chunliang Yang*, Miguel Vadillo, Liang Luo* and Rongjun Yu* (University College London, Institute of Developmental Psychology, Beijing Normal University, China, Universidad Autónoma de Madrid, Spain, Collaborative Innovation Centre of Assessment Toward Basic Education Quality, Beijing Normal University, China, National University of Singapore, Singapore) Testing (quizzing) boosts classroom learning: A meta-analysis.

5:00  Posters and Drinks Reception
Posters displayed and drinks served in the Keynes Foyer until 7pm.

7:15  EPS Pub Quiz Social Event
K Bar, Keynes College
START OF PARALLEL SESSIONS

Session B
Keynes Lecture Theatre 4

1:30  Amelia Skye Turrell*, Andrea Halpern*, Sarah Burke*, Ellie Tozer* and Amir-Homayoun Javadi (University of Kent, Bucknell University, USA, University College London, Tehran University of Medical Sciences, Iran) (Sponsor: Amir-Homayoun Javadi) The emotive and neurological effects of ‘Drops’ in different music genres.

2:00  Lisa P. Y. Lin* and Sally Linkenauger* (Lancaster University) (Sponsor: Matthew Longo) The influence of virtual hand size on the perception of virtual object size.


3:00  Tea / Coffee

3:30  Qing Han*, Casimir Ludwig and Susanne Quadflieg* (University of Bristol) (Sponsor: Casimir Ludwig) The structure of information provision anchors decision making strategies.

4:00  Reneta Kiryakova*, Stacey Aston*, Ulrik Beierholm* and Marko Nardini (Durham University) (Sponsor: Daniel Yon) Developmental changes to learning rates for novel perceptual priors.

4:30  Marko Tesic*, Alice Liefgreen* and David Lagnado (Birkbeck, University of London, University College London) (Sponsor: David Lagnado) The propensity interpretation of probability and diagnostic split in explaining away.

5:00  Posters and Drinks Reception
Posters displayed and drinks served in the Keynes Foyer until 7pm.

7:15  EPS Pub Quiz Social Event
K Bar, Keynes College
Session A
Keynes Lecture Theatre 1

9:00 Andrew Martin*, Klaus Kessler*, Shena Cooke*, Jasmine Huang* and Marcus Meinzer* (The University of Queensland, Australia, University of Kent, Aston University, Greifswald University, Germany) (Sponsor: Heather Ferguson) The right temporoparietal junction is causally associated with embodied perspective taking.

9:30 Jessica Wang and Beth Armstrong* (Lancaster University) Social cognition and social well-being in old age.


10:30 Tea / Coffee

11:00 Tian Ye* and Antonia Hamilton (University College London) (Sponsor: Antonia Hamilton) A virtual reality study of spontaneous visuospatial perspective selection in adults.

11:30 Abbie Millett*, Antonia D'Souza* and Geoff Cole (University of Suffolk, University of Essex) (Sponsor: Geoff Cole) Attribution of vision and knowledge in ‘spontaneous perspective taking’.

12:00 Steven Samuel*, Klara Hagspiel*, Madeline Eacott* and Geoff Cole (University of Essex) (Sponsor: Geoff Cole) Visual perspective-taking: We don't see it.

12:30 Lunch
Session B
Keynes Lecture Theatre 4

9:00 Andrew Johnson and Richard Allen (Bournemouth University, University of Leeds) Odour-colour binding effects in olfactory working memory.

9:30 Rory Spanton* and Christopher Berry (University of Plymouth) (Sponsor: Christopher Berry) Does variability in memory strength for studied items scale with encoding variability, or mean strength?

10:00 Timothy Hollins, Tina Seabrooke, Christopher Mitchell*, Andy Wills and Angus Inkster* (University of Plymouth, University of Southampton) The role of retrieval competition on the magnitude of the pretesting effect.

10:30 Tea / Coffee

11:00 Wesley Pyke*, Thanos Vostanis* and Amir-Homayoun Javadi (University of Kent, University College London, Tehran University of Medical Sciences, Iran) (Sponsor: Amir-Homayoun Javadi) Anodal transcranial direct current stimulation during a complex task can impair long term retention of memory.

11:30 Arianna Moccia* and Alexa Morcom (University of Sussex) (Sponsor: Alexa Morcom) Did I see it? Event-related potential (ERP) studies of prioritisation of recollection.

12:00 Robin Hellerstedt, Arianna Moccia*, Chloe Brunskill*, Howard Bowman and Zara Bergstrom (School of Psychology, University of Kent, University of Sussex, School of Computing, University of Kent) Aging-related changes to ERP markers of memory: Implications for forensic applications.

12:30 Lunch
Session A  
Keynes Lecture Theatre 1

1:30  Tim Vestner*, Katie Gray and Richard Cook (Birkbeck, University of London, University of Reading) (Sponsor: Richard Cook) Why are social interactions found quickly in visual search tasks?

2:00  Ruihan Wu* and Sarah White (University College London) (Sponsor: Sarah White) Do individuals with elevated autistic traits camouflage more?

2:30  Tea / Coffee

Symposium  Inference of others’ minds.

3:00  Jérôme Sallet (University of Oxford)  
Social brain networks in human and non-human primates.

3:30  Shinsuke Suzuki (The University of Melbourne, Australia)  
Integration of multiple computations in social decision-making.

4:00  Marco Wittmann (University of Oxford)  
Social influences on performance learning in medial prefrontal cortex.

4:30  Patricia Lockwood (University of Oxford)  
Neural basis of generosity and selfishness.

5:00  Keynes Lecture Theatre 1 – EPS Business Meeting

6:00  Keynes Lecture Theatre 1 – 18th EPS Mid-Career Prize Lecture  
Matthew Rushworth (University of Oxford)  
Frontal cortical interactions during decision making.

7:30  Conference Dinner at The Drapers Arms  
Arrival from 7:30pm with food served from 8:00pm.
Thursday 16 April, pm

Session B
Keynes Lecture Theatre 4

1:30 John Shaw*, Padraic Monaghan and Zhisen Urgolites* (De Montfort University, Lancaster University, University of California San Diego, USA) (Sponsor: Nabil Hasshim) Effect of sleep on memory for binding different types of visual information.

2:00 Silvia Gennari, Gareth Gaskell and Yaqi Wang* (Shandong University, University of York) Language influences on event memory are mediated by consolidation across sleep.

2:30 Tea / Coffee

3:00 Jose Luis Tapia*, Rafael Salom*, Francisco Rocabado*, Eva Rosa* and Manuel Perea* (Universidad Nebrija, Spain, Universidad Católica de Valencia San Vicente Mártil, Spain, Universitat de València, Spain) (Sponsor: Bernhard Angele) Contextual diversity and its facilitative role in language acquisition.


4:00 Nera Bozin*, Mafalda Batista da Costa* and Erika Nurmsoo (University of Kent, University of Surrey, Canterbury Christ Church University) (Sponsor: Erika Nurmsoo) Children’s representational flexibility when changing the meaning of an expression or a drawing.

4:30 Antje Meyer and Laurel Brehm* (Max Planck Institute for Psycholinguistics, The Netherlands) Taking turns in time: Disassociating cue use in turn taking using cross-validation.

5:00 Keynes Lecture Theatre 1 – EPS Business Meeting

6:00 Keynes Lecture Theatre 1 – 18th EPS Mid-Career Prize Lecture
Matthew Rushworth (University of Oxford) Frontal cortical interactions during decision making.

7:30 Conference Dinner at The Drapers Arms
Arrival from 7:30pm with food served from 8:00pm.


**Session A**  
**Keynes Lecture Theatre 1**

9:00  
**Matthew Plummer**, **Robin Hellerstedt**, **Stuart Gibson**, **Jon Simons** and **Zara Bergstrom** (School of Psychology, University of Kent, School of Physical Sciences, University of Kent, University of Cambridge) (Sponsor: Zara Bergstrom) Face memory updating enhanced following retrieval vs re-study.

9:30  
**Zara Bergstrom**, **Matthew Plummer**, **Robin Hellerstedt**, **Stuart Gibson** and **Jon Simons** (School of Psychology, University of Kent, School of Physics, University of Kent, University of Cambridge) Reactivation and updating of face memories.

10:00  
**Jonathan Prunty**, **Jolie Keemink** and **David Kelly** (University of Kent) (Sponsor: Markus Bindemann) Ecological validity in infant eye-tracking research: Facial expressions, a worked example.

10:30  
**Jolie Keemink**, **Lauren Jenner**, **Nicky Wood**, **Jonathan Prunty** and **David Kelly** (University of Kent, Kent & Canterbury Hospital) (Sponsor: David Kelly) Interactive gaze-contingent eye-tracking tasks reveal reduced social responsiveness in infant siblings.

11:00  
Tea / Coffee

11:30  
**Fraser Smith**, **Lucy Petro**, **Lars Muckli** and **Vicky Adams** (University of East Anglia, University of Glasgow) (Sponsor: Stephanie Rossit) Early visual regions in the human brain contain information about occluded portions of human faces.

12:00  
**Matthew Fysh** and **Markus Bindemann** (University of Kent) (Sponsor: Markus Bindemann) Similarity and accuracy in unfamiliar face matching: The match-mismatch paradox.

12:30  
**Markus Bindemann** (University of Kent) Person perception in virtual worlds: The case of facial identity matching at airports.

**End of Meeting**
Friday 17 April, am

Session B
Keynes Lecture Theatre 4

9:00  Farah Akthar* and Robin Walker  (Royal Holloway, University of London) (Sponsor: Robin Walker) Reading with a central vision loss: the case for scrolling text.

9:30  Tamila Kalsi*, Kevin Paterson and Ruth Filik  (University of Nottingham, University of Leicester) (Sponsor: Ruth Filik) The role of context in the processing of semantic ambiguities: Eye-tracking evidence from younger and older adults.

10:00  Henri Olkoniemi*, Raymond Bertram* and Johanna Kaakinen*  (University of Turku) (Sponsor: Jukka Hyönä) Knowledge is a river and education is like a stairway: An eye movement study on how L2 speakers process metaphors and similes.

10:30  Francisco Rocabado*, Bernhard Angele and Jon Andoni Duñabeitia*  (Universidad Nebrija, Spain, Bournemouth University) (Sponsor: Bernhard Angele) Predicting the unpredicted: No relationship between "the"-skipping and response inhibition.

11:00  Tea / Coffee

11:30  Sara Milledge*, Hazel Blythe and Simon Liversedge  (University of Southampton, Northumbria University, University of Central Lancashire) (Sponsor: Simon Liversedge) Parafoveal pre-processing of phonology in English children.

12:00  Kayleigh Warrington, Kiruth Sidhu*, Alex Roney*, Victoria McGowan, Marina Soltan*, Darmeena Gopikrishna*, Katarzyna Kołodziejczyk*, Kevin Paterson and Sarah White  (University of Leicester) Effects of reading goals on parafoveal processing during reading.

12:30  Jukka Hyönä and Timo Heikkilä*  (University of Turku, Finland) Relating foveal and parafoveal processing efficiency with eye-movement measures of text reading.

End of Meeting
1. Leia Brasnell*, Monica Reis*, Markus Bindemann and Matthew Fysh* (University of Kent) (Sponsor: Markus Bindemann) Effects of human-computer interaction and time pressure on face matching.

2. Jacqueline Claydon*, Reuben Moreton* and Markus Bindemann (University of Kent, Open University) (Sponsor: Markus Bindemann) Forensic facial examiners’ eye movements during face matching: Qualitative or quantitative differences between experts and controls?

3. Saima Noreen* and Malcolm MacLeod* (De Montfort University, Stirling University) (Sponsor: Nabil Hasshim) Moving on or deciding to let go? A pathway exploring the effects of emotional and decisional forgiveness on intentional forgetting.


5. Jörn Alexander Quent* and Richard Henson (University of Cambridge) (Sponsor: Richard Henson) Both schema-congruency and schema-incongruency improve memory performance and recollection in a virtual reality experiment.


8. Christopher Atkin*, Duncan Guest, Christina Howard, Thomas Baguley and Joshua Baker* (Nottingham Trent University) (Sponsor: Duncan Guest) The Same or Different? Capacity limitations in visual imagery versus visual memory of simple structured objects.


10. Alice Liefgreen* and David Lagnado (University College London) (Sponsor: David Lagnado) Representing and evaluating competing causal explanations.

11. Luca Kiss* and Karina Linnell (Goldsmiths, University of London) (Sponsor: Karina Linnell) The effect of background music on attentional state and task-performance in sustained attention.

12. Jason Hill* and Travis Proulx* (Cardiff University) Inducing the mindful eye: Attentional and psychophysiological components of mindfulness training.

14. **Shilei Chen**, **Patrick Leman** and **Wijnand van Tilburg** (King’s College London, University of Essex) (Sponsor: Caroline Catmur) Do you like me? Women’s self-objectification and need for approval.

15. **Thomas Hein**, **Lilian Weber**, **Jan de Fockert** and **Maria Herrojo Ruiz** (Goldsmiths, University of London, Translational Neuromodeling Unit (TNU), University of Zurich and ETH Zurich, Switzerland, National Research University Higher School of Economics, Russian Federation) (Sponsor: Daniel Yon) State anxiety biases estimates of uncertainty during reward learning in volatile environments.

16. **Indu Dubey**, **Maddie Groom**, **Ameena Tahir** and **Antonia Hamilton** (De Montfort University, University of Nottingham, University College London) (Sponsor: Nabil Hasshim) Social sharing and reputation management in adults with high autistic traits and social anxiety. **Withdrawn**

17. **Katie Carpenter** and **David Williams** (University of Kent) (Sponsor: Heather Ferguson) Predicting the future and judging the past: Examining prospective and retrospective metacognition in relation to mindreading and ASD traits.

18. **Mahsa Barzy**, **Marta Ponari**, **David Williams** and **Heather Ferguson** (University of Kent) (Sponsor: Heather Ferguson) Role of intention in moral judgements: Evidence from autism and facial EMG.


20. **Harry Farmer**, **Chris Bevan**, **David Green**, **Mandy Rose**, **Kirsten Cater** and **Danae Stanton-Fraser** (University of Greenwich, University of Bath, University of Bristol, University of the West of England) (Sponsor: Harry Farmer) A broken empathy machine: Virtual reality does not reduce prejudice or increase pro-social behaviour towards refugees.


22. **Divyush Khemka**, **Narges Ahmadiari**, **Geoffrey Bird** and **Caroline Catmur** (King’s College London, University of Oxford) (Sponsor: Caroline Catmur) Imitation in one’s own presence: self-focus does not uniquely modulate imitative response tendencies.

23. **Jessica Dawson** and **Tom Foulsham** (University of Essex) (Sponsor: Tom Foulsham) Does looking at the speaker depend on visual or auditory cues?
24. **Carl Bunce* and Richard Cook** (Birkbeck, University of London) (Sponsor: Richard Cook) Visual mechanisms that code inter-interactant distance exhibit psychophysical adaptation.


26. **Tahani Alqahtani* and Doug Barrett** (University of Leicester) (Sponsor: Doug Barrett) Age-related changes in perception and top-down guidance during visual search.


