WINTERCONFERENCE 2015 ✸ EGMOND AAN ZEE

DECEMBER 17 - 19

Programme Overview	2
Instructions for presenters	3
Hotel Zuiderduin	3-4
Condensed Schedule Thursday	5
Condensed Schedule Friday	6
Condensed Schedule Saturday	7
Thursday: Presentations by Session - Titles & Authors	8
Friday: Presentations by Session - Titles & Authors	12
Saturday: Presentations by Session - Titles & Authors	19
Abstracts	
Keynote Lectures	22
Symposia	23
Oral Presentations	27
Poster Presentations	40

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PROGRAMME OVERVIEW

THURSDAY

13:00	Bus leaves from Alkmaar train station	
13:00 - 15:30	Registration*	NVP desk
14:20 - 14:30	Opening	Lamoraalzaal
14:30 - 15:30	Keynote lecture: *Daniel Wolpert*	Lamoraalzaal
15:30 - 15:40	Coffee/Tea	Lounge 1
15:40 - 17:00	Symposium: The Brain in Control	Lamoraalzaal
	/ Parallel sessions 1	Abdijzaal and Room 522
17:00 - 18:30	Registration*	NVP desk
17:00 - 19:00	Poster session 1 + drinks	Lounge 1 and 2
19:00 - 21:00	Dinner	Ritz
21:00 - 23:00	NVP Pubquiz	Zuiderduinzaal

FRIDAY

07:00 - 08:30	Breakfast	Restaurant
08:00 - 10:00	Registration*	NVP desk
08:30 - 09:50	Symposium: Computational Cognitive Neuroscience	Lamoraalzaal
	/ Parallel sessions 2	Abdijzaal and Room 522
09:50 - 10:00	Coffee/Tea	Lounge 1
10:00 - 11:00	Keynote lecture: *Pieter Roelfsema*	Lamoraalzaal
11:00 - 11:10	Coffee/Tea	Lounge 1
11:10 - 12:30	Symposium: Towards a cognitive account of human creativity	Lamoraalzaal
	/ Parallel sessions 3	Abdijzaal and Room 522
12:30 - 13:30	Lunch	Restaurant
13:30 - 14:30	Registration*	NVP desk
13:30 - 15:30	Poster session 2 + coffee/tea	Lounge 1 and 2
15:30 - 16:50	Symposium: Knowledge representation and concept learning	Lamoraalzaal
	/ Parallel sessions 4	Abdijzaal and Room 522
16:50 - 17:00	Coffee/Tea	Lounge 1
17:00 - 18:00	Keynote lecture: *Eric-Jan Wagenmakers*	Lamoraalzaal
18:10 - 19:00	NVP business meeting	Lamoraalzaal
18:00 - 19:00	Registration*	NVP desk
19:00 - 21:00	Dinner	Ritz
20:00 - 21:00	Dinner lecture: The Bayesian Brain: A physicist's perspective	Ritz
21:00 - 02:00	Bar open	The Pub
21:00 - 02:00	Bowling	Lucky Strike

SATURDAY (Check-out before 10:30)

07:00 - 08:30	Breakfast	Restaurant
08:00 - 09:00	Registration*	NVP Desk
08:30 - 09:50	Symposium: Neural Network Profiles and Dynamics Begin to Shed Light on Neurocognitive Aging	Lamoraalzaal
	/ Parallel sessions 5	Abdijzaal and Room 522
09:50 - 10:00	Coffee/Tea	Lounge 1
10:00 - 11:00	Keynote lecture: *Heidi Johansen-Berg*	Lamoraalzaal
11:00 - 11:10	Coffee/Tea	Lounge 1
11:10 - 12:30	Symposium: Predicting human actions: Specialized and general mechanisms	Lamoraalzaal
	/ Parallel sessions 6	Abdijzaal and Room 522
12:30 - 13:30	Lunch	Restaurant
13:30 - 14:50	Symposium: Opportunities and Applications of Ultra High-Field MRI in Cognitive Neuroscience	Lamoraalzaal
	/ Parallel sessions 7	Abdijzaal and Room 522
14:50 - 15:00	Coffee/Tea	Lounge 1
15:00 - 16:00	NVP Dissertation award ceremony	Lamoraalzaal
16:00	Closing	Lamoraalzaal
16:20	Bus leaves for Alkmaar train station	Central entrance hotel

*Payments can only be made online, a computer is available at the NVP desk.

INSTRUCTIONS FOR PRESENTERS

Oral presentations

Make sure you are present 15 minutes before the start of your session. All rooms will be equiped with a monitor switch, but a computer is not provided. You are responsible to take to the room a laptop on which your presentation runs smoothly, which can be plugged into the monitor switch.

Poster presentations

Poster boards have a size of 100 cm (width) * 125 cm (height), which is big enough for an A0 portrait poster. On Thursday, posters can be mounted from 13:00 until Friday 12:30. On Friday, posters can be mounted from 12:30 until the end of the conference.