28. **Wendy Ross* and Frédéric Vallée-Tourangeau** (Kingston University) (Sponsor: Frédéric Vallée-Tourangeau) Chance and interactivity in an anagram task.

29. **Emma James, Gareth Gaskell and Lisa Henderson** (University of York) Accessing prior linguistic knowledge when learning new words from spoken stories.

30. **Tianqi Wu*, Zhenguang Cai and Min Wang*** (Xi’an Jiaotong University, Xi’an, China, The Chinese University of Hong Kong, Hong Kong) (Sponsor: Zhenguang Cai) Implicit learning ability and language acquisition: Evidence from artificial language learning.


32. **Eirini Zormpa*, Antje Meyer and Laurel Brehm*** (Max Planck Institute for Psycholinguistics, Donders Institute for Brain, Cognition and Behaviour, Radboud University Nijmegen) (Sponsor: Antje Meyer) Answers are remembered better than the questions themselves.

33. **Wilasinee Siriboonpipattana*, Lyndsey Nickels, Paul Sowman*, Roelien Bastiaanse* and Srdjan Popov*** (Macquarie University, Australia, University of Groningen, Netherlands, University of Potsdam, Germany, University of Trento, Italy, Newcastle University) (Sponsor: Lyndsey Nickels) Electrophysiological evidence from time reference violation in Thai.

34. **Nera Bozin* and Erika Nurmsoo** (University of Kent, Canterbury Christ Church University) (Sponsor: Erika Nurmsoo) Exploring children’s and adult’s interpretation of drawings (Pre-registered study).
Individual and cultural differences in learned predictiveness.

Sue Lynn Mah and Mark Haselgrove
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Studies using associative learning measures have revealed that patients with schizophrenia show an inability to ignore irrelevant stimuli. However, literature surrounding the deficits of attention have been confounded with symptom chronicity and medication state. As an alternative, individual differences (i.e. schizotypy) have been employed to assess schizophrenia via proxy. As with schizophrenia, disruptions in attentional learning in schizotypy is also mixed. The study described here uses learned predictiveness to examine if schizotypy, trait anxiety and the Big 5 traits play a mediating role in the disruptions of attentional learning. Results show a correlation between the negative subscale of schizotypy and learned predictiveness which supports previous findings. Correlations also revealed that there was a difference between individualistic and collectivistic cultures with regards to trait Conscientiousness of the Big 5 in mediating learned predictiveness.

The categorical perception of control.
Wen Wen
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When people actively interact with their environment, external sensorimotor feedback serves as an important cue to draw the line between what can be controlled by oneself, and the other part of the world. It is known that stimuli related to the self hold a special state in our cognitive system. However, how these categories of control vs no-control (i.e. something that can be controlled by oneself vs the other things) shape our perceptive sensitivity, remains unknown. In this study, we examined the perceptive sensitivity at the boundary between full-control and no-control, within both categories. The results showed that when the level of control increased from a no-control state, people showed higher sensitivity to the change when it occurred within the boundary, as compared to occurrences within the categories of no-control and full-control. On the other hand, when the control decreased from a full-control state, people showed the highest sensitivity to the change when it crossed the upper edge of the boundary. In summary, the results showed a typical categorical perception in the domain of control. More importantly, the results revealed an important difference in such perception, depending on the direction of change i.e. from no-control to full-control, and vice-versa.

Illusions of control without delusions of grandeur.
Daniel Yon ¹,² Carl Bunce² and Clare Press²
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We frequently experience feelings of agency over events we do not objectively influence – so-called ‘illusions of control’. These illusions have prompted widespread claims that we can be insensitive to objective relationships between actions and outcomes, and instead rely on grandiose beliefs about
our abilities. However, these illusory biases could instead arise if we are highly sensitive to the relationship between our actions and their outcomes, and attribute agency when correlations emerge simply by chance. We motion-tracked participants while they made agency judgements about a cursor that could be yoked to their actions or follow an independent trajectory. A combination of signal detection analysis, reverse correlation and computational modelling indeed demonstrated that 'illusions' of control emerged solely from sensitivity to spurious action-outcome correlations. Counterintuitively, this suggest that 'illusions' of control could arise because agents have excellent insight into the relationships between actions and their outcomes in a stochastic, fluctuating world.

### Shared and distinct brain activity for diverse executive functions.

Moataz Assem, John Duncan and Sneha Shashidhara
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New fMRI acquisition and analysis methods developed in the Human Connectome Project allow unprecedented precision in localising cortical activity. Using these methods, we compare precise activation patterns for three kinds of executive function (EF) – working memory, set shifting and inhibition. In line with the concepts of a “common EF” factor and a cortical multiple-demand system, activity patterns for the three functions are variations on a similar theme, with strong and specific overlaps in dorsal and medial frontal, dorsal and medial parietal, and occipitotemporal cortex. But in line with partial specialization, each function has its own, quantitative variation on this common theme. We propose a common cortical circuit for integrated cognition whose activity is modulated by the exact content of specific task operations.

### Mapping differential responses to cognitive training using machine learning.

Mengya Zhang, Joseph Rennie, Joe Bathelt, Erin Hawkins and Duncan Astle
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We used two simple unsupervised machine learning techniques to identify differential trajectories of change in children who undergo intensive working memory training. We used self-organising maps (SOMs) – a type of simple artificial neural network – to represent multivariate cognitive training data, and then tested whether the way tasks are represented changed as a result of training. The patterns of change we observed in the SOM weight matrices implied that the processes drawn upon to perform working memory tasks changed following training. This was then combined with K-Means clustering to identify distinct groups of children who respond to the training in different ways. Firstly, the K-means clustering was applied to an independent large sample (N=616, mean age= 9.16 years, range: 5.16-17.91 years) to identify sub-groups. We then allocated children who had been through cognitive training (N = 179, mean age: 9.00 years, range: 7.08-11.50 years) to these same four subgroups, both before and after their training. In doing so we were able to map their improvement trajectories. Scores on a separate measure of fluid intelligence were predictive of a child’s improvement trajectory. This work provides an alternative approach to analysing cognitive training data that goes beyond considering changes in individual tasks. This proof-of-principle demonstrates a potentially powerful way of distinguishing task-specific from domain-general changes following training and of establishing different profiles of response to training.
Testing (quizzing) boosts classroom learning: A meta-analysis.

David Shanks¹, Chunliang Yang², Miguel Vadillo³, Liang Luo⁴ and Rongjun Yu⁵  
¹ University College London  
² Institute of Developmental Psychology, Beijing Normal University, China  
³ Universidad Autónoma de Madrid, Spain  
⁴ Collaborative Innovation Centre of Assessment Toward Basic Education Quality, Beijing Normal University, China  
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Over the last century hundreds of laboratory and classroom studies have repeatedly demonstrated that testing, by comparison with restudying and many other learning strategies (e.g., concept mapping), can more effectively consolidate long-term retention of studied/tested knowledge and facilitate mastery of new information, a phenomenon termed the testing effect. The current review integrated 48,582 students’ data, extracted from 223 independent studies, to investigate the magnitude, boundary conditions, and cognitive underpinnings of test-enhanced learning in the classroom. The results showed that overall testing (quizzing) raised student academic achievement to a medium extent (g = 0.499). The magnitude of the effect was modulated by a variety of factors, including the learning strategies in the control condition, test format consistency, material matching, provision of corrective feedback, test repetition, test administration location and timepoint, treatment duration, and experimental design. The documented findings support additional exposure, transfer-appropriate processing, and motivational theories of the testing effect. In addition to their significance for theory development, these results have practical significance for enhancing teaching practice and guiding education policy, and highlight important directions for future research.

The emotive and neurological effects of ‘Drops’ in different music genres.

Amelia Skye Turrell¹, Andrea Halpern², Sarah Burke¹, Ellie Tozer¹ and Amir-Homayoun Javadi¹,³,⁴  
¹ University of Kent  
² Bucknell University, USA  
³ Universidad Autónoma de Madrid, Spain  
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Prediction, tension and deviation play a role in music emotion induction. Particularly emotive music moments are Drops; where features such as pitch, rhythm and tempo increase to create tension during pre-Drop and then change within predictable deviations during post-Drop. Such moments have been linked to greater excitement, as well as emotion-related prefrontal cortex (PFC) activity. However, it is unclear whether emotions induced by Drops vary across music genre; for instance, they more frequently occur in modern dance music. In this study, 63 participants listened to Drops from dance and classical music whilst rating felt levels of valence and arousal and underdoing continuous EEG. Valence and arousal ratings were similar across both music genres; dance Drops were rated slightly more arousing and positive. EEG source reconstruction showed no significant differences in brain activity across genres. However, findings replicated previous research with greater precuneus (PCUN) activity pre-Drop related to tension and increased inferior frontal and
middle frontal gyri activity during predictable changes at post-Drop. Results suggest Drops induce arousing and positive emotions due to their structure of tension and predictable change, correlating with PCUN and PFC activity. However, similarities between genres suggest music’s emotion-inducing effects may rely more on specific musical structures.

The influence of virtual hand size on the perception of virtual object size.

Lisa P. Y. Lin and Sally Linkenauger
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To successfully interact with the environment, the perceiver must scale spatial layout with respect to the maximum extent over which they can perform actions, also known as action boundaries. Empirical evidence has shown that these action boundaries are the perceptual rulers to which objects’ sizes and distances are scaled. For example, the perceived size of a graspable object would be perceived as a proportion of one’s handspan. If perceived extents are scaled to the action capabilities of one’s body, then changes in the sizes of those action capabilities should result in changes in the perception of those extents. In this set of studies, we investigated this hypothesis by assessing the influence of hand size on the perception of object size using virtual reality. Participants were asked to estimate the size of an object following brief interaction with the object, with either a virtual hand that gradually increased or decreased in size over trials. We found that individuals’ estimations of object sizes to be consistent with the body-based scaling hypothesis, in which they perceived the object to shrink or grow in size over time, while perceiving their virtual hand as having a more constant size.

Cognitive functions underlying search efficiency in mice and humans: an assessment based on a novel foraging paradigm.

Spencer Talbot, Todor Gerdjikov and Carlo De Lillo
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Three experiments assessed cognitive functions underlying search efficiency in mice and humans. They featured a novel foraging paradigm where subjects searched for rewards among locations grouped by visual features. Across trials, a subset of locations never yielded rewards whereas other subsets alternated in yielding rewards. We measured Foraging Efficiency (FE) (minimisation of searches to retrieve all rewards) and underlying cognitive functions: 1) Working Memory (WM) for locations searched in each trial, which prevents redundant searches; 2) Long-Term memory (LTM) for never rewarded locations that had to be avoided; 3) temporal Pattern Monitoring (PM), enabling searches of rewarded locations at trial outset. A comparison of mice tested in an open arena (Experiment 1) and humans tested with virtual reality (Experiment 2) revealed remarkably similar learning and LTM in the two species. By contrast, striking inter-species differences emerged in WM and PM, even with further incentive to improve FE, provided by expanding the search space (Experiment 3). The similarity of mice and humans in hippocampal functions, contrasting with inter-species differences in functions tapping frontal functions is discussed, together with the relevance of this pattern of results for evaluating strengths and weaknesses of the use of mice models of human cognition.
The structure of information provision anchors decision making strategies.

Qing Han, Casimir Ludwig and Susanne Quadflieg
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In decision problems with multiple cues of different validities, participants vary in the extent to which they weigh and integrate all the available information. The way information is presented influences the cognitive effort involved in the application of different decision strategies. We used a classic “stock market” paradigm to test the way decision strategies are influenced by (changes in) the structure of information provision. Participants were given binary cues that predicted whether the value of two stock options would increase or decrease. These cues varied in their predictive validity and were given either in a fixed order of descending validity or in a randomised order (in separate blocks). Initially, participants were most likely to adopt the optimal, weighted additive rule (WADD) strategy, regardless of the information structure. However, participants who were switched from a fixed to a random structure were likely to shift to a more heuristic decision strategy (equal weighting). We suggest these findings reflect a form of anchoring of cognitive effort: participants who can apply WADD with relatively little effort initially are unlikely to expend the additional effort needed to maintain this strategy when presented with less structured information.

Developmental changes to learning rates for novel perceptual priors.

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To make optimal decisions, adults combine prior and sensory information in a way predicted by Bayesian statistics. However, children’s abilities to do this are still developing to 9-10 years of age. It is possible that children are slower at learning to use new priors than adults. We measured the learning rates of priors, comparing the speed of learning to an ideal Bayesian learner. In an “octopus catching” task, adults and 6-11-year-old children judged the position of a “hidden” octopus by combining their prior expectations of where the octopus is likely to appear with a noisy sensory cue. Adults relied on prior information more as they performed more trials in the task. However, the speed at which adults learned was slower than the ideal observer. When the prior variance increased halfway through the task, adults also rapidly re-weighted prior information. In contrast, while the weight placed on prior information verged more towards optimal with increasing exposure, younger children still placed significantly more weight on the sensory information than is optimal by the end of the task. These findings suggest that learning to use and weight novel statistical regularities is a major contributor to difficulties with performing Bayesian computations in childhood.

The propensity interpretation of probability and diagnostic split in explaining away.

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Explaining away is a pattern of causal inference where independent causes compete to account for an effect and where causal judgements are made under uncertainty. Knowing that a patient has a cough (an effect), further learning that the patient has an asthma (cause 1) will decrease the probability that the patient has also a flu (cause 2) since asthma is sufficient to ‘explain away’ the cough. This is despite flu and asthma being marginally independent causes. Majority of studies have found that people ‘insufficiently’ explain away and have proposed several explanations (Fernbach & Rehder, 2013; Morris & Larrick, 1995; Rehder 2014; Rehder & Waldmann, 2017; Rottman & Hastie, 2016). We explore the novel possibility that the insufficiency may be driven by (i) some people interpreting probabilities as propensities and (ii) an erroneous diagnostic reasoning strategy whereby people split the whole probability space between the causes. We have empirically tested (i) and (ii). Results suggested an overall insufficiency in explaining away. However, in accordance with the propensity interpretation we have found that a large proportion of participants did not update their probability estimates from the priors. We have also found that a large proportion of participants erroneously split the probability space between the causes in diagnostic reasoning. Together, (i) and (ii) accounted for approximately 75% of all data.

The right temporoparietal junction is causally associated with embodied perspective taking.

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A prominent theory claims the right temporoparietal junction (rTPJ) is associated with embodied processes relevant to perspective taking. We used high-definition transcranial direct current stimulation (HD-tDCS) to provide evidence that the rTPJ is causally associated with embodied processes underpinning perspective taking. Eighty-eight young adults were stratified to receive either rTPJ or dorsomedial prefrontal (dmPFC) anodal HD-tDCS in a sham-controlled, double-blind, repeated-measures design. Perspective tracking (line-of-sight) and perspective taking (embodied rotation) were assessed using a visuo-spatial perspective taking (VPT) task that required understanding what another person could see or how they see it, respectively. Embodied processing was manipulated by positioning the participant in a manner congruent or incongruent with the orientation of an avatar on the screen. As perspective taking, but not perspective tracking, is influenced by bodily position, this allows the investigation of the specific causal role for the rTPJ in embodied processing. Crucially, anodal stimulation to the rTPJ increased the effect of bodily position during perspective taking, whereas no effects were identified during perspective tracking. Stimulation to the dmPFC had no effect on perspective tracking or taking. Therefore, the present study supports the theory that the rTPJ is causally involved in embodied perspective taking.

Social cognition and social well-being in old age.

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Communication is key for building social relationships and networks. In order to succeed in communication, one has to be able to account for others’ perspectives while engaging in fast moving social interactions. This ability is known as theory of mind (ToM)-use. We will present an individual differences study aimed to establish whether ToM-use changes in old age, and whether the success/failure of ToM-use can be attributed to changes in the underlying mechanisms. Specifically, this project examined the roles of working memory and the ability to manage complex linguistic input. Ninety-six young and older adults’ success rate in ToM-use was measured with a referential communication task (Keysar et al., 2003) in which a communicative partner varies the complexity of the sentences she delivers (similar to Wang et al., 2016). Participants’ working memory capacities were also measured to reveal its implication in ToM-use, as suggested by the ToM-use literature (Lin et al., 2010; Zhao et al., 2018). Finally, we examined the relationship between ToM-use and loneliness, which is a heightened problem among older adults. This study shed light on the real-world consequences of cognitive changes in old age.
Changes in Visual Perspective-Taking across the lifespan: A longitudinal perspective.

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The ability to consider other people’s perspectives plays a critical role in daily life, allowing successful interactions to occur. Prior research has shown that, although neurotypical adults can rapidly and accurately compute both their own and other people’s perspectives, they experience difficulties when another person’s viewpoint conflicts with their own. Using a longitudinal design, this study examined whether age predicts changes in visual perspective-taking (VPT) abilities, and how these changes relate to executive function capacities across the lifespan, in participants aged 10-86 years. Participants completed a Level-1 VPT task (Ferguson et al., 2017; Samson et al., 2010), and four executive function measures (inhibition, working memory, set-shifting, planning), at two time points ~2.5 years apart. Analysis examined how individual differences in executive function capacities may underlie the degree to which interference is experienced from the irrelevant perspective when perspectives are in conflict in the VPT task (i.e., egocentric and altercentric interference). At Time 1, inhibitory control predicted increased egocentric interference. Analyses examining longitudinal associations between VPT and executive function showed that Time 1 inhibitory control and working memory performance significantly predicted increased egocentric interference at Time 2. These results, and the impact of advancing age on these relationships, will be discussed.

A virtual reality study of spontaneous visuospatial perspective selection in adults.

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In a busy space, people encounter many other people with different viewpoints, but classic studies of perspective taking examine only one agent at a time. This study explores the issue of selectivity in visual perspective taking (VPT) when different people are available to interact with. We consider the hypothesis that humanisation impacts on VPT in three experiments using virtual reality methods. We designed a two-agent social mental rotation task, where participants sit in a virtual reality room with two agents sitting opposite by a table. On each trial, participants were required to identify whether a rotated letter was canonical or mirror-reversed, and the letter could be oriented towards one or the other agent. Experiment 1 focused on the contrast between a moving and a static agent; Experiment 2 contrasted an in-group agent with an outgroup agent. In both experiments, we show that participants are faster or more accurate to recognize letters which are oriented towards one or the other agent. Experiment 3 further investigated the neural mechanism behind this selection. Our results support the claim that humanisation alters the propensity to engage in VPT in rich social contexts.
Attribution of vision and knowledge in ‘spontaneous perspective taking’.

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Recent applications of Theory of Mind (ToM) have suggested that the computation of another individual’s visual perspective occurs both ‘rapidly’ and ‘spontaneously’. This concept has been examined using a variety of methods including the gaze cueing (i.e. Driver, et al. 1999), dot perspective (i.e. Samson et al. 2010), and ambiguous number paradigms (i.e., Surtees, Butterfill and Apperly 2012). The central results show that responses are facilitated when an agent in a display can see the critical stimuli that the participant must detect. In the presented work, we demonstrated this concept in which participants tended to judge an ambiguous number from the position of an agent. However, contrary to the previous work, we found this effect to occur regardless of the agent’s inability to see the number due to an occluding object (Experiment 1). Thus, we do not support the current perspective taking assumption. Consequently, we propose an alternative explanation to the perspective taking hypothesis that the agent acts as a reference point in which to orientate the image. We test this hypothesis in Experiments 2, 3, and 4, and show that non-human reference points can generate perspective-taking-like data. Therefore, our results do not support the ToM account of previous studies.

Visual perspective-taking: We don’t see it.

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The ability to understand another agent’s visual perspective has sometimes been attributed to the generation of a representation of another person’s vision (“I see what you see”). We presented adults with pictures of an agent looking at two lines, one of which was closer to the agent than the other and hence appeared longer from his/her visual perspective. In all six conditions in which participants were instructed to imagine how long the lines appeared to the agent we failed to find any evidence that the agent’s vision was successfully represented. Participants also failed to judge the closer line to look longer from their own perspective if they imagined themselves in the agent’s location, or when they were asked about how long the lines would appear in a photograph taken from the same location. Finally, in the two conditions when we showed participants a photo taken from the agent’s location a powerful effect emerged; the closest line was judged to appear longer than the furthest line. Overall, our data suggest that adults fail to imagine how things appear visually from non-egocentric vantage points, and rules out an “I see what you see” account.

Odour-colour binding effects in olfactory working memory.

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We examined intentional odour-colour binding effects in olfactory working memory and the extent to which participants can control and allocate executive resources to components of the task. Using a probed recall paradigm, participants were presented with sequences of 3-odorants each presented in different coloured cubes. At test, participants received one of the preceding odorants in a neutral coloured box and were required to state the colour of cube from each this odour was previously presented. In Experiment 1, we demonstrated that participants can perform this task above chance and that performance produced the canonical serial position function, exhibiting recency but not primacy. In Experiment 2, we showed that instructing participants to focus on remembering the first odour-colour pairing in each sequence resulted in the development of a primacy component. These findings are consistent with the working memory prioritisation effects reported for visual memory (Hu, Allen, Baddeley & Hitch, 2016). These experiments are the first to apply feature binding paradigms to olfaction and tentatively suggest functional similarities between visual and olfactory working memory.

Does variability in memory strength for studied items scale with encoding variability, or mean strength?

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The unequal variance signal detection (UVSD) model of recognition memory assumes that the variance of memory strength for studied items (σ₀) is greater than that of non-studied items. It has been proposed that this is caused by a large number of factors that affect memory strength at encoding, which add variable amounts of strength to a baseline amount. However, Spanton and Berry (2019) failed to find evidence for this ‘encoding variability hypothesis’ and instead found that estimates of σ₀ trended to be strongly positively correlated with estimates of mean memory strength (d) across participants, suggesting that σ₀ may simply scale with d. The present study tested the encoding variability and scaling accounts by creating conditions in which mean memory strength and encoding variability was either low or high in a 2 x 2 factorial design. In low strength conditions, d was significantly lower, as expected, with no main effect of encoding variability. Estimates of σ₀ were also lower in these conditions, and were unaffected by the encoding variability manipulation, despite the manipulation successfully impacting upon recognition ratings. This supports the idea that variance in memory strength for studied items scales with mean strength, rather than encoding variability.


The role of retrieval competition on the magnitude of the pretesting effect.

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Guessing an answer on an initial test, followed by corrective feedback, leads to better memory than an equivalent study period. This pretesting effect boosts subsequent recognition of targets, regardless of their associative relationship with the cue. However, for cued-recall, pretesting benefits cued-recall of related- but not unrelated-targets (Seabrooke et al., 2020). Here, we explore a potential mechanism for this differential effect: retrieval competition. Participants in two experiments studied lists that consisted of single facts from multiple categories (e.g. colours, musical genres), and multiple facts sharing a common category (e.g. foods), each of which was paired with a unique name (e.g. John’s favourite colour is ______). Participants either guessed the final word before seeing it (the pretesting condition) or studied the sentences intact. Experiment 1 used a final recognition test, and found a pretesting effect that did not vary with the category structure. Experiment 2 used a final cued recall test, and found that pretesting boosted recall for facts from unique categories, but not from shared categories. We conclude that pretesting boosts memory strength for all answers presented as feedback, but this benefit is masked in cued-recall whenever competition between potential alternative answers prevents access to the target.


Anodal transcranial direct current stimulation during a complex task can impair long term retention of memory.

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Transcranial direct current stimulation (tDCS) to the left dorsolateral prefrontal cortex (l-DLPFC) has been shown to improve performance on a multitude of cognitive tasks. These are however often simple, testing only one cognitive domain at a time. Therefore, the efficacy of brain stimulation for complex tasks has yet to be understood. Using a task designed to increase learning efficiency, this study investigates whether tDCS over the l-DLPFC, can modulate long-term memory retention. Participants took part in 6 training sessions in which active or sham tDCS was administered. A computer-based task was used, containing 48 flags from countries unknown to the participants. The aim was to say aloud the name of the countries at least 60 times in one-minute blocks. In two testing sessions, one day and one week after the final training session, participants were tested on all flags they had learnt. No difference in learning speed between active and sham tDCS was found. However, in the sham condition, long term memory retention was significantly greater in the second testing session, compared to the active condition. These results suggest that for complex task, anodal-tDCS is ineffective at improving learning speed and of detriment to long-term retention when employed during encoding.

Did I see it? Event-related potential (ERP) studies of prioritisation of recollection.

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People can bias their memory search to prioritise recollection of sought-for information, but the conditions under which this prioritisation can occur are unclear. Previous studies have suggested that it depends either on ease of target recollection, or on overlap of retrieval cues with targeted and non-targeted memory traces. We contrasted these hypotheses using electroencephalographic event-related potentials (ERPs) in two preregistered experiments (osf.io/j84z6; osf.io/pqn4z). Participants targeted studied object pictures or auditorily presented object names in two recognition memory exclusion blocks. In Experiment 1, test probes were visually presented object names (greater overlap with studied auditory words than pictures). In Experiment 2, probes were object line drawings (greater overlap with studied pictures than auditory words). When test cues strongly more overlapped with targets than non-targets, the left-parietal ERP old/new effect from 500–800 ms was reliable for targets but substantially reduced or absent for non-targets suggesting prioritisation of recollection. Since target recognition was better and faster for pictures than auditory words across both experiments, this ERP difference did not reflect easier target recollection. The data favour a cue strength account, in which the degree of diagnostic overlap between retrieval cues and the targeted versus competing memory traces determines whether recollection can be prioritised.

Aging-related changes to ERP markers of memory: Implications for forensic applications.

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This project investigated whether aging-related changes to EEG activity can impair the accuracy of forensic memory detection tests, which rely on EEG markers of memory as indications of criminal guilt. These tests are based on the logic that guilty suspects will hold incriminating knowledge about the crimes they have committed, and therefore should reveal their guilt with brain activity related to recognition when presented with information about their crimes. However, we predicted that the forensic memory detection tests might not be as accurate in older adults, because of the well-known changes to memory-related brain activity that occurs with aging. We investigated both standard old/new recognition and P300-based forensic memory detection in 30 younger (age < 30) and 30 older adults (age > 65). In line with predictions, memory related ERP effects were significantly reduced in both tasks in the older group, despite highly similar behavioural performance. This pattern was consistent across both group level and individual level statistical analyses. The results suggest that ERP-based forensic memory detection is less accurate in older populations, and also have broader implications for EEG research on aging and cognition.
Why are social interactions found quickly in visual search tasks?

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When asked to find a target dyad amongst non-interacting individuals, participants respond faster when the individuals in the target dyad are shown face-to-face, than when they are presented back-to-back. A growing body of literature interprets this in terms of specialized social interaction processing. However, human faces and bodies are salient directional cues that exert a strong influence on how observers distribute their attention. Here we report that a similar search advantage exists for ‘point-to-point’ and ‘point-to-face’ target arrangements constructed using arrows – a non-social directional cue. These findings indicate that the search advantage found for face-to-face dyads is a product of the directional cues present within arrangements, not the fact that they are processed as social interactions, per se. While the study of social interaction perception is an exciting new field, paradigms are still being refined. A multitude of published studies have already employed the face-to-face vs. back-to-back manipulation to isolate the neural, perceptual, and mnemonic processes recruited by interacting individuals. Our results highlight the influence of the directional cues present within these arrangements. It may prove significant (and problematic) that this manipulation not only alters the perception of social interaction, but also the way that participants attend to these displays.

Do individuals with elevated autistic traits camouflage more?

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It has been shown that autistic individuals with IQ in the normal range camouflage to improve their social experience. Although neurotypical individuals are considered to have intact mentalizing abilities, previous studies have revealed that this population report engaging in camouflaging behaviours across a variety of social situations. It is therefore possible that some neurotypical individuals may similarly perform better in mentalizing tasks, if they also employ cognitive camouflaging skills. This study attempts to investigate whether camouflaging extends to the neurotypical population at a cognitive level and whether this is related to self-reported individual differences. Sixty-eight neurotypical adults were recruited. Mentalizing abilities were measured by anticipatory looking during matched implicit and explicit tasks, using a multi-trial paradigm. Individual differences in autistic, camouflaging behavioural and mental health traits were assessed with questionnaires. We find a large discrepancy between performance on implicit and explicit tasks. Preliminary data analysis indicates that better performance in mentalizing tasks relates to self-reported individual differences. Neurotypical individuals may engage in camouflaging at both behavioural and cognitive levels, similar to previous reports of autistic individuals. Whether this camouflaging shares the same underlying mechanisms and motivations in NT and autistic individuals is discussed, as well as suggestions for future research.
Symposium – Inference of others’ minds.

Social brain networks in human and non-human primates.

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To compare socio-cognitive functions in primates, we first studied the structure of the circuits supporting those functions and often called the social brain. We identified using resting-state fMRI strong similarities between macaque and human social brains; even in the Temporo-Parietal Junction (TPJ) a region associated with the ability to attribute thoughts to others, a key process to support complex social decision-making and often thought to be uniquely human. We have identified the middle Superior Temporal Sulcus (mid-STS) in macaques as a potential homolog to the human TPJ. Our following projects aimed at testing in macaques the functions associated with mid-STS region in monkeys. To do so we notably used a set free-viewing fMRI task. Importantly videos used were constructed to test a prediction of the computation supported by the human TPJ. Again, we identified in the macaque mid-STS a coding of a social prediction error, a core computation at the basis of mentalising ability. Overall, this study shows that the mid-STS region in macaque shares some structural and functional properties with the human TPJ. This suggests that mentalising functions in humans stem from a social brain precursor that was present in the last common ancestor to human and monkeys.

Integration of multiple computations in social decision-making.