HOTEL ZUIDERDUIN

Thursday 17 December

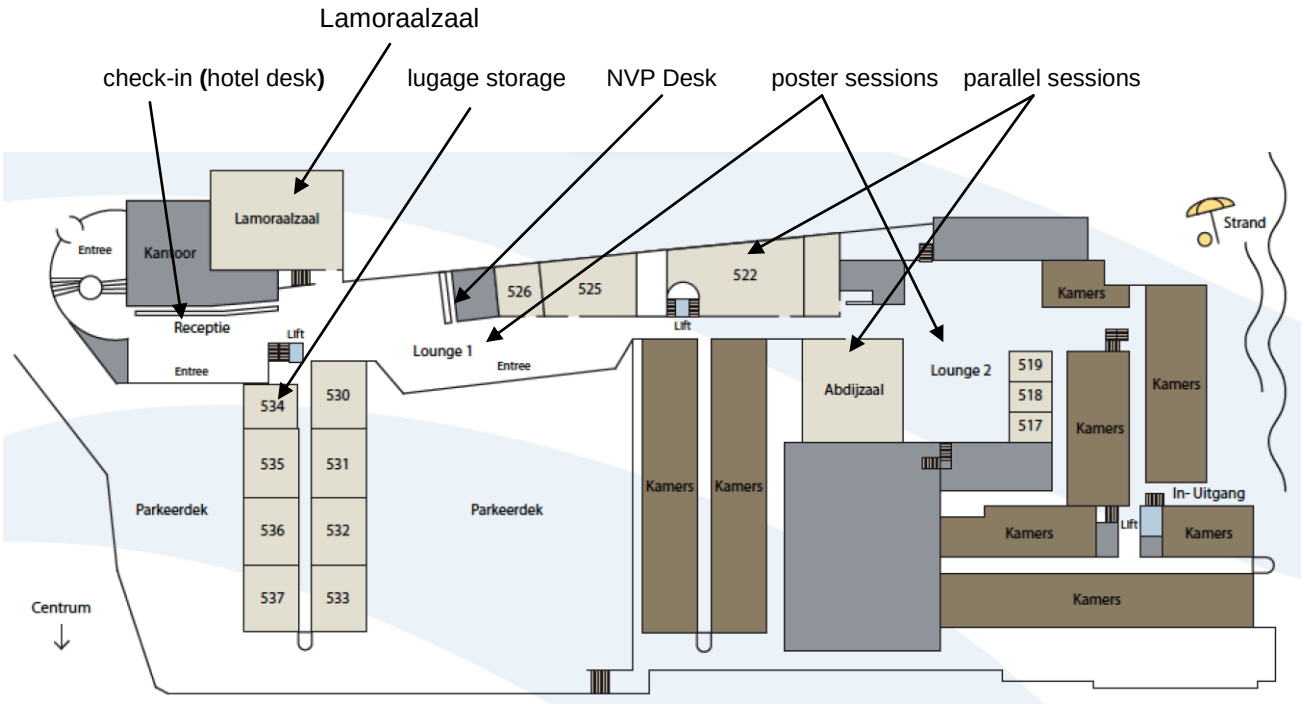
Conference Registration: NVP desk opens at 13.00
Luggage storage in room 534
Check-in Hotel Zuiderduin: after 15:00 (hotel desk)

Friday 18 December

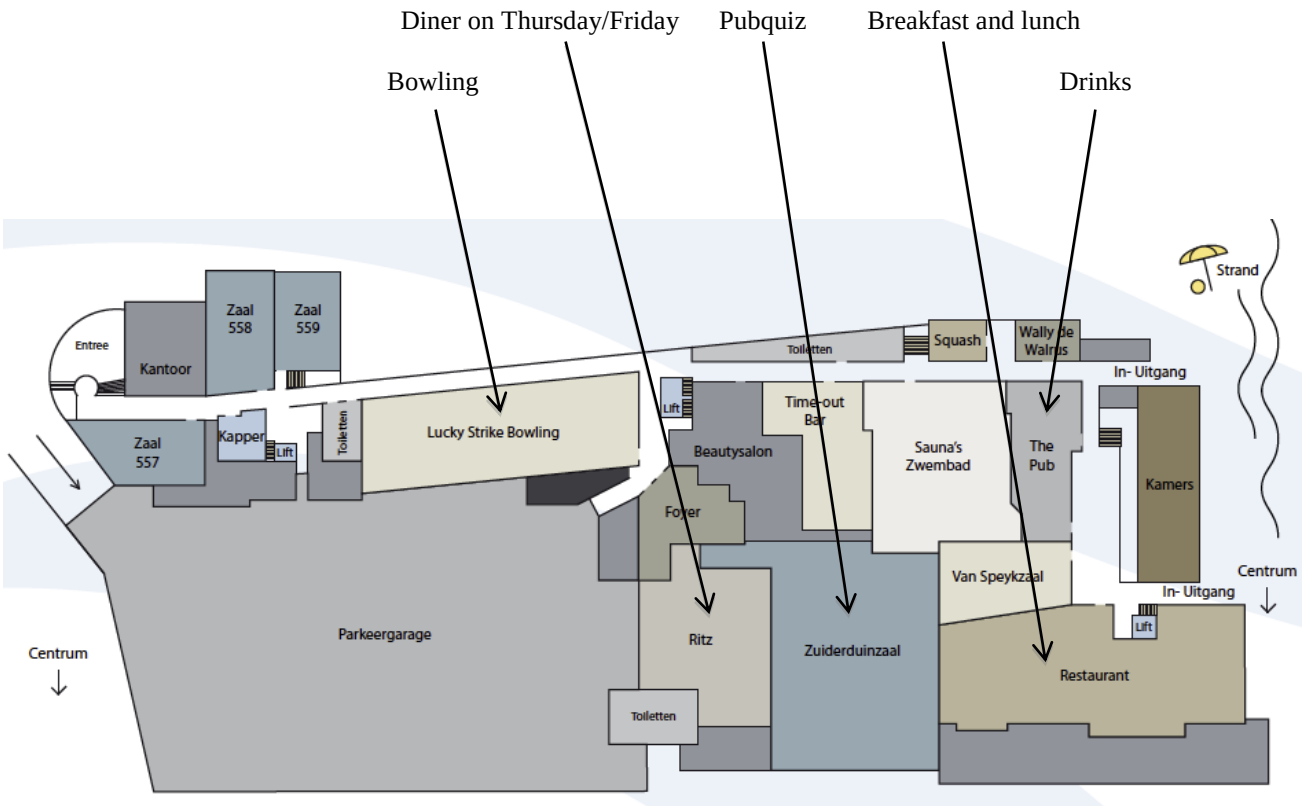
Conference Registration: NVP desk opens at 8:00
Luggage storage in room 534
Check-in Hotel Zuiderduin: after 15:00 (hotel desk)