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To make appropriate decisions in social milieus, it is often necessary to make inferences about the internal states, traits and intentions of others. Recently researchers have begun to uncover neural mechanisms underlying human social decision-making by combining functional magnetic resonance neuroimaging (fMRI) with computational modeling of behavior. Accumulating evidence suggests that social decisions are made through integrating across multiple computations (e.g., self-oriented valuation, inference about others’ mind, and so on) implemented in distinct brain regions. Yet, much less is known about how these processes are integrated together again in the brain to guide behavior. Here, in this presentation, I will discuss the current state of knowledge about the integration process in the contexts of altruistic behavior and collective decision-making for consensus formation.

Social influences on performance learning in medial prefrontal cortex.

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Humans have to track the success of their actions for survival. However, in a social world, we not only have to monitor our own performance, but also the performance of other people. Here we show using functional magnetic resonance imaging, that dorsomedial prefrontal area 9, an area typically
involved in mentalizing, tracks the performance of others. In addition, it encodes information about the relationship between oneself and others (cooperation or competition), and also one’s own performance success. Importantly, the presence of self-related signals in area 9 was crucial for how area 9 monitored other’s performance. Knowledge about one’s own performance spread to how well participants judged others. This resulted in estimating other people as more similar to oneself in cooperative relationships, but more dissimilar to oneself in competitive relationships. In a second study we show that transcranial magnetic stimulation to area 9 enhances this bias, causing judgements of other’s performance to me even more merged with knowledge about one’s own. These findings highlight a key role for area 9 in monitoring other’s performance and suggest it operates in an implicit self-centred frame of reference.

Neural basis of generosity and selfishness.

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The question of whether humans are fundamentally selfish or generous has intrigued many disciplines from philosophy to economics for centuries. From small acts of kindness to major sacrifices, just how willing are humans to help others? Here I will describe how social computations are reflected in anatomically distinct portions of the medial prefrontal cortex, and the individual differences that may drive variability between people. I will show that in general, people care more about their own outcomes than others, but that there are substantial individual differences that are linked to specific brain areas. These findings could have important implications for understanding everyday social decision-making and its disruption in disorders of social behaviour such as psychopathy and autism.

End of Symposium

Effect of sleep on memory for binding different types of visual information.

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Visual long-term memory has a large and detailed storage capacity for individual scenes, objects, and actions. However, memory for combinations of actions and scenes is considerably poorer, suggesting difficulty in binding this information together. Sleep can enhance declarative memory of information, but whether sleep can also boost memory for binding information and whether the effect is general across different types of information is not yet known. Experiments 1 to 3 tested effects of sleep on binding actions and scenes, and Experiments 4 and 5 tested binding of objects and scenes. Participants viewed composites and were tested 12-hours later after a delay consisting of sleep (9pm-9am) or wake (9am-9pm), on an alternative forced choice recognition task. For action-scene composites, memory was relatively poor with no significant effect of sleep, with recognition
close to chance level. For object-scene composites sleep did improve memory. Sleep can promote binding in memory, depending on the type of information to be combined.

Language influences on event memory are mediated by consolidation across sleep.

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Can a commentator’s descriptions of concurrent events modulate how observers later recollect the events? Would recollection change after observers slept? Two experiments addressed these questions and specifically asked whether linguistic descriptions of visual events may shape event recollection before or after sleep. Participants studied 21 cartoon-like animations that were described by phrases implying either slow or fast motion (e.g. a Chinese lantern rising, or a firework being launched). We then tested participants’ memories for the events after 12 hours including sleep (overnight) or wake (same day). In the test session, they replayed the animations in their minds, and verbally recalled the events. We found that mental replays were not affected by the type of description after 12 hours awake. In contrast, replays were longer for slow than fast descriptions after a sleep interval, suggesting that event memories were distorted during sleep towards the features highlighted by the language. In addition, verbal recall was longer after sleep and tended to include combined visual and linguistic information. A second experiment replicated the key results. In combination, these findings suggest that language modulates event memory through the integration of episodic details and verbal concepts operating during sleep-dependent memory consolidation.

Contextual diversity and its facilitative role in language acquisition.

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Recent experimental evidence has shown that contextual diversity (number of different contexts in which a word appears) might be a better predictor than word-frequency (the total number of occurrences of a word) in word recognition tasks (e.g., Perea, Soares, & Comesaña, 2013) and during sentence reading (e.g., Plummer, Perea, & Rayner, 2014). However, the nature of contextual diversity and its relationship with other variables needs more research. I will present three studies that we have carried out to analyse the role of contextual diversity in incidental vocabulary learning. Our studies were performed in a natural environment-school settings in their regular schedule-and with both developing and developed readers. In all of them, the procedure consisted of a 3-day learning phase, and a subsequent evaluation with memory and orthographic-semantic integration tasks. We have examined whether the effect of contextual diversity is modulated by the students’ reading abilities. Also, we explored the nature of the effect by manipulating perceptual aspects, rather than semantic ones. Our results showed that contextual diversity has a facilitative effect on the acquisition of new words in a natural environment. Thus, suggesting the need to take this factor into account in the development of new learning material.
Domain generality and specificity of statistical learning: the case of orthographic regularities.

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Individuals become sensitive to frequently recurring patterns in the environment. This sensitivity to statistical regularities has been hypothesized to influence visual word recognition. The current series of experiments test whether sensitivity to orthographic regularities derive from a general domain statistical learning mechanism, or it has been specifically developed for reading only. As a testbed we focused on ngram frequency. We have implemented a statistical learning paradigm where stimuli are pseudofont strings made of recurrent pairs of characters. Participants have to memorize the false font strings and subsequently disentangle old from new stimuli. Our results show that participants made decisions about novel stimuli based on the bigram frequency of the learned pseudofont strings, suggesting sensitivity to the frequency of letter co-occurrences in the novel script. In a non-linguistic version of this paradigm, we explored the boundaries of this phenomenon: what type of visual object, if any, fails n-gram based statistical learning? Stimuli became progressively less word-like (e.g., Y-shaped objects and gabor patches) and we show that sensitivity to co-occurrence statistics was present with all stimulus types suggesting that word recognition operates like any other visual mechanism able to capture statistical regularities in the visual environment.

Children’s representational flexibility when changing the meaning of an expression or a drawing.

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Referential pacts create expectations that the same partner will use the same expression for the same referent in communication. To date, studies have explored whether children expect the same individual to use the same expression. We tested whether, given the same individual and expression, children expect the same referent. We tested this with both language and drawings in a between participant’s design with 97 three- to five-year-old children. One partner established the initial meaning by referring to a target using an ambiguous expression (‘the round one’ for a ball) or by clearly drawing a target (a circle as a ball). Either the same partner or a new partner used the same symbol (‘the round one’ or the circle) to request an object from an array that included either the original object (a ball) or a new, similarly shaped object (a plate). Children showed no difference in reaction time when they chose referents with the same or a new partner - showed no partner sensitivity. The results demonstrate that children flexibly accept two different referents for the same symbol. Importantly, they also suggest that relationships in referential pacts between the person, the symbol, and the meaning, might not have equal weights.
Taking turns in time: Disassociating cue use in turn taking using cross-validation.

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In conversation, turns follow each other with minimal gaps. To achieve this, speakers must launch their utterances shortly before the predicted end of the partner’s turn. End-of-turn prediction is often assumed to involve representing the partner’s speech plan as if it were one’s own. Therefore, coordination should be optimal when the upcoming speaker knows precisely what the partner will say. In a series of experiments, we tested this hypothesis. Participants were tasked with coordinating their speech onset precisely with the offset of a confederate’s utterance. The object the confederate was naming was either visible to the participant or occluded from view. As predicted, occlusion hampered coordination, but the effect was small. Using machine-learning techniques we found strong evidence for a separation of timing (speech onset and offset) from content cues. This suggests that to coordinate their turns, speakers can rely on phonetic cues in the partner’s speech, rather than predicting utterance content.
Face memory updating enhanced following retrieval vs re-study.

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Episodic memories are susceptible to updating, especially when actively reconstructed during retrieval compared to when information is re-studied (Roediger & Butler, 2011), even if the strength of memories between conditions is matched (Bridge & Voss, 2014), demonstrated using associative memories. Less research has examined the consequences of retrieval vs. re-study on the updating of item memories. The present research addressed this issue using face memories across three experiments. In all experiments, participants learnt several face targets before undergoing memory ‘refresh’, where targets were presented with distractor foil faces. ‘Active’ retrieval required participants to select faces they recognised from learning. ‘Passive’ re-study involved participants being told which faces to encode for a subsequent test. Finally, a ‘selection’ task required participants to select which faces they thought were perceptually distinctive. A ‘final recognition test’ identical to the ‘active’ refresh task was then completed, with memory updating measured as the proportion of final test trials where participants selected the same distractor face between refresh and test. Results demonstrated that ‘final test bias’ was highest following active refresh, with no difference between passive and select conditions. These findings suggest that active retrieval attempts of face memories enhance the updating of these memories.


Reactivation and updating of face memories.

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Episodic memory retrieval not only involves reactivation of dormant memory traces, but can also elicit encoding of information in the current environment into memory, which can update memory and bias future retrieval attempts. Prior research has focused on how recollection can update complex, relational event memories, but less is known regarding whether simple item memories, such as memories for human faces, can be updated during recognition attempts. We investigated recognition-induced updating of face memories, using behavioural and EEG measures. In all experiments, participants first encoded computer generated face images. In a subsequent face recognition test, each trial presented a previously seen target face with other distractor faces that varied in similarity to the target, and participants were asked to select the target. This test was
followed by a second test identical to the first. Across experiments, we found that high confidence in initial recognition judgements predicted that participants would select a similar face in the second test regardless of accuracy, showing memory biases due to updating. ERPs and EEG oscillations revealed the involvement of multiple neural processes during retrieval and updating, which indicated that repeated recognition attempts induced both encoding of errors and reactivation-related strengthening of already encoded memories.

**Ecological validity in infant eye-tracking research: Facial expressions, a worked example.**

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Measuring looking behaviour is a fundamental technique for investigating preverbal populations. However, while infant eye-tracking has witnessed substantial development, study methodologies and analysis tools have not advanced comparably. We will introduce several tools for handling the rich data generated in paradigms that present infants with dynamic and naturalistic social stimuli, including gaze-contingent eye-tracking, dynamic areas of interest and statistical heatmaps. The benefits of collecting convergent measures (e.g. pupil size) alongside eye movements will also be discussed. To do this we will present data from an eye-tracking study of facial expression scanning and pupillary responses in six-, nine- and twelve-month-old infants (N = 149). Through this worked example we firstly show that infants show differential scanning and pupillary responses for dynamic and static facial expressions, supporting the use of more naturalistic, dynamic stimuli in future research. Secondly, by using these methods we find that although infants from six months show ‘bespoke’ and diagnostic scanning of all six basic dynamic facial expressions, evoked pupillary responses suggest infants show a clear dilatory response to happy expressions only, highlighting the distinction between infants’ perceptual and conceptual processing of emotional facial expressions.

**Interactive gaze-contingent eye-tracking tasks reveal reduced social responsiveness in infant siblings.**

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Studies with infant siblings of children with Autism Spectrum Disorder (ASD) suggest that ASD symptoms emerge between 12 and 24 months (Bussu et al., 2018). Yet, a reliable first-year marker remains elusive. In this talk, we propose that the fundamentally social nature of ASD requires us to develop methods that are sufficiently socially demanding and realistically interactive in order to reliably identify early manifestations. We present two studies using interactive gaze-contingent face stimuli, in which infants could trigger socio-communicative responses from faces by fixating pre-specified regions of the face. We collected eye-tracking data and video-recorded behavioural response data from typically developing infants and infant siblings (6/9/12mo). In study 1 (N = 162), infants could elicit socially engaging and socially disengaging responses by fixating the eye or mouth area. In study 2 (N = 153), infants induced emotionally expressive responses by engaging in
eye contact. Our findings demonstrate reduced social responsiveness from infant siblings at the group (F(1, 147) = 4.10, p = .042, ηp² = .028) and individual level (Fischer’s Exact, p = .032). Whereas eye-movements provide no evidence of deviances, behavioural response data show significant aberrancies in reciprocity. We discuss our results in relation to subsequent infant sibling development.


**Early visual regions in the human brain contain information about occluded portions of human faces.**

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Visual occlusion is a particularly challenging problem for both the human visual system and for state of the art deep learning networks. In human vision, neurons in sensory brain areas are subject to multiple sources of influence, spanning information coming from the sensory input, local processing and cortical feedback. Here we investigated the role of early visual and higher level brain regions in facial expression processing under visual occlusion, using a novel paradigm that allows the dissociation of bottom-up from recurrent influences. We presented observers with occluded face stimuli revealing different portions of the face in different conditions (e.g. eye region, or face with eyes hidden) and investigated the similarity of the brain responses to non-overlapping visual inputs. Participants fixated and performed either an expression or gender categorization task on the same stimulus set. MVPA decoding revealed that even in primary visual cortex, similar responses could be observed to non-overlapping face stimuli (e.g. eye region to face minus eye region). Our results suggest that contextual influences, likely carried via cortical feedback, provide a surprisingly rich amount of information to early visual areas, under conditions of visual occlusion.

**Similarity and accuracy in unfamiliar face matching: The match-mismatch paradox.**

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The matching of two unfamiliar face images to decide if one person is depicted (an identity match) or two (an identity mismatch) has been studied extensively in Cognitive Psychology in recent years. Despite this research, little progress has been made towards understanding the strategies that observers use to accomplish this task. Considering that unfamiliar-face matching is constrained by the visual information within stimuli, perceptual similarity should play a primary role in how observers attempt this process, but the nature of this similarity-accuracy relationship is unclear. Across a series of experiments, the current study investigated the association between overall facial similarity and accuracy at the level of individual items, how the similarity of individual facial features characterises identity matches and mismatches, and explored the relationship between accuracy and observers’ assessment of the likelihood that two face images depicted the same person.
or different people. We suggest that together, these experiments provide evidence that observers rely on two distinct strategies when comparing unfamiliar faces to make identity match and mismatch decisions, consisting of the summing and weighing of visual information in stimuli.

Person perception in virtual worlds: The case of facial identity matching at airports.

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Person identification is a critical security task at airports and is commonly performed through comparison of a traveller’s face with photo-ID. This task has been studied extensively in the laboratory with highly-controlled perceptual tasks based on the comparison of pairs of face photographs. Whereas this approach has been successful for isolating a range of cognitive processes, it is limited in capturing how this task operates in complex environments. In turn, real world environments rarely afford the access and control required for rigorous scientific experimentation in this field. In this talk, I will outline our development of a virtual reality airport to study person identification in more complex environments. I will report a series of experiments in which face matching performance in VR correlates with established laboratory tasks (GFMT, KFMT), and then demonstrate with a second series of experiments how unusual body language biases face matching in VR. Finally, I will briefly illustrate some ongoing work to refine this experimental approach. This will be of wider interest to researcher studying person perception, social and real-world interaction.

Reading with a central vision loss: the case for scrolling text.

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Background: Macular degeneration results in a loss of central vision, with profound consequences for the individuals’ ability to read. People with a central vision loss may, however, be able to read by adopting an ‘eccentric viewing (EV) strategy’, by shifting their gaze away from the text, to make use of their remaining peripheral vision. Reading in this way is difficult as it relies on a highly atypical pattern of eye movement behaviour. Dynamic text formats, such as horizontally scrolling and rapid serial visual presentation (or RSVP) have been recommended as methods to facilitate reading when using eccentric viewing, as they can reduce the demands placed on the eye movement system. Present study: Here, we compare reading performance (comprehension and accuracy) with a central vision loss with static and dynamic text formats. Reading performance (comprehension and accuracy) was significantly better with single horizontally-scrolling lines and poorest with RSVP. Although participants showed better adherence to maintaining an EV position during reading with RSVP, this did not show improvements in their comprehension. Conclusion: The findings highlights the potential of scrolling text to enhance reading in people with a central vision loss.
The role of context in the processing of semantic ambiguities: Eye-tracking evidence from younger and older adults.

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Doubly quantified sentences, such as, “Every kid climbed a tree” are ambiguous regarding whether there is one tree or multiple trees. Previous research has shown that grammatical factors (e.g., the order in which the quantifiers appear) do not affect the general preference for a singular entity, evidenced in shorter reading times for “The tree was” than “The trees were” in a subsequent sentence. However, the influence of contextual information, especially in older adulthood, has received little attention. Forty-eight younger (18-30) and 48 older adults (65+) had their eye movements monitored while they read sentences in which a contextual bias for a singular entity (e.g., “Every student in the class is listed on a register.”) or plural entities (e.g. “Every school pupil in the country has their attendance marked on a register.”) was established. A singular (“This register…”) or plural continuation (“These registers…”) then followed. Results showed that unlike grammatical factors, contextual factors do affect on-line processing, with longer reading times for continuations which were incongruent with the number of entities implied by the context. Furthermore, older adults relied on contextual information more so than their younger counterparts, suggesting age differences in the use of contextual information during on-line sentence processing.

Knowledge is a river and education is like a stairway: An eye movement study on how L2 speakers process metaphors and similes.

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At present, very little is known about the processes underlying L2 speakers’ understanding of written metaphors and similes. This information would add to current theories on figurative language comprehension, which as of yet do not take into account reader-related factors in comprehending figurative expressions like metaphors. In the present study, we used eye tracking to examine how native Finnish speakers (N=63) read written English nominal metaphors (“education is a stairway”) and similes (“education is like a stairway”) (Ashby, Roncero, Almeida, & Agaus, 2018). Identical words were used in the topic–vehicle pair (education–stairway) in both conditions. After reading, participants evaluated familiarity of each topic-vehicle pair as metaphors. Participants’ English proficiency was measured using the Bilingual-language Profile Questionnaire and the Lexical Test for Advanced Learners of English. The results showed that readers were more likely to regress within metaphors than within similes, indicating that processing of metaphors requires more effort than processing of similes. The familiarity of a metaphor and English language skills modulated this effect. The results are discussed in the light of current theories.
Predicting the unpredicted: No relationship between "the"-skipping and response inhibition.

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Skilled readers are likely to skip short, high-frequency words such as “the” in English. When deciding to skip such words, readers fail to take into account the preceding sentence context and will frequently skip an upcoming word that looks like “the” even if it is incompatible with the context, i.e. infelicitous (Angele & Rayner, 2013). It is not clear if (1) this failure to identify a potential problem with a sentence stems from an inability to access the information about the sentence context at the point of making the skipping decision or (2) a problem in selecting the appropriate information in order to make the decision. The latter case resembles response inhibition tests where participants need to make a decision in the presence of incongruent stimuli. If skipping and response inhibition depend on the same cognitive processes, we should find a relationship between a participant’s performance on response inhibition tests and the rate at which they skip words with an infelicitous gaze-contingent preview. We report an experiment testing this hypothesis in which there was no evidence for a relationship between the congruency effect in response inhibition tests and the rate of skipping infelicitous previews in a sentence reading task.

Parafocal pre-processing of phonology in English children.

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We examined parafoveal pre-processing of phonology during silent sentence reading in children aged 8-9 years. Skilled adult readers pre-process phonology from N+1 during fixations on N (e.g., Chace, Rayner, & Well, 2005; Jouravlev & Jared, 2018; Pollatsek, Lesch, Morris, & Rayner, 1992), but this has not previously been examined in typically developing children under the age of 18. Participants’ eye movements were recorded as they read sentences that were presented using the boundary paradigm (Rayner, 1975), with target word previews that were correctly spelled words (e.g., cheese), pseudohomophones (e.g., cheeze), or spelling controls (e.g., cheene). The orthographic similarity of previews was also manipulated to be either similar (e.g., cheese/cheeze/cheene) or dissimilar (e.g., queen/kween/treen) to the correct target word. The results showed that orthographic similarity facilitated both adults’ and children’s pre-processing. More importantly, children pre-processed phonology very early in their lexical processing. The children demonstrated a pseudohomophone advantage from preview that was broadly similar to that displayed by the adults, although orthographic similarity of the pseudohomophone previews seemed to play a more important role in early processing for the children than the adults. Overall, these results provide strong evidence for phonological recoding during silent reading in 8-9 year-old children.


**Effects of reading goals on parafoveal processing during reading.**

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Three experiments employed gaze-contingent moving window paradigms (McConkie & Rayner, 1975) to assess how reading goals (reading vs. skimming) modulate parafoveal processing. In Experiments 1 and 2, single sentences were presented with either no mask, all words masked except for the fixated word, the fixated word and one word to the right, or the fixated word and two words to the right. Outside of the moving window, words were masked with visually similar letters (orthographic mask). In Experiment 1, sentences were simple and contained familiar concepts. In Experiment 2, sentences contained unfamiliar concepts. The results demonstrated reduced disruption resulting from the orthographic mask during first-pass when skimming compared with reading. Parafoveal preview for fixated words is likely to be limited during skimming as longer saccades result in more eccentric (visually degraded) previews. Building on this, Experiment 3 investigates whether the pattern of results shown in Experiments 1 and 2 for single sentences also holds during reading of paragraphs. In this experiment, medical students read paragraphs describing a patient case history while a circular moving window was presented around the point of fixation. The implications for how eye movement control mechanisms may be modulated by reading goals will be discussed.

**Relating foveal and parafoveal processing efficiency with eye-movement measures of text reading.**

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We examined the relationship between foveal and parafoveal word processing efficiency and sentence- and word-level eye-movement parameters in reading. Foveal processing efficiency was assessed with performance accuracy in the lexical decision and naming task, where 6-8-letter words and pseudowords were presented backward-masked for identification using different exposure times (20-60ms). Parafoveal processing efficiency was assessed by presenting 5-letter words and pseudowords for 120 ms to the right and left of the fixation point (1.33-2.24 degrees of visual angle). Mean overall performance measures were calculated for both foveal and parafoveal performance. Participants read for comprehension 8 popular science texts on different topics. Sentence-based LMM–analyses revealed that foveal processing efficiency predicts first-pass forward fixation and reinspection times, while parafoveal processing efficiency predicts the number of first-pass forward fixations. Thus, foveal word recognition efficiency predicts the speed of reading, while the width of the perceptual span measured by the parafoveal task is related to the number of progressive fixations.
made during reading. Word-based analyses revealed that foveal processing efficiency predicted gaze durations, number of first-pass fixations and skipping probability, while parafoveal processing efficiency predicted skipping probability and number of first-pass fixations. In conclusion, word recognition efficiency reliably predicts online text processing.
Effects of human-computer interaction and time pressure on face matching.

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In airports, eGates equipped with face recognition technology are utilised to facilitate face identification. This process is semi-automated; whereby human operators monitor eGates to safeguard against identification errors. Recent work suggests that human observers are poor at catching such errors. The current study extends this work by examining how this human-computer interaction is influenced by other real-world factors such as time pressure, with which eGate operators must contend. Specifically, we investigated the extent to which time pressure impacted observers’ ability to match pairs of unfamiliar faces that were labelled onscreen as the same person, different people, or that were unresolved. Across two experiments, response accuracy was influenced by the trial labels and was also impacted by time pressure, but these factors exerted independent effects on performance. These findings suggest that at passport control, human-computer interaction is not compromised by time pressure.

Forensic facial examiners’ eye movements during face matching: Qualitative or quantitative differences between experts and controls?

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The error-prone nature of unfamiliar face matching is well-documented, but forensic facial examiners demonstrate an advantage in this task over non-expert observers. In this study, we eye-tracked facial examiners from the police and control groups of fingerprint analysts and lay observers to investigate the basis of this accuracy advantage. In an identity matching task, which required same- versus different-identity decisions for pairs of faces, facial examiners outperformed both control groups. Analysis of eye movement data showed that facial examiners sampled more facial features and viewed faces for longer than the control groups during face matching. In spite of these differences, facial examiners employed similar viewing strategies to the control groups. For example, all three groups of observers demonstrated a left visual field bias during face viewing and allocated a comparable percentage of fixations to central facial features. In addition, the percentage of fixations to facial features was highly correlated between groups, again pointing to shared viewing strategies irrespective of expertise. These results indicate that facial examiners expertise is driven by quantitative rather than qualitative differences in viewing strategies.

Moving on or deciding to let go? A pathway exploring the effects of emotional and decisional forgiveness on intentional forgetting.

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We report three empirical studies that represent the first systematic attempt to explore the relationship between emotional and decisional forgiveness, and intentional forgetting. On this basis, we propose a model that provides a credible explanation for the relationship between forgiveness and forgetting. Specifically, we propose that engaging in emotional forgiveness promotes the psychological distancing of an offence - such that victims construe the offence at a higher and more abstract level. This high-level construal, in turn, promotes larger intentional forgetting effects which, in turn, promote increased emotional forgiveness. Our studies found that participants in an emotional forgiveness manipulation reported increased psychological distance and recalled more high-level construals than did participants in either a decisional or no-forgiveness manipulation (Study 1). Using the list-method directed forgetting (LMDF) paradigm, we found that participants in an emotional forgiveness manipulation showed larger forgetting effects for both offence-relevant and -irrelevant information using both hypothetical (Study 2) and real-life (Study 3) moral transgressions, compared to participants in either decisional or no-forgiveness manipulations. The potential implications of these findings for coping with unpleasant episodes in our lives are considered.

Combination of transcranial direct current stimulation and physical exercise impairs memory.

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Physical exercise has previously been shown to be beneficial for long-term retention when administered post encoding. Similarly, transcranial direct current stimulation (tDCS) has been shown to facilitate superior encoding, thus improving subsequent long-term retention. To date, no study has compared the effect of employing both methods during one intervention. Here, over two studies, we first highlighted enhancements of long-term retention for both techniques, when administered independently of one another, compared to a control group. It was then hypothesised that by combining these methods, improvements of long-term retention over and above independent effects would be seen. In the second study, we employed tDCS during encoding and in the same intervention a protocol of physical exercise during a retention interval. Our results ran contrary to the hypothesis, in that, instead of improvement, no effect was shown compared to a control group and a significant impairment was shown compared to physical exercise alone. Whilst further research is required to make formal speculations as to why these results were achieved, one can assume that the combination of both methods somehow interferes with either the consolidation or retrieval process. This research provides behavioural evidence highlighting the complex nature of learning and long-term memory retention.

Both schema-congruency and schema-incongruency improve memory performance and recollection in a virtual reality experiment.

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The literature on schema and memory suggests that both schema-congruency and schema-incongruency can benefit memory performance. A recent study (Greve et al, 2019) confirmed this, by finding that memory was as a U-shaped function of congruency, with best memory for highly congruent (expected) or highly incongruent (unexpected) events. However, this paradigm used simple, experimentally-acquired rules, which may not generalise to richer, everyday schemas, such as what objects to expect in a familiar environment. To test for this generalisation, we ran three immersive virtual reality experiments, in which participants explored a virtual kitchen containing various everyday objects. The expectancy each object’s location varied parametrically, based on subjective ratings. As predicted (see https://osf.io/4sw2t/), we replicated the U-shaped function of object-location memory in both recall and recognition tests, and even when the recognition foils were equally expected. Furthermore, according to the SLIMM model (van Kesteren et al., 2012), the two ends of the U-shape are supported by different memory systems so should be dissociable: in particular, memory for unexpected information should be associated with recollection. Contrary to this prediction however, both ends of the U-shape were associated with recollection (as inferred from Remember/Know judgments), while familiarity showed no evidence of sensitivity to expectancy.

**Knowing what you need to know in advance: The neural processes underpinning flexible semantic retrieval of thematic and taxonomic relations.**

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Flexible retrieval is a key capacity within semantic cognition, which allows us to focus on knowledge relevant to our goals or the context. We used fMRI to examine how we tailor semantic retrieval to suit the task demands when the type of conceptual relationship was known in advance, and when it was unknown; we particularly asked whether task knowledge modulates semantic responses within the heteromodal “hub” in anterior temporal lobes (ATL) or alternatively unimodal “spoke” regions, which are thought to interact to compute concepts. Left inferior frontal gyrus (LIFG) showed greater activation when the relationship was known in advance. An overlapping region showed a stronger response to distant relationship, suggesting this structure supports both top-down and bottom-up control. Multivariate pattern analysis further revealed that the response in LIFG reflects goal information related to different conceptual relationships. ATL and hippocampus were sensitive to conceptual relationships, yet they showed no effect of task knowledge. Instead, top-down control modulated the response in visual cortex: when the goal was unknown, there was greater deactivation to the first word, and greater activation to the second word. We conclude that top-down control of semantic retrieval is primarily achieved through the gating of task-relevant ‘spoke’ regions.

**A gradient from long-term memory to novel cognition: graded transitions through default mode and executive cortex.**

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Human cognition is flexible, ranging from highly familiar situations to novel scenarios. Traditionally, these aspects of cognition are ascribed to dichotomous neural systems supported by default mode (DMN) and multiple-demand (MDN) networks. In reality, however, most situations are neither completely familiar, nor entirely novel, highlighting the need to understand how cognition is constrained in a graded fashion. A contemporary account proposes a connectivity gradient along the cortical surface that captures the transition from heteromodal DMN, through MDN regions, to unimodal regions. We asked whether brain responses changed linearly along the connectivity gradient as we parametrically varied the match between task demands and global semantic similarity within a feature matching task. At one end of this ‘task gradient’, probe and target words shared both goal-relevant and irrelevant features, such that task requirements were well-aligned with long-term memory; at the other end, items only shared the goal-relevant feature. We found the brain’s response to the semantic task varied systematically with the task gradient along the connectivity gradient. The peak response for semantic control in previous studies fell midway between DMN and MDN, showing these graded functional transitions capture the layout of networks involved in semantic processing.

The Same or Different? Capacity limitations in visual imagery versus visual memory of simple structured objects.