Saturday 19 December

8:00 – 10:30 Check-out (hotel desk)
Luggage storage in room 534
You must be checked-out of your room by 10:30!



Map of the **first floor**: hotel desk (*check-in*), Lamoraalzaal (*keynote lectures, business meeting, NVP dissertation award*), room 534 (*lugage storage*), Lounge 1 and 2 *(poster session, coffee/tea breaks and drinks)*, Abdijzaal and Room 522 (*parallel sessions*) and NVP desk.



Map of the **ground floor**: Ritz (*Dinner on Thursday and Friday*), Zuiderduinzaal (*Pubquiz on Thursday*), Lucky Strike Bowling (*Bowling on Friday*), The Pub (*Thursday and Friday Night Bar*) and Restaurant *(breakfast and lunch*).

CONDENSED SCHEDULE THURSDAY, 17TH

14:20	**Opening**	Lamoraalzaal
14:30	Keynote Lecture: ***Daniel Wolpert***	Lamoraalzaal
15:30	**Coffee/Tea**	Lounge 1

Parallel Sessions			
Only first authors are mentioned			
Room	**Abdijzaal**	**522**	**Lamoraalzaal**
Session	**Development**	**Emotion**	**Symposium:The Brain in Control**
Chair	Dekker	Kret	Van Steenbergen / Ridderinkhof
15:40	t001 Beking	t005 Kret	s001 den Ouden
16:00	t002 Dekker	t006 Jepma	s002 van Steenbergen
16:20	t003 Overvliet	t007 Mulckhuyse	s003 Rigoni
16:40	t004 de Jong	t008 Bouman	s004 Mars

17:00	**Poster Session 1 + Drinks**	Lounge 1 and 2
19:00	**Dinner**	Ritz
21:00	**NVP Pubquiz**	Zuiderduin zaal

CONDENSED SCHEDULE FRIDAY, 18TH

7:00	**Breakfast**	Restaurant	
Parallel Sessions			
Only first authors are mentioned			
Room	**Abdijzaal**	**522**	**Lamoraalzaal**
Session	**Cognitive Control**	**Memory and Learning**	**Symposium: Computational Cognitive Neuroscience**
Chair	Nieuwenhuis	Murre	Scholte / van Gerven
8:30	t013 van Leusden	t017 Murre	s005 Dumoulin
8:50	t014 Ort	t018 Kruijne	s006 Knapen
9:10	t015 van Slooten	t019 Sense	s007 van Gerven
9:30	t016 Warren	t020 Jolij	s008 Scholte
9:50	**Coffee/Tea**	Lounge 1	
10:00	Keynote Lecture: ***Pieter Roelfsema***	Lamoraalzaal	
Session	**Attention 1**	**Perception 1**	**Symposium: Towards a Cognitive Account of Human Creativity**
Chair	Theeuwes	Groen	Hommel
11:10	t025 Jahfari	t029 Seijdel	s009 Ritter
11:30	t026 Olivers	t030 Ramakrishnan	s010 Rietzschel
11:50	t027 Fahrenfort	t031 Groen	s011 Baas
12:10	t028 Failing	t032 Colizoli	s012 Hommel
12:30	**Lunch**	Restaurant	
13:30	**Poster Session 2 + Coffee/Tea**	Lounge 1 and 2	
Session	**Attention 2**	**Social**	**Symposium: Knowledge Representation and Concept Learning**
Chair	Slagter	Crone	Neville / Murre
15:30	t037 Van der Stigchel	t041 Braams	s013 Berkers
15:50	t038 Hogendoorn	t042 Sowden	s014 Zeelenberg
16:10	t039 Oostwoud Wijdenes	t043 Achterberg	s015 Meeter
16:30	t040 Slagter	t044 Arslan	s016 Neville
16:50	**Coffee/Tea**	Lounge 1	
17:00	Keynote Lecture: ***Eric-Jan Wagenmakers***	Lamoraalzaal	
18:10	**NVP Business Meeting**	Lamoraalzaal	
19:00	**Dinner**	Ritz	
20:00	**Dinner lecture: The Bayesian Brain**	Ritz	
21:00	**Drinks**	The Pub	
21:00	**Club NVP**	Lucky Strike	