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Visual mental imagery and visual memory appear to utilise similar brain networks. However, limited research has investigated how similar the systems are in terms of capacity limits. Capacity limits of visual working memory (VWM) and visual short-term memory (VSTM) have been the focus of considerable research, but to our knowledge none has attempted to ascertain the number of objects that can be simultaneously imagined. This study aimed to provide estimates of imagery capacity and explore how this relates to the capacity of visual memory. Participants completed three tasks that explored imagination, VWM and VSTM, respectively. Set size was manipulated similarly in each task enabling modelling of imagination and visual memory capacity. Capacity estimates were similar in the two visual memory tasks and higher than that of imagination. The relations between these tasks are discussed alongside the theoretical implications about the mechanisms underpinning imagery and visual memory.

A pupillometry investigation of the effects of structure on working memory in children.

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We report the results of an experiment investigating the relationship between pupil size, performance and effects of structure in working memory. Eighteen participants aged between 10-13 years of age were tested in a spatial and a verbal working memory task. Their pupil dilation was measured during the encoding and the retention of spatial and verbal sequences, which could be structured or unstructured. In the spatial span, participants observed Gabor icons, arranged as a square matrix, changing orientation according to sequence that they had to repeat by mouse-clicking the icons in the appropriate serial order. Structured sequences followed a linear organisation whereas unstructured sequences violated it. In the digit span, participants repeated back sequences of auditorily presented digits. Structured sequences followed a regular pattern of increasing/decreasing numbers. Unstructured sequences did not. Results revealed that structured sequences were easier to report for both spatial and verbal material. Pupil size did vary for structured and unstructured sequences in the spatial span task only. A larger pupil size was observed during the encoding of structured sequences at encoding. This results are discussed in relation to the mental effort required to attend to structure during the encoding of spatial sequences.

Representing and evaluating competing causal explanations.

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Research in philosophy and cognitive science has argued for a number of ‘virtues’ that lay people seem to favour in explanations, including simplicity and coherence. Whether these virtues are also central to evaluating competing explanations in more applied domains such as the criminal justice system, however, is still unexplored. In a series of experiments, we examine how people evaluate competing explanations of evidence in a criminal case (a ‘simple’ common cause explanation vs. a ‘complex’ independent causes explanation) when these are presented and evaluated either one at a time, or simultaneously for each individual item of evidence. In addition, we present findings showing that people naturally represent these competing explanations differently (when asked to draw causal models) depending on the order of presentation of the information and that these differential representations of the same information (e.g. integrated model vs. two separate models) in turn affects how the explanations are evaluated. Finally, we present findings showing that people naturally seek mechanistic details underlying cause-effect relations, and that including this information influences how complex explanations are understood and evaluated. We discuss findings in light of the literature on the cognitive basis of explanatory preferences and normative frameworks of evaluating competing explanations.

The effect of background music on attentional state and task-performance in sustained attention.

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Although background music listening during tasks that require sustained attention is widespread, the literature is inconclusive about its effects. The present study investigated the effect of background music on performance of a sustained-attention task and on the prevalence of different attentional states, founded on the non-linear relationship between arousal and performance. Forty students completed a variation of the Psychomotor Vigilance Task - that has long been used to measure
sustained attention - in silence and with their preferred music in the background. We collected subjective reports of attentional state, specifically mind-wandering, task-focus and external-distraction states, as well as reaction time (RT) measures of performance. Results indicated that background music increased the proportion of task-focus states and proportionally decreased mind-wandering states but did not affect external-distraction states. Task-focus states were linked to shorter RTs than mind-wandering or external distraction states; nonetheless, background music did not affect overall RT. Moreover, analysis of the music stimuli did not show any significant effects of tempo, lyrics, or genre. These findings show for the first time that preferred background music can increase task-focused attentional states on a low-demanding sustained attention task, and are compatible with arousal mediating the link between background music and task-performance.

Inducing the mindful eye: Attentional and psychophysiological components of mindfulness training.

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The locus coeruleus-norepinephrine (LC-NE) system plays an integral role in the regulation of explorative (tonic mode) and exploitative (phasic mode) behaviours during tasks requiring sustained attention. Pupillary dilation (PD) reliably differentiates between these states, with tonic activity associated with larger baseline / smaller task-evoked PD, and phasic activity associated with smaller baseline / larger task-evoked PD. Mindfulness can be conceptualised as a tonic state, with both ‘inward’ (toward mental states) and ‘outward’ (toward sensory stimuli) tonic modes characterising the meditative process. Increased trait mindfulness and participation in mindfulness induction have been shown to improve performance in tasks requiring sustained tonic attention, but PD has yet to be utilised in intervention studies. We combined the use of PD and attention tasks to explore psychophysiological mechanisms underlying attentional performance improvements observed in mindfulness groups. We developed a novel mindfulness-based intervention aimed at students, and tested a variety of behavioural and psychophysiological outcomes. Results from the first wave of participants suggests improved attentional performance (RTs, error-rate) and increased tonic markers of LC-NE activity (PD) as a result of mindfulness participation. Improvements in sub-clinical self-report measures were also observed. Taken together, we shed light on the psychophysiological mechanisms associated with the cognitive, behavioural and clinical improvements of mindfulness intervention.

Interhemispheric communication during haptic self-perception.

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When people move their finger across a planar surface, a slight resistance that decreases movement velocity is illusorily perceived as a bump on the surface. If the surface touched is one’s own skin, a bump should also increase the pressure from the finger to the skin surface. Participants made two movements of the right hand while holding a haptic force-control robot. Resistances were added to both, and participants judged “which bump felt bigger; first or second?”. The movements were
transferred to a second, slave robot, delivering task-irrelevant stroking touch to the left forearm. The slave robot briefly increased or decreased tactile pressure in synchrony with right hand velocity decrease, consistent with encountering bumps, or holes respectively (blocked factor), during self-touch. We investigated whether left tactile events changes would bias judgement of the bump size perceived with the right hand. Left tactile pressure increases and decreases both increased bump size perceived by the right hand. Tactile information was thus transferred inter-hemispherically, but the sign of tactile information was not respected. In experiment 2, randomizing (rather than blocking) tactile pressure increases/decreases abolished these biases. Inter-hemispheric transfer during self-touch is based on consistent models of synchronized events, but omits geometric object information.

Do you like me? Women’s self-objectification and need for approval.

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Existing research on self-objectification (SO) has mostly uncovered its negative impacts on women in intrapersonal contexts, such as their mental health, affective change, cognitive ability, etc. However, little research has examined how SO shapes women’s behaviours and self-presentation in interpersonal contexts. The present research aims to address this gap by examining the impact of SO on approval motivation in terms of possible self-presentation online. Study 1 (N = 103) found that trait SO of women was positively correlated with the need for approval. Study 2 (N = 94) replicated the effect of study 1 by adding a behavioural measure of approval motivation (examining to what extent were participants willing to modify their social media profile pictures with a filter). Results showed that women high in trait SO tended to modify their profile picture more than women with lower levels of SO. In study 3 (N = 100), participants were randomly assigned to groups where two ideal levels of modification (low modification vs. high modification) were indicated to lead to the optimal level of approval by others. Results indicated that women with higher trait SO chose to modify their profile picture to a greater extent, regardless of the level of optimal approval.

State anxiety biases estimates of uncertainty during reward learning in volatile environments.

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Previous research established that clinical anxiety impairs decision making and that high trait anxiety interferes with learning rates. Less understood are the effects of temporary anxious states on learning and decision making in healthy populations. In our study, both a state anxious and a control group learned probabilistic stimulus-outcome mappings in a volatile task environment while we recorded their electrophysiological (EEG) signals. By using a hierarchical Bayesian model, we assessed the effect of state anxiety on Bayesian belief updating with a focus on uncertainty estimates. State anxiety was associated with an underestimation of environmental and informational uncertainty, and an increase in uncertainty about volatility estimates. Anxious individuals deemed their beliefs about reward contingencies to be more precise and to require less updating, ultimately leading to impaired reward-based learning. Further, we tracked the neural representation of belief update signals in trial-
wise EEG amplitudes, showing distinct spatio-temporal patterns in both lower-level precision-weighted prediction errors (pwPEs) about the reward outcomes and higher-level volatility-pwPEs. Expanding previous computational work on trait anxiety, our findings establish that temporary anxious states in healthy individuals impair reward-based learning in volatile environments, primarily through changes in uncertainty estimates and hierarchically-related pwPEs considered vital to Bayesian accounts of learning.

Social sharing and reputation management in adults with high autistic traits and social anxiety.

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Social Difficulties are common in autism spectrum disorders (ASD) and anxiety disorders e.g. social anxiety (SA). Cognitive theories predict that since people with ASD may have poor theory of mind, they should have reduced capacity for reputation management, whereas people with social anxiety should have hyperactive reputation management. Therefore, it would be interesting to see how autistic traits and SA impact the tendency to share social information that could be judged. In this study, we developed a novel social sharing (SS) task which allows participants to share (or not share) their score in a simple computer game with another person (computer). 77 adults were evaluated for their autistic traits, SA, and SS on the novel task. There was a significant negative correlation between the SS scores and autistic traits of the participants but the correlation between SS and SA was not significant. Results from logistic regression show a three-way interaction between the score on the computer game (feedback), autistic traits, and SA. This suggests that in general people with high AQ engage in less reputation management. However, people with high AQ and high SA are sensitive to reputation management. The results support the reduced social motivation theory in ASD.

Predicting the future and judging the past: Examining prospective and retrospective metacognition in relation to mindreading and ASD traits.

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If mindreading and metacognition rely on the same cognitive processes then there should be no dissociation between them (Carruthers, 2011). It is widely accepted that, at a cognitive level, mindreading is diminished in autism spectrum disorder (ASD; Brunsdon and Happé, 2014). Therefore, if the one mechanism account is correct, metacognition should also be diminished. Research has been mixed and has shown that adults diagnosed with ASD can perform equally as well as neurotypical (NT) adults (Carpenter et al., 2019). An alternative explanation is that they are using a different strategy. If individuals with ASD are using the same strategies, we would expect to find the same pattern of performance when completing metacognitive tasks. NTs have been shown to perform better on retrospective metacognitive tasks compared to prospective ones (Siedlecka et al., 2019). The current study examined performance on prospective and retrospective confidence judgements in relation to ASD traits and mindreading among a student population. The results
showed that ASD traits and mindreading correlated with metacognition in both prospective and retrospective tasks. Furthermore, our results showed that mindreading mediated the relationship between ASD traits and prospective metacognition but not retrospective. In contrast to what was expected there was no relationship between the difference in metacognition and mindreading or ASD traits.

Role of intention in moral judgements: Evidence from autism and facial EMG.

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Using facial EMG, previous literature has shown that while processing language online, people evaluate the emotional valence of stories using their facial muscles (Hart et al., 2018). Considering that autism is associated with theory of mind (ToM) impairments, this pre-registered study aimed to investigate how autistic adults keep track of the emotional processes in stories, by manipulating characters’ intentions in moral scenarios. Participants listened to short stories in which the main character hurt or did not hurt another person/animal, and we manipulated the character’s intentions (neutral belief vs. negative belief), thus setting up moral scenarios. Participants (N=52) rated the consequence of the characters’ actions in terms of severity, and EMG recorded muscle activity over the corrugator and frontalis muscles (used for frowning/surprise). Explicit ratings showed that participants integrated the character’s intentions when judging the severity of the outcome; group did not modulate this effect. Analysis of EMG revealed greater corrugator activity while reading the immoral actions, and this effect was modulated by the negative prior belief of the character (i.e. knowing that their act would result in harm). Importantly, there were differences in the strength of belief influences between autistic and TD groups.

The effect of reading narrative fiction on social cognition: A multi-experiment investigation.

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Fictional stories represent the social world as they depict interactions between characters. Thus, reading narrative fiction has been theorised to improve social cognition (Nussbaum, 1996). We tested this claim in a series of 4 experiments assessing social cognition using a battery of self-report, explicit and implicit indicators (e.g., word fragment completion, Frith-Happé animations, Reading the Mind in the Eyes, Implicit Association Test, Affect Misattribution Procedure, and pupillometry). Experiment 1 tested the association between lifetime exposure to print fiction and social cognitive abilities in a correlational design. Experiments 2, 3, and 4 implemented a randomised design and assessed social cognition (before and) after a reading assignment. Experiment 2 contrasted short narrative fiction with narrative non-fiction and expository non-fiction excerpts. Experiment 3 compared a short story told from 3rd person perspective and internal focalisation vs. a narrative told from 1st person perspective and internal focalisation vs. a narrative told from 3rd person perspective and external focalisation. Experiment 4 examined the effects of reading an entire (narrative fiction vs. narrative non-fiction vs. expository non-fiction) book; pre- and follow-up assessments were
included in addition to post tests. Across all experiments and measures, results do not support the view that reading narrative fiction enhances our ability to understand the social world.

A broken empathy machine: Virtual reality does not reduce prejudice or increase pro-social behaviour towards refugees.

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Recent work in the development of virtual reality (VR) has been motivated by the claim that the medium is an "Ultimate Empathy Machine" capable of building empathy with, and changing attitudes towards, others by putting us in their situation. The current study tested this hypothesis using a between subject design which modulated two affordances of VR, immersion (the sense that one is physically present in a place) and agency (the ability to control one’s viewpoint on a scene). 132 participants watched the VR documentary “Clouds Over Sidra”, which shows the life of a young Syrian Refugee, across a full factorial design of high vs low immersion and high vs low agency. Prior to viewing they completed both an implicit association test examining attitudes towards Arabs vs European and explicit questionnaire measures relating to prejudice towards Arabs. After watching the piece participants again completed those measures along with measures of pro-social donation via willingness to donate to a charity for Syrian refugees. Results found no evidence for a significant difference in either explicit or implicit prejudice or in the tendency towards pro-social behaviour between the four groups suggesting that VR’s power to change attitudes is less effective than has been claimed.

Empathy in adolescents and young adults: how the brain responds to physical vs social pain.

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Understanding and sharing other’s emotions (i.e. empathy) forms a crucial part of social interaction. Previous studies report mixed findings on the developmental trajectory of empathic concern when observing others in pain (Beadle et al., 2013; Ritcher & Kunzmann, 2011). Thus far, the majority of research examining empathy responses has focused on physical pain, and significantly less has assessed empathy for others in social pain. In the current study, we measured behavioural (i.e. pain ratings) and EEG responses (i.e. suppression of 8-13Hz alpha activity over the prefrontal motor cortex) while 80 adolescents (10-19 years) and 80 younger adults (20-40 years) viewed pictures depicting hands and feet in physically painful (e.g. knife cutting finger) or socially painful (e.g. refusing handshake) situations, compared with non-painful situations. Behavioural responses showed that pain ratings for painful stimuli increased significantly with increasing age. Moreover, sensorimotor brain responses showed greater alpha suppression in response to people in physical vs. social situations, and for pain vs. no-pain situations, but the physical/social context did not modulate
pain responses. Importantly, we found that brain responses to painful situations are modulated by participant age; sensorimotor activity to painful vs. non-painful stimuli increased through adolescence and young adulthood.

Imitation in one’s own presence: self-focus does not uniquely modulate imitative response tendencies.

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Previous studies have reported that imitative responses may be modulated by top-down social factors such as self-focus. However, growing evidence suggests that such social factors may actually modulate domain-general processes such as spatially compatible responding, rather than social-specific processes such as imitation. In this study, we aimed to identify the cognitive processes being modulated under conditions of heightened or diminished self-focus. Participants performed a stimulus-response compatibility task which independently measures both spatial and imitative response tendencies, under two conditions: heightened self-focus, where the task was performed in the presence of two mirrors; and diminished self-focus, where the mirrors were covered. While participants were faster to respond to compatible trials than to incompatible trials, both imitatively and spatially, there was no significant modulation of either spatial or imitative compatibility by self-focus, although the magnitude of the modulation of spatial compatibility was numerically similar to the effect of self-focus on imitation found in previous studies. These results provide no evidence that social factors modulate social-specific, rather than domain-general, mechanisms.

Does looking at the speaker depend on visual or auditory cues?

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Previous research into the way we observe group interactions has investigated the role of speech sound on attention; with findings demonstrating that sound promotes fixations to a speaker. Conclusions were that participants follow the verbalizations to better understand the conversation. This study aims to further examine this conclusion using clips of target discussants to explore how the tendency to fixate on the speaker changes with the auditory and visual information presented. Additionally, this study uses stimuli of a natural group conversation, which surpasses previous research which commonly uses artificial dyad encounters. Experimental clips were either edited to remove the sound, freeze framed or transition to a blank screen. Findings suggest that participants observe silenced and freeze framed clips in a similar way to that of control clips in regards to fixating speaking targets and temporal characteristics. These findings suggest we continue to fixate targets even when no additional visual information can be gained.
Visual mechanisms that code inter-interactant distance exhibit psychophysical adaptation.

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The distance between interacting individuals (“inter-interactant distance”) is an important cue when interpreting social interactions from third-person perspectives. Smaller distances suggest intimate interactions between familiar people, while larger distances may suggest professional interactions between unfamiliar people. The present study sought to determine whether visual mechanisms encoding this attribute exhibit psychophysical adaptation, whereby prolonged exposure to particular visual input biases perception of subsequently viewed stimuli. Participants (N = 20) judged whether two people were standing more or less than 1 metre apart, under three conditions: having adapted to small inter-interactant distances, having adapted to large inter-interactant distances, and in absence of any adaptation. Consistent with previously reported adaptation effects, we find that adapting to large distances makes subsequently viewed dyads appear closer together, while adapting to smaller distances makes them appear further apart. These findings suggest mechanisms used to represent distance between people exhibit adaptation. Adaptation is thought to reflect the ongoing calibration of the visual system to the ambient environment. One possibility is that inter-interactant distance is represented via opponent-coding whereby distinct neural populations are tuned to small and large distances. Adaptation may modulate the relative excitability of these populations in order to optimise the representation of interactions around us.

Developmental changes in perspective-taking and mental state inferences: Adolescents, young adults and older adults.

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Everyday life is characterized by social interactions which require us to “put ourselves in other’s shoes”. Previous research has shown that aging plays a crucial role in social understanding (e.g. Henry et al., 2016). We tested a large sample of participants (N=240) to compare how adolescents, young adults and older adults perform on crucial social competency: the ability to take another person’s perspective. In Experiment 1 participants followed the instructions of an on-screen avatar to move objects around a grid; importantly, some of those objects were occluded from the speaker’s but not the participant’s view, leading to a discrepancy in the two communicators’ perspectives (shared vs. privileged). Results showed that, compared to both adolescents and young adults, older adults were overall slower to respond according to the avatar’s perspective and committed more egocentric errors. In Experiment 2, participants completed a perspective-taking task that crossed the content (visual vs. spatial perspective) and type of judgement (level-1 vs. level-2). Results showed a general cognitive slowdown with age, but this was amplified for level-2 perspective judgements and for larger angular rotations. Overall, these results show that social attention undergoes age-related change, though these effects are not universal across all types of social interaction.
Age-related changes in perception and top-down guidance during visual search.

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The current study investigated the effects of aging on observers’ ability to search for one, or one-of-two, size and colour conjunction targets. Forty-six observers from 18 to 75 years old participated in the study. Displays contained numerically equivalent sets of 12, 24 or 36 coloured distractors, and single- and dual-target searches were elicited by pre-cueing one or two targets. A 2 (target) x 2 (search type) by 3 (set size) repeated-measures ANOVA yielded significant main effects of search type and set size on RTs. Dual-target costs were calculated by subtracting RTs on single- from those on dual-target searches for each observer. Regression analyses indicated target identity, set size and age predicted 61% of the variance of RTs on single-target searches. Target identity, set size and age accounted for 37% of the dual-target cost on RTs. For single-target searches, the significant age-related decrements in RT are consistent with a decline in perceptual acuity and general slowing of responses. For dual-target searches, the significant effect of age is likely to reflect a decrease in the efficiency of top-down guidance when observers are required to select and inhibit alternate sets of distractors to detect one-of-two potential targets.

Too old for the job? Isolated choice effect and its implications for age diversity hiring for organisations.

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Many organisations aim to increase diversity and inclusiveness, yet, older age can have a significant, negative impact on hiring outcomes. Previous research by Chang, Kirgios, Rai, and Milkman (in press) shows that people make more gender diverse hiring decisions when selecting for multiple roles simultaneously, rather than in isolation. We extend this finding of an isolated choice effect to older worker selection in a pre-registered, conceptual replication of Chang et al. (in press).

Participants in an isolated choice condition (n = 406) were assigned one of four job roles and asked to make a hypothetical hiring choice from three candidates with relevant experience, two younger (age 21-32) and one older (age 61-67). Participants in a set choice condition (n = 96) were presented candidates for the same four roles simultaneously. Consistent with the isolated choice effect, our results showed participants in the set choice condition selected significantly more older candidates than those in the isolated choice condition (b = -0.051, p = .046). To better understand reasons for this effect, we will conduct a follow-up study that introduces additional non-hiring decisions (e.g. office location, software provider) into the isolated choice condition to balance cognitive effort between conditions.

Chance and interactivity in an anagram task.

We explored the benefits of interactivity in creativity and discovery with an anagram task (https://osf.io/we3ru/?view_only=730b84dacac24f1cafc315c20dd4fc2b). The experiment also examined the role of chance and impasse. In a repeated-measures design, 69 participants were invited to solve eight 5-letter anagrams presented in the form of movable letter tiles in two conditions: high interactivity (where tiles could be moved at will) and low interactivity with shuffle (the tiles could not be rearranged save through random shuffles). Participants were also asked to indicate whether they experienced impasse. Overall, the proportion of correct trials in the high interactivity condition (M = .75, SD = .24) was significantly greater than in the low/shuffle condition (M = .65, SD = .27), t(68) = 2.57, p = .012. Thirty-six participants encountered impasse on at least one trial in both conditions. Among those participants, the average proportion correct in the high condition (M = .36, SD = .41) remained significantly greater than in the low/shuffle condition (M = .17, SD = .31), t(35) = 2.87, p = .007. The results indicate that simply changing the array at random is not enough; rather a coupled and dynamic system is necessary to fully leverage the benefits of interactivity.

Accessing prior linguistic knowledge when learning new words from spoken stories.

Pseudowords with many versus few phonological neighbours are more readily learned under explicit training conditions, suggesting that both adults and children can utilise prior knowledge during word learning (James, Gaskell, & Henderson, 2019). Here, we examined whether such neighbour benefits persist when encountering new words incidentally via stories, with more limited opportunities for strategically engaging prior knowledge. Children (Experiment 1) and adults (Experiment 2) were exposed to pseudowords with zero, one, or many neighbours via a spoken story with illustrations. New word knowledge was assessed immediately and after opportunities for consolidation (+1 day, +1 week), using a stem-completion task to assess word-form recall, and a recognition task to assess form-meaning familiarity. Children and adults recalled more word-forms at later tests, but only adults showed the same neighbour benefit as in explicit training studies. In contrast, children were less able to benefit from neighbours after encountering pseudowords in stories, and instead showed interference from neighbours in the recognition task. A third experiment will address whether these developmental differences result from adults (but not children) being provided with written text alongside the spoken narrative, enabling us to determine how prior knowledge may be differently engaged for children and adults across learning contexts.

Implicit learning ability and language acquisition: Evidence from artificial language learning.

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Despite mounting evidence showing that implicit statistical learning is closely related to language acquisition, it still remains unclear whether implicit learning ability can predict language performance. Recent studies suggest that statistical learning and implicit learning are different, so using statistical learning as a measure of implicit learning ability may not reflect the real predictive link to language outcomes (Arnon, 2019). This study adopts priming (lexical and syntactic priming), which is regarded as a form of implicit learning (Chang et al., 2012), to assess implicit learning ability. We are interested in whether such an implicit learning ability measured by lexical and syntactic priming can predict performances in learning corresponding linguistic aspects (i.e., vocabulary and syntax) of an artificial language. Results showed that vocabulary learning and lexical priming were positively correlated r(68) = .59, p < .001, but no significant correlation was found between syntactic learning and syntactic priming (r(68) = -.15, p = .25). Multiple linear regression results indicated that syntactic priming and lexical priming both significantly predicted lexical learning but neither of them predicted syntactic learning. Such findings suggest that learners who have a better implicit learning ability demonstrated by larger priming effects tend to exhibit better vocabulary learning performance.


Nonword repetition: The role of articulatory planning.

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The ability to repeat a heard nonword is a positive predictor of vocabulary acquisition. A prominent view is that nonword repetition constitutes a relatively pure measure of a passive phonological short-term store, uncontaminated by a contribution of articulatory planning (or ‘rehearsal’). The results of two experiments challenge this view: Experiment 1 showed that articulatory suppression—but not finger tapping—during nonword presentation markedly impairs nonword repetition. Experiment 2 showed that nonword repetition is also affected by the phonological similarity of its constituent vowels, positively so when measuring the repetition of the order of entire syllables (due to redundancy provided by the repeating vowel in similar nonwords) and negatively when measuring the repetition of the order of consonants. This further supports a role for articulatory planning in nonword repetition given the recent (re)attribution of the (negative) phonological similarity effect to speech-planning errors. Experiment 2 also demonstrated a Hebb repetition effect in the context of nonword repetition for the first time, in line with the view of the Hebb effect as an analogue of word-form learning. The findings are in line with an account of verbal serial short-term memory that emphasizes articulatory planning processes over a dedicated passive phonological store.
Answers are remembered better than the questions themselves.

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When we communicate, we often use language to identify and successfully transmit new information. We can highlight new and important information by focussing it through pitch, syntactic structure, or semantic content. Previous work has shown that focussed information is remembered better than neutral or unfocussed information. However, most of this work has used structures, like clefts and pseudo-clefts, that are rarely found in communication. We used spoken question-answer pairs, a frequent structure where the answers are focussed relative to the questions, to examine whether answers are remembered better than questions. On each trial, participants (n=48) saw three pictures on the screen while listening to a recorded question-answer exchange between two people, such as “What should move next to the painting? – The goat”. In an online Yes/No recognition memory test on the next day, participants recognised the names of pictures that appeared as answers 6% more accurately than the names of pictures that appeared as questions (β = 0.27, Wald z = 4.51, 95% CI = 0.15, 0.39, p = < 0.001). Thus, linguistic focus affected memory for the words of an overheard conversation. We discuss the methodological and theoretical implications of the findings for studies of conversation.

Electrophysiological evidence from time reference violation in Thai.

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Reference to a time frame in which an event takes place can be done by using verbal morphology where an agreement of time reference (present, past, future) and verb is required. If the time frame is set by a temporal adverb, the verb inflection must coincide for sentences to be correct. Previous studies on time reference processing in Indo-European languages using EEG revealed that the disagreement elicits P600. The current study examined the neural correlates of time reference processing in Thai, a language that does not inflect verbs for tense, but uses aspectual markers to express time. The study explored whether the same P600 would be detected when aspectual markers were violated, and whether the same effect would be evoked when the violation occurred in different sentence positions. Data from 31 participants were collected and cleaned using automated Independent Component Analysis. A cluster-based permutation test was computed. Results revealed that, in Thai, time reference may rely more on lexical semantics, indexed by modulation of an N400 observed between 300-500ms latency range, rather than purely morphosyntactic processes as reported in Indo-European languages. Brain physiology reflects different time reference processing depending on the linguistic devices used for temporal information.
Exploring children’s and adult’s interpretation of drawings (Pre-registered study).

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When determining the meaning of a drawing, participants rely on artist intent (Preissler & Bloom, 2008). If the artist draws a line when looking at a pink pencil, participants name the drawing as a pencil. However, it remains unclear how participants limit the meaning of a drawing - do they interpret the meaning of a line representing just that pencil (identity), pencils in general (category), all long things (shape) or stationary more broadly (theme). We explored this question with sixty-four 4- and 5-year-old children and a control group of adults. Participants participated in a game where they helped tidy objects into bags with the help of drawings. The experimenter drew an ambiguous drawing representing a toy (e.g. line as a straw). Subsequently, participants were asked to tidy up toys in two bags. The experimenter attached the ambiguous drawing to one bag saying ‘I will show you what goes here’, and pointed to the other bag saying ‘and everything else goes here’. We recorded what participants put in the bag with a drawing. Both 4- and 5-year old children and adults sort according to category, suggesting that despite seeing a particular referent being drawn, they generalise the meaning of the drawing.

Accommodation in Canterbury

University of Kent Campus
The conference is based in Keynes College, where there are student (en-suite) rooms available. Prices from £95 for one person for two nights.
https://kenthospitality.kent.ac.uk/KxBnB/Search.aspx?nightCount=2&arrivalDate=2020-04-15&roomCount=1&location=&promotion=&people=1

Travelodge Canterbury Chaucer Central
63 Ivy Lane, CT1 1TU - 08719 846 471
Prices from £120 for one person for two nights.
2 miles from campus, very close to bus station for buses to the university.
https://www.travelodge.co.uk/hotels/499/Canterbury-Chaucer-Central-hotel

Premier Inn Canterbury City Centre
New Dover Road, Canterbury, CT1 1UP - 0871 527 9408
Prices from £110 for one person for two nights.
2 miles from campus, very close to bus station for buses to the university.
https://www.premierinn.com

House of Agnes
71 St Dunstans Street, Canterbury, CT2 8BN - 01227 472 185
Prices from £160 for one person for two nights.
1.5 miles from campus, centre of the City and close to bus stop outside St Dunstan’s Church.
http://www.houseofagnes.co.uk/

Falstaff Hotel
8-12 St Dunstan’s Street, Canterbury, CT2 8AF - 01227 462 138
Prices from £150 for one person for two nights.
1.5 miles from campus, university bus stop on opposite side of the street of main entrance.
https://www.thefalstaffincanterbury.com/

Cathedral Lodge Hotel
Cathedral, The Precincts, Canterbury CT1 2EH - 01227 865 350
Prices from £180 for one person for two nights.
1.75 miles from campus, centre of the City and close to bus station.
https://www.canterburycathedrallodge.org/

This is not an exhaustive list of accommodation and there are many other hotels, Airbnb and bed and breakfast options available!