CONDENSED SCHEDULE SATURDAY, 19TH

7:00	**Breakfast**	Restaurant	
Parallel Sessions			
Only first authors are mentioned			
Room	**Abdijzaal**	**522**	**Lamoraalzaal**
Session	**Language**	**Perception 2**	**Symposium: Neural Network Profiles and Dynamics**
Chair	Zwaan	van Rijn	Ridderinkhof
8:30	t049 Poletiek	t053 Akyurek	s017 van Reekum
8:50	t050 Zwaan	t054 Brown	s018 Oei
9:10	t051 Willems	t055 Wokke	s019 van de Vijver
9:30	t052 de Groot	t056 Pinto	s020 Geerligs
9:50	**Coffee/Tea**	Lounge 1	
10:00	Keynote Lecture: ***Heidi Johansen-Berg***	Lamoraalzaal	
11:00	**Coffee/Tea**	Lounge 1	
Session	**Decision Making**	**Clinical**	**Symposium: Predicting Human Action**
Chair	van Duijvenvoorde	Rouw	Bekkering
11:10	t061 van Baar	t065 Backhouse	s021 Brass
11:30	t062 Li	t066 Bird	s022 Stapel
11:50	t063 Borst	t067 Rouw	s023 Bekkering
12:10	t064 Blankenstein	t068 Lever	s024 Hintz
12:30	**Lunch**	Restaurant	
Session	**Working Memory**	**Action**	**Symposium: Ultra High-Field MRI in Cognitive Neuroscience**
Chair	Olivers	Verwey	Van der Keuken
13.30	t073 Jongkees	t077 Heeman	s025 van der Zwaag
13.50	t074 van Driel	t078 Press	s026 Johansen-Berg
14:10	t075 Gayet	t079 Los	s027 Moerel
14.30	t076 Sligte	t080 Verwey	s028 Harvey
14:50	**Coffee/Tea**	Lounge 1	
15:00	**NVP Dissertation award ceremony**	Lamoraalzaal	
16:00	**Closing**	Lamoraalzaal	
16:20	**Bus leaves for Alkmaar train station**	Main Entrance to Hotel	

Thursday, Oral Session 1 (15:40-17:00)

Abdijzaal – Development

t001 The influence of sex hormones on brain lateralization and cognitive performance
Tess Beking, Reint Geuze, Baudewijntje Kreukels & Ton Groothuis

t002 Late development of cue integration in childhood co-occurs with emergence of sensory fusion in cortex
Tessa Dekker, Hiroshi Ban, Bauke van der Velde, Andrew Welchman, Martin Sereno & Marko Nardini

t003 The development of haptic 2D shape recognition
Krista Overvliet & Ralf Krampe

t004 Healthy Ageing at Work
Marlon de Jong, Monicque Lorist & Jacob Jolij

Room 522 – Emotion

t005 Emotion Processing in Homo and Pan
Mariska Kret

t006 Self-reinforcing expectancy effects on pain: Behavioral and brain mechanisms
Marieke Jepma & Tor Wager

t007 The role of the right posterior parietal cortex in attentional control of emotional task irrelevant stimuli: a 1 Hz rTMS study
Manon Mulckhuyse, Jan Engelmann, Dennis Schutter & Karin Roelofs

t008 The effect of emotion on gait initiation
Daniëlle Bouman, John F. Stins & Peter J. Beek

Lamoraalzaal – Symposium: The Brain in Control

s001 Cruise control or in control? Neuropharmacology of biased learning and decision-making
Hanneke den Ouden

s002 The role of outcome encoding and reward processing in action control
Henk van Steenbergen

s003 Is intentional inhibition based on ideomotor processes? Evidence from the readiness potential
Davide Rigoni

s004 Networks of control: Comparing frontal cortex connectivity between humans and macaques
Rogier Mars

Thursday, Poster Session 1 (17:00-19:00)

p001 With peppermints you're not my prince: Aroma modulates self-other integration
Claudia Rossi Paccani, Roberta Sellaro, Bernhard Hommel & Lorenza S. Colzato

p002 Grid-cell representations in mental simulation
Jacob L.S. Bellmund, Lorena Deuker, Tobias Navarro Schröder & Christian F. Doeller

p003 Empathic response to cute and scary robots
Lisa van Es, Roy de Kleijn, George Kachergis & Bernhard Hommel

p004 Transcranial Alternating Current Stimulation for Modulating Cognitive Functioning: A Literature Update
Vera Mekern, Roberta Sellaro, Michael Nitsche & Lorenza s. Colzato

p005 Investigating the parameters of transsaccadic memory
Martijn Schut, Jasper Fabius & Stefan Van der Stigchel

p006 Reorganisation of mnemonic networks in hippocampus and medial prefrontal cortex
Silvy Collin, Branka Milivojevic & Christian Doeller

p007 Longitudinal development of neural activity in the frontoparietal network: contributions of age, performance, working memory and brain structure
Sabine Peters, Anna van Duijvenvoorde, Cédric Koolschijn & Eveline Crone

p008 The Hunger Games: Modulation of Salience by Reward in an Experimental Setting
Francesco Walker, Berno Bucker & Jan Theeuwes

p009 Object-based benefit in visual working memory: Is it real?
Benchi Wang, Jan Theeuwes, Christian Olivers & Zhiguo Wang

p010 Inhibition of re-fixations can be flexibly adjusted
Jasper Fabius, Martijn Schut & Stefan Van der Stigchel

p011 Lateralized EEG power spectra predict individual differences in visual awareness
Rob van der Lubbe

p012 Contrast sensitivity in screen-based office tasks for young and old age groups under various illuminance levels
Paul Lemmens, Jan Souman, Hannelore Herremans, Luc Schlangen & Ambali Talen

p013 Posterior alpha EEG dynamics dissociate visual search template from accessory memory items.
Ingmar de Vries, Joram van Driel & Chris Olivers

p014 Tracking the dynamics of visual working memory representations using steady-state-visual-evoked potentials
Anouk M. van Loon, Constantina Archeou & Chris N. L. Olivers

p015 Predicted stimuli have increased chance of entering awareness
Erik Meijs, Heleen Slagter, Floris de Lange & Simon van Gaal

p016 Updating of visual-spatial working memory across saccades
Paul Boon, Artem Belopolsky & Jan Theeuwes

p017 Attentional guidance tracks the strategic transition of accessory memories between visual working memory and long-term memory.
Dirk van Moorselaar, Jan Theeuwes & Chris Olivers

p018 Location- and Feature-based inhibition of reward distractor in visual search
Xin Xue, Jan Theeuwes & Sheng Li

p019 Phasic arousal determines the accessory stimulus effect: a pupillometry study
Klodiana- Daphne Tona, Peter Murphy, Stephen B. Brown & Sander T. Nieuwenhuis

p020 Adolescent Risky Decision Making: Differential Strategies and Underlying Neural Substrates
Laura Dekkers, Anna van Duijvenvoorde, Wouter Weeda, Brenda Jansen & Hilde Huizenga

p021 Does the pupil track attentional guidance by visual working memory contents?
Katya Olmos Solis, Anouk Van Loon & Chris Olivers

p022 Evaluating moral dilemmas: developmental changes and individual differences
Sandy Overgaauw & Eveline Crone

p023 The Hyperactive Agency Detection Device is Not Hyperactive in Threatening Situations
David Maij & Michiel van Elk

p024 Neural correlates of social aggression in young children provoked by negative feedback in a social judgment task.
Ilse C. van Wijk, Bianca G. van den Bulk, Renske Huffmeijer, Marinus H. van IJzendoorn & Marian J. Bakermans-Kranenburg

p025 Role of Partner Pupil size and Pupil Mimicry in the Development of Trust- an fMRI study
Luisa Prochazkova, Eliska Prochazkova, H.Steven Scholte & Mariska Kret

p026 Investigation of Theta Oscillation Phase Locking After Attentional Blink Training
Jessy Ceha, Trudy Buwalda & Marieke van Vugt

p027 Life is unfair, and so is speed skating: Some athletes can randomly benefit from alerting effects due to inconsistent starting procedures
Edwin Dalmaijer, Beorn Nijenhuis & Stefan van der Stigchel

p028 Social Status and Rejection in Bargaining Situations: An Event-Related Potential Study in Adolescents and Adults
Kiki Zanolie, Laura Steinmann & Eveline Crone

p029 Pavlovian reward learning underlies value driven attentional capture
Berno Bucker & Jan Theeuwes

p030 Social Status and Risk-Taking in a Gambling Task: An Event-Related Potential Study in Adolescents and Adults
Laura Steinmann, Eveline Crone & Kiki Zanolie

p031 Selection history determines visual salience
Artem Belopolsky

p032 Increasing the role of belief information in moral judgments by stimulating the right temporoparietal junction
Roberta Sellaro, Berna Güroğlu, Michael Nitsche, Wery van den Wildenberg, Bernhard Hommel & Lorenza Colzato

p033 Neural correlates of prosocial behavior: Compensating social exclusion in a four-player Cyberball Game
Mara van der Meulen, Marinus van IJzendoorn & Eveline Crone

p034 The influence of a scene preview on eye movement behaviour in natural scenes.
Nicola Anderson, Mieke Donk & Martijn Meeter

p035 Age effects on the transfer of sequence knowledge between different types of movements
Jonathan Barnhoorn, Falko Döhring, Edwin van Asseldonk & Willem Verwey

p036 Frontoparietal alpha band stimulation alters spatial attention
Martine van Schouwenburg, Ted Zanto & Adam Gazzaley

p037 Brain potentials highlight stronger implicit food memory for taste than context associations.
Heleen R. Hoogeveen, Jacob Jolij, Gert J. ter Horst & Monicque M. Lorist

p038 The Social Dominance Paradox
Jennifer Cook, Hanneke den Ouden, Cecilia Heyes & Roshan Cools

p039 The difference between looking 'for' and looking 'at' something in a real-world search paradigm
Daniel Schreij, Nicki Anderson & Jan Theeuwes

p040 The impact of salience and visual working memory on the monitoring and control of saccadic behaviour: An eye-tracking and ERP study
Matthew Weaver, Clayton Hickey & Wieske van Zoest

p041 Trust and Reciprocity Development in Adolescence
Suzanne van de Groep, Rosa Meuwese, Kiki Zanolie & Eveline Crone

p042 Friend versus foe: Neural correlates of sharing considerations with liked and disliked peers in adolescents
Elisabeth Schreuders, Sanny Smeekens, Antonius N. H. Cillessen & Berna Güroğlu

p043 The role of visuospatial attention during retention of information in visual short-term memory
Marlies Vissers, Rasa Gulbinaite, Bob Bramson, Tijl van den Bos & Heleen Slagter

p044 Memorable in a Glimpse: Recognition of Memorable and Non-Memorable Pictures in Rapid Serial Visual Presentation
Nico Broers, Mary C. Potter & Mark R. Nieuwenstein

p045 Emotional and cognitive characteristics of Misophonia
Mercede Erfanian & Romke Rouw

p046 Visual in-car warnings: how fast do drivers respond?
Remo van der Heiden, Christian Janssen, Lidwien Visser-Goossens & Chantal Merkx

p047 Functional specialization of the male insula during taste perception.
Jelle R. Dalenberg, Heleen R. Hoogenveen, Remco J. Renken, Dave R. M. Langers & Gert J. ter Horst

p048 Was that a threat? A classical conditioning study on reinforcement-driven attentional bias
Daniel Preciado, Jaap Munneke & Jan Theeuwes

p049 The influence of individual differences in action production on identification of others' affective states
Rosanna Edey, Iroise Dumontheil, Jennifer Cook & Clare Press

p050 Pupil Dilation Reflects Unattended Violations of The Beat
Atser Damsma & Hedderik van Rijn

p051 Title: Imitative and complementary actions in peri- and extrapersonal space
Tim Faber, Michiel van Elk & Kai Jonas

p052 Attention-Based Perceptual Learning Does Not Influence Conscious Access
Micha Heilbron, Surya Gayet, Chris Paffen & Stefan van der Stigchel

p053 Domain-general motor contributions to duration perception
Daniel Yon & Clare Press

p054 Attention for emotions in bonobos (Pan paniscus)
Linda Jaasma, Evy van Berlo, Mariska Kret, Thomas Bionda & Jasper Wijnen

p055 Visual selectivity is not enhanced by arousal.
Árni Gunnar Ásgeirsson & Sander Nieuwenhuis

p056 Attentional scope modulates alpha oscillations over occipital areas; consequences for multisensory integration.
Raquel London, Elger Abrahamse & Durk Talsma

p057 Social cognition and its embodied roots
Sebo Uithol

p058 Streaming conscious movement: is Tai Chi Chuan boosting age-related cognitive & motoric functioning?
Roderik Gerritsen

p059 On the relative contributions of multisensory integration and crossmodal exogenous spatial attention to multisensory response enhancement
Nathan van der Stoep, Charles Spence, Tanja Nijboer & Stefan Van der Stigchel

p061 Use it or lose it? The case of temporal integration in aging
Jefta Saija, Deniz Başkent, Tjeerd Andringa & Elkan Akyürek

p062 Do perceptual biases induced by visual attention follow predictions from a neural model?
B.P. Klein, C.L.E. Paffen, S.F. te Pas & S.O. Dumoulin

p063 Hanging out with the right crowd: Peer influence on risk-taking behavior in adolescence
Jorien van Hoorn, Eveline A. Crone & Linda van Leijenhorst

p064 Exploiting social-categorical knowledge to predict individual human behavior
Egbert Hartstra, Suhas Vijayakumar & Harold Bekkering

p065 Mismatch Negativity Based Neurofeedback for Cochlear Implant Users
Annika Luckmann, Deniz Baskent & Jacob Jolij

p066 Using Numerosity Productions to Study Mathematical Development: Evidence for an Operational Momentum Effect in Preschoolers
Oliver Lindemann

p067 Salivary testosterone and cortisol differentially predict competitive decision-making in predator-prey contests
Michael Giffin, Eliska Prochazkova & Carsten De Dreu

p068 Structural development of the social brain and links with social functioning
Rosa Meuwese, Kathryn L. Mills, Anna C. K. van Duijvenvoorde, Eveline A. Crone & Berna Güroğlu

p069 Does affective bipolarity drive creativity?
Bruno Bocanegra

p070 The influence of features in visual working memory: effects on posterior brain areas
Michel Quak & Durk Talsma

p071 Prior knowledge of the locations of potentially relevant objects reduces effects of visual salience
Jeroen Silvis & Mieke Donk

p072 Cognitive flexibility game training in healthy seniors
Jessika Buitenweg, Renate van de Ven, Jaap Murre, Ben Schmand & Richard Ridderinkhof

p073 The Effects of Temporal Integration on Working Memory
Michael Wolff & Elkan Akyürek

p074 Flickering your attention: Evaluation of temporal attention using SSVEP
Anderson Mora-Cortes & Mike X Cohen

p075 Interpreting ambiguity in adolescence: examining interpretation bias for health and social information
Merel Koopmans, Lauren Heathcote, Elaine Fox, Christopher Eccleston & Jennifer Lau

p076 Modulating face memory in younger and older adults using non-invasive brain stimulation.
Tegan Penton, Marin Tamm & Michael J Banissy

p077 The relation between affective touch and pupil size
Chris Dijkerman & Roel van Hooijdonk

p078 Liking versus complexity: Decomposing the inverted U-curve by accounting for individual differences
Yağmur Güçlütürk, Richard Jacobs & Rob van Lier

p079 Holding hands alleviates pain and reduces pain-specific brain responses
Marina Lopez Sola & Tor Wager

p080 Effects of target and reward-signaling distractor proximity on attentional capture
Bronagh McCoy & Jan Theeuwes

p081 Skin conductance distinguishes between familiar and unfamiliar buildings
Richard Jacobs & Rob Van Lier

p082 Prospective event representation through hippocampal regularity learning
Sander Bosch, Branka Milivojevic, Peter Smulders, Floris de Lange & Christian Doeller

p083 Cue-elicited food-seeking in an obesogenic environment
Sanne de Wit, Poppy Watson, Reinout Wiers & Bernhard Hommel

p084 Controlling the Avatar: Dysfunctional Mechanisms in Third Person Body Control
Hein van Schie, Willem Sleegers & Ruud van Loon

p086 The Mental Whiteboard Hypothesis on Serial Order in Working Memory
Elger Abrahamse, Jean-Philippe van Dijck, Steve Majerus & Wim Fias

p087 An event-based Account of Conformity
Diana Kim & Bernhard Hommel

Friday, Oral Session 2 (08:30-09:50)

Abdijzaal – Cognitive Control

t013 Transcutaneous Vagus Nerve Stimulation Enhances Post-error Slowing
Jelle van Leusden, Roberta Sellaro, Daphne Tona, Bart Verkuil, Sander Nieuwenhuis & Lorenza Colzato

t014 Control over target selection determines switch costs in multiple-target search.
Eduard Ort, Johannes Fahrenfort & Chris Olivers

t015 Through the eyes, slowly
Joanne van Slooten, Tomas Knapen & Jan Theeuwes

t016 The effect of atomoxetine on random and directed exploration in humans
Christopher Warren, Robert Wilson, Jos Bosch, Jonathan Cohen & Sander Nieuwenhuis

Room 522 – Memory and Learning

t017 Hermann Ebbinghaus' Classic Forgetting Curve from 1880: Replication and Analysis
Jaap Murre & Joeri Dros

t018 Ungoverned and Unstoppable Long-term Priming of Visual Search
Wouter Kruijne & Martijn Meeter

t019 An Individual's Rate of Forgetting is Stable over Time, but Differs Across Materials
Florian Sense, Friederike Behrens, Rob R. Meijer & Hedderik van Rijn

t020 Decoding the Future: Single Trial Analysis of Anticipatory Responses in Prestimulus EEG Activity
Jacob Jolij

Lamoraalzaal – Symposium: Computational Cognitive Neuroscience

s005 Population receptive field reconstruction in visual cortex
Serge Dumoulin

s006 The influence of feature-based attention on visual processing in the human brain
Tomas Knapen

s007 Probing cortical representations with deep learning
Marcel van Gerven

s008 Not all stimuli are processed equally. Different optimal architectures for different types of stimuli.
H.Steven Scholte

Friday, Oral Session 3 (11:10-12:30)

Abdijzaal – Attention 1

t025 How individual differences in learning strategies can influence visual attention
Sara Jahfari & Jan Theeuwes

t026 The impending demise of the item in visual search
Christian Olivers & Johan Hulleman

t027 Neural markers of perceptual integration in visual cortex without conscious access
Johannes Fahrenfort, Jonathan van Leeuwen, Chris Olivers & Hinze Hogendoorn

t028 Reward Alters Perception of Time
Michel Failing & Jan Theeuwes

Room 522 – Perception 1

t029 Spatial coherence and contrast energy of an image index complexity and signal the need for recurrent processing
Noor Seijdel, Iris Groen, Sara Jahfari, Sennay Ghebreab, Victor Lamme & H.Steven Scholte

t030 Deep vision model reveals consistent neural object recognition architecture
Kandan Ramakrishnan, H.Steven Scholte, Arnold W.M.Smeulders & Sennay Ghebreab

t031 Differential representation of man-made and natural images in scene-selective cortex
Iris Groen, Edward Silson & Chris Baker

t032 Creating colored letters: Can synesthesia be learned?
Olympia Colizoli, Jaap M. J. Murre, H. Steven Scholte, Daan M. van Es, Tomas Knapen & Romke Rouw

Lamoraalzaal – Symposium: Towards a cognitive account of human creativity

s009 Understanding and Improving the Selection of Creative Ideas
Simone Ritter

s010 The Creative Paradox of Autonomy and Constraints: Task Structure and Individual Differences
Eric F. Rietzschel

s011 Mad Genius Revisited: Risk of Psychopathology, Biobehavioral Approach-Avoidance, and Creativity
Matthijs Baas

s012 Enhancing Creativity
Bernhard Hommel

Friday, Poster Session 2 (13:30-15:30)

p088 γ-Aminobutyric acid (GABA) improves action selection processes: evidence from transcutaneous vagus nerve stimulation (tVNS) and synthetic GABA administration
Laura Steenbergen, Roberta Sellaro, Ann-Kathrin Stock, Christian Beste & Lorenza Colzato

p089 A single bout of meditation biases cognitive control but not attentional focusing: Evidence from the global-local task
Pauline van der Wel, Roberta Sellaro, Bernhard Hommel & Lorenza Colzato

p090 Neurotransmitters as food supplements: the behavioral effect of GABA
Evert Boonstra, Roy de Kleijn, Lorenza S. Colzato, Anneke Alkemade, Birte U. Forstmann & Sander Nieuwenhuis

p091 Action Selection as a Source of Visual Bias
Davood Gozli

p092 Dissociating sensory from decision processes in human perceptual decision making
Pim Mostert, Peter Kok & Floris P. de Lange

p093 Evolving the keys to visual crowding
Erik van der Burg, Christian Olivers & John Cass

p094 The Full Body Illusion in Action
Lieke Swinkels, Hein van Schie & Arjan ter Horst

p095 The influence of a scarcity mindset in every day decision making
Inge Huijsmans, Leticia Rettore Micheli, Wenwen Xie, Mirre Stallen & Alan Sanfey

p096 Convergent and divergent thinking in creativity associate with differences in EEG delta power
Nathalie Boot, Simon van Gaal, Matthijs Baas & Carsten de Dreu

p097 Norepinephrine modulates resting-state MRI functional connectivity in the human brain
Ruud van den Brink, Thomas Pfeffer, Tobias Donner & Sander Nieuwenhuis

p098 The relationship between physiological arousal and inhibitory control in adults with autism spectrum disorder.
Marieke Kuiper, Lisette Verhoeven & Hilde Geurts

p099 Integrative or Lexicographic Decision Strategies? A Drift Diffusion Model Study
Laura Dekkers, Noor Seijdel, Wouter Weeda, Brenda Jansen & Hilde Huizenga

p100 Learning from internal and external error signals in second language acquisition
Sybrine Bultena, Kristin Lemhöfer, Claudia Danielmeier & Harold Bekkering

p101 When failure doesn't matter: Second chances promote risky investments
Rob Nijenkamp, Mark Nieuwenstein, Ritske De Jong & Monicque Lorist

p102 What is the Effect of Economic Anticipation on Behavioral Risk Taking? An Experimental Study on the Impact of Economic Messages.
Diamantis Petropoulos Petalas, Paul Hendriks Vettehen & Hein van Schie

p103 A novel algorithm for action component substitution
Roy de Kleijn, George Kachergis & Bernhard Hommel

p104 Risk-taking in teens with autism spectrum disorders (ASD) on the Balloon Analogue Risk Task (BART) (working title)
Linda Olde Dubbelink & Hilde Geurts

p105 Visual information processing during recovery from prolonged disorders of consciousness: Comparing behavioural indices to brain responses. (Part one of two)
Viona Wijnen & Henk Eilander

p106 Ten to Twelve Years After Early Intensive Neurorehabilitation of Young Patients with Severe Disorders of Consciousness: Research and a Documentary (Part two of two)
Viona Wijnen, Henk Eilander, Evert Schouten & Lavrijsen Jan

p107 Should I Stay or Should I Go? How Reward Functions Influence Discretionary Task Interleaving
Christian Janssen, Emma Everaert, Heleen Hendriksen, Ghislaine Mensing & Laura Tigchelaar

p108 Tyrosine incorporated in a protein source enhances inhibitory control in healthy adults
Valerie Junk, Martijn Veltkamp, Roberta Sellaro & Lorenza Colzato

p109 Should I stay or should I go? Individual differences in effects of methylphenidate on the affective biasing of instrumental action
Jennifer C. Swart, Jennifer L. Cook, Monja I. Froböse, Dirk E.M. Geurts, Roshan Cools & Hanneke E.M. den Ouden

p110 Interrupt me! Comparing self-interuptions with external interruptions and creating an interruption management system
Ioanna Katidioti, Jelmer Borst, Marieke van Vugt & Niels Taatgen

p111 The perspective structure of visual space: computations and experimental results
Casper Erkelens

p112 The "Semantic P600" in Second Language Processing: When Syntax Conflicts with Semantics
Xiaochen Zheng & Kristin Lemhöfer

p113 On the dimensionality of representations measured with fMRI
Lukas Snoek & H.Steven Scholte

p114 Probing short-term face memory in developmental prosopagnosia
Punit Shah, Anne Gaule, Sebastian Gaigg, Geoffrey Bird & Richard Cook

p115 Eye-opener: pupil signals