Travel in Canterbury

There is a bus service that runs from Canterbury Bus Station in the centre of the city and the University. The buses are the Uni1, Uni2 and 4. As the meeting is outside of term time, buses will be running to a non-term time schedule. The Uni1 will take you to / from Canterbury East train station and the Uni2 will take you to Canterbury West train station.

Please check before you travel!   https://www.stagecoachbus.com/plan-a-journey
**Eating and Drinking**

On Campus, each college in the University has its own café bar. In Keynes College there are two places to eat: Dolche Vita (offers a range of fusion dishes) and K Bar (provides a more casual area to eat and drink).

**Evening Meals**

Most of Canterbury’s restaurants are reasonably priced and within the City centre:

- Osterio Posillipo (Buonissimo, rustic Italian) [http://posillipo.squarespace.com/]
- The Foundry (Traditional pub food) [https://www.thefoundrycanterbury.co.uk/]
- Azouma (Moroccan and Lebanese) [https://www.azouma.co.uk/]
- Oscar & Bentleys (Gluten free bistro) [https://www.oscar-bentleys.co.uk/]
- The Ancient Raj (Indian) [http://www.ancient-raj.com/]
- Cafe Mauresque (Andalucían / North African) [http://www.cafemauresque.co.uk/]

**Places of Interest**

Canterbury enjoys a rich history of over 2000 years. From accounts of ancient settlers to medieval intrigue, before stories of the many famous historical figures, artists and notable locals round up Canterbury's story right up to the present day!

Canterbury is home to a UNESCO World Heritage Site, comprised of the oldest cathedral in England (paid entry), the ruins of St Augustine’s Abbey (paid entry) and St Martin’s Church, the oldest church in continuous use in England!

[https://www.canterbury-cathedral.org/]
[https://www.english-heritage.org.uk/visit/places/st-augustines-abbey/]
[https://www.martinpaul.org/visitstmartins.htm]

The Beaney House of Art and Knowledge (free entry art gallery and museum, also contains the Visitor Information centre: [https://canterburymuseums.co.uk/beaney/visitor-information/]) and Canterbury Roman Museum (paid entry) exhibits the City’s story from the pre-Roman period to the present day: [https://canterburymuseums.co.uk/]

Take a boat ride on the historic river Stour (Celtic for ‘great water’) with either a rowing boat or a luxurious punting tour.

[http://www.canterburyrivertours.co.uk/]
[https://www.canterburypunting.co.uk/]
[http://canterburypunts.uk/]

Canterbury is a City steeped in literary history, including Christopher Marlowe, Aphra Behn, Charles Dickens, Joseph Conrad, W. Somerset Maugham and Mary Tourtel. Most famously, you can pay a visit to the Canterbury Tales to see Geoffrey Chaucer’s characters brought to life!

[https://www.canterburytales.org.uk/your-visit/opening-times-and-prices/]

Kent is known as the Garden of England and travelling even a short distance outside of the City centre will bring you to beautiful country landscapes ideal for exploring. There are also many parks and outside spaces in and around Canterbury including the Westgate Gardens, Dane John Gardens and the Blean Ancient Woodlands.
Conference Dinner

The conference dinner will be held on Thursday 16th April at 8:00pm (arrival from 7:30pm) at the Drapers Arms, which is just a 20 - 30 minute walk from the meeting into Canterbury city centre. The restaurant address is 1 - 2 Sun Street, Canterbury, CT1 2HX.

This year, dinner bookings and payment will be exclusively online. Payments must be made electronically using a credit or debit card (PayPal is not currently supported). Please complete all required information to ensure your place and menu choices at the dinner. Once booked, the system will generate an automatic receipt to your email address.

The standard dinner cost for EPS members is £24.95 this year. Please note that postgraduates can book at a reduced fee of £12.50, but must provide evidence of their postgraduate status by emailing a letter from their supervisor (or a direct email from the supervisor) to expsychsoc@kent.ac.uk.

Starters

Leek, Pea & Potato Soup (VG / Can be made GF)
Smoked Mackerel Salad, Beetroot, Leaves, Horseradish, Crème Fraiche (Can be made GF)
Chicken Liver Parfait, Apple & Date Chutney with Toast (Can be made GF)

Mains

Pan Roasted Chicken Breast, Sautéed Potatoes, Spinach with a Mushroom Cream Sauce (GF / Can be made VG)
Mushroom, Goats Cheese & Onion Marmalade Wellington with Basil & Tomato (VG)
Salmon Fillet, Crushed Potatoes, Tomato Chutney, Seasonal Greens with a White Wine Cream Sauce (GF / Can be made VG)

Dessert

Chocolate Truffle Cake & Fresh Cream (GF)
Lemon & Lime Posset with Shortbread (GF)
Selection of Ice Cream & Sorbet (V/VG)

Please book your place before 6 April: https://tinyurl.com/sva76hr

The portal will close after this date and we cannot accommodate late admissions. No cash or cheque payments are possible.

- Please note that we will have a maximal number of 60 spaces and these will be reserved on a first come/first served basis.
- Please indicate if you have any dietary requirements in the text box on the form.

Please contact Sam Hurn at expsychsoc@kent.ac.uk with any questions, but email the Kent Online Store with any queries concerning the booking process or payment (store@kent.ac.uk).
18th Mid-Career Prize Lecture

will be delivered by
Professor Matthew Rushworth
University of Oxford

Frontal cortical interactions during decision making.

6.00pm, Thursday 16th April 2020

Keynes Lecture Theatre 1
University of Kent
Keynes College
Canterbury
CT2 7NP

The lecture will be open to the public
APPLYING TO JOIN THE
EXPERIMENTAL PSYCHOLOGY SOCIETY

To apply for membership to the Experimental Psychology Society please go to the EPS website: https://eps.ac.uk/applying-for-membership/ and fill in the form, ensuring all boxes are completed (Entries should be made in clear black type) before signing and returning to the EPS Administrator: expyschosoc@kent.ac.uk or sending to:

Sam Hurn
EPS Administrator
School of Psychology
Keynes College
University of Kent
Canterbury
CT2 7NP

All information should be included on the form, not on additional sheets.

Under "Publications", only articles that have appeared in print by the time of nomination, in peer-reviewed psychological or cognate journals, should be listed. Because of space limitations, a complete publication list is not required; two recent examples, where the nominee is single or first author, are sufficient.

Applicants must be nominated by two EPS members.

These forms should be returned by 1st September.

See Criteria and Procedures on following page.
CRITERIA AND PROCEDURES TO JOIN

Soon after the closing date of 1st September, brief details of all candidates will be circulated to members of the Society, who may request further information if they wish. The nomination forms will be considered by the Committee at their Autumn meeting. The Committee will decide whether each candidate is eligible for admission to Ordinary Membership, i.e. those candidates who have:

a) secured a PhD
b) published at least two independent accounts of their work in a reputable, peer-reviewed psychological journals
c) personally delivered an oral paper to the Society at one of the three EPS meetings held each year

Candidates who do not meet all these criteria can be considered only in exceptional circumstances. Those who are resident outside Europe will be asked for assurance that they can attend meetings reasonably often.

Any candidate not selected as eligible by the Committee will be informed of this and will be advised whether he/she may again be proposed for membership in a future year and if so subject to what conditions. The list of those selected as eligible will be put to the Annual General Meeting in January for approval.
**Annual General Meeting**

The 72nd Annual General Meeting was held on Thursday 9th January 2020 at 5:00pm in the Lower Ground Floor Lecture Theatre, Department of Cognitive, Perceptual & Brain Sciences, University College London, 26 Bedford Way, London, WC1H 0AP.

There were over 40 members in attendance.

**20/01 Minutes**

Minutes of the Business Meeting, held at Bournemouth University on Thursday 11th July 2019, were approved as no issues raised.

**20/02 Matters Arising**

2.1 Update on Plan S and effects on QJEP and the EPS

Outgoing President Celia Heyes outlined the current situation regarding Plan S and any potential effects on QJEP and the EPS as a whole. Projections from the publishers of QJEP, SAGE, indicate that there is a potential of a 10-15% drop in journal revenue in the next two years, with a more precipitous drop following this. However, SAGE has successfully negotiated Open Access agreements with Scandinavian consortia and will hope to do the same with JISC, the big UK consortium.

The UKRI has not published its draft policy, and since there have not been any other significant developments, the Plan S Working Group has not been convened since the committee’s meeting in November. It is now likely that UKRI will publish its draft policy in February 2020, so a meeting of the Working Group may be convened after this.

It was suggested by a member to consider a model similar to PeerJ, the Journal of Life and Environmental Sciences. It was noted that this was a similar model to what SAGE is trying to negotiate.

**20/03 Hon Secretary’s Report**

3.1 Annual Report of the Society (to be circulated)

The Hon. Secretary outlined some of the achievements of the EPS during 2019.

- Highly successful meetings in London, Manchester and Bournemouth
- Awarded numerous research grants (N=44), student bursaries (N=13) and travel awards (N=149), recognized scientific excellence through prizes
- New ECR committee member
- Monitored and managed risk from Plan S
- GDPR officer on committee and new archiving policy
- Increased social media engagement @ExpPsychSoc
• Made steps to make EPS greener
• Clarified consent for public sharing of presented work

The Hon Sec led a discussion on future-proofing EPS finances, and proposed an increase to members’ fees alongside a new, tiered membership structure (Ordinary members - >6yrs post PhD, £60, ECR members - <6yrs post PhD, £30 and student/postdoc affiliate - <2yrs post PhD, £10). These fees would bring the EPS in line with the next lowest fees for a similar Society. A member queried whether it would be preferable to wait until more information from Plan S was available before raising the price. Questions were also raised by members regarding which category retired members should pay, what benefits affiliate members would receive, how increased admin of policing membership would be managed, and whether costs could be recouped by charging non-members to attend meetings. When put to a vote, the majority of members approved the proposal to raise membership fees in principle, and agreed that the committee should continue to look into these issues and return with an updated proposal at a future business meeting.

In response to the increased submission rates for meetings, it was proposed that a third parallel session would be trialled at the July 2020 Swansea meeting for the second day of the meeting only. This was approved by the majority of members by show of hands. Members offered additional suggestions to manage the increasing submission rates, including: opening the portal for a set time and choosing the best submissions, reserving a set proportion of talks for members, and reducing the length of talk slots to a total of 20 minutes. These suggestions will be discussed by the Committee.

A proposal to pilot ‘Research plan’ posters at the Swansea meeting in July was approved by majority. Members highlighted that this should not be limited to students.

The Hon Sec proposed a way of improving accessibility of EPS content by adding a tick-box at the submission point for presenters to opt-in recordings of talks at meetings, which will later be available on the EPS YouTube channel. It was confirmed that recordings would not be made for presenters who choose not to opt-in.

The Hon Sec announced a new ‘Kuppuraj Bishop Global South travel award’, thanks to a generous donation from Dorothy Bishop, and this was enthusiastically approved by members. The committee will prepare wording for a call.

20/04 Hon Treasurer’s Report

4.1 Treasurer’s Report (summary accounts to be circulated)

Accounts are in good health, with increased income and reduced outgoings in the 2018/2019 accounts compared to 2017/2018. The reduction in expenditure is mainly due to a reduction in grant applications and awards, most notably Grindley Grants. Administrative costs remain stable. Reserves have increased but no investments have been made yet. The Society is ready to do so when necessary. It was decided to wait until Plan S uncertainty has cleared before making any investments.
### 20/05 QJEP Editor’s Report

#### 5.1 Editor’s Report

The editor made his report to the AGM, stating that overall, the Journal is in very good condition. There was a slight increase in submissions, with 479 in 2019 compared to 426 in 2018 and 450 in 2017.

Pending approval of the election of Antonia Hamilton as Editor in Chief in agenda point 20/11, the handover of duties will begin shortly thereafter. Simon thanked the committee, his editorial team and everyone at SAGE for their support during his time as Editor. Simon was in turn thanked by the Committee for his services during his term as Editor in Chief of QJEP.

### 20/06 President’s Commendations for Student Poster Prize at an EPS meeting

The President’s Commendation for Student Poster Prize was awarded to Bryony Payne of University College London, for her poster entitled ‘Perceptual prioritisation of self-associated voices’.

### 20/07 Confirmation of the Forty Ninth Bartlett Lecturer

Professor Chris Frith approved by members by way of applause.

### 20/08 Confirmation of the Nineteenth EPS Mid–Career Award

Professor Mike Anderson approved by members by way of applause.

### 20/09 Confirmation of the Twenty Eighth EPS Prize Lecturer

Dr Sarah Lloyd-Fox approved by members by way of applause.

### 20/10 Confirmation of the Ninth Frith Prize

Dr Emma James approved by members by way of applause.

### 20/11 Election of QJEP Editor in Chief

Professor Antonia Hamilton approved by members by way of applause.

### 20/12 Election of Officers and Committee Members

All nominations (Early Career Representative Dr Daniel Yon, Goldsmiths, London Organiser Dr Jo Taylor University College London, Conference Secretary Elect Dr Andrew Johnson, Bournemouth University and Ordinary Committee Member Dr Elisabeth Bradford, University of Dundee) approved by members by way of applause.
20/13 Admission of Ordinary Members
All proposed new members approved by members by way of applause.

20/14 Future Meetings
April 2020, University of Kent  Local Organisers: Heather Ferguson and Sam Hurn
July 2020, Swansea University  Local organiser Jeremy Tree

20/15 Any Other Business
The Hon Sec expressed considerable thanks to James Bisby as local organiser for this meeting.

Thanks were also expressed for three outgoing ordinary committee members; Kaz Brandt, Jeremy Tree and Anna Weighall, for all of their work whilst on the committee.

Finally, many thanks were given to outgoing President, Cecilia Heyes, for all of her work during her tenure.

20/16 Date, time and place of next meeting
Next business meeting will be at Keynes College, University of Kent, Canterbury, 16th April 2020.

Professor Heather Ferguson
Hon. Secretary
Agenda for April 2020 Business Meeting

A Business Meeting will take place in Keynes Lecture Theatre 1, Keynes College, University of Kent, Canterbury, on Thursday 16th April 2020 at 5:00pm.

20/16 Minutes of the 72nd Annual General Meeting held on Thursday 9th January 2020 at 5:00pm in the Lower Ground Floor Lecture Theatre, Department of Cognitive, Perceptual & Brain Sciences, University College London, 26 Bedford Way.

20/17 Matters Arising

20/18 Secretary’s Report

20/19 Treasurer’s Report

20/20 QJEP Editor’s Report

20/21 Arrangements for Future Meetings

20/22 Any Other Business

Date, time and place of next meeting.
Next Meeting: Swansea University. 1-3 July 2020

This meeting will include the 48th Bartlett Lecture by Susan Carey (symposium organised by Josep Call), and the 27th EPS Prize Lecture by Camilla Gilmore (symposium organised by Silke Goebel). This meeting will also include a British Science Association / EPS Undergraduate Project Prize talk by the 2020 winner, Lenard Dome of Plymouth University.

Local organiser: Jeremy Tree

The submission portals will open at 10am on Monday 20th April 2020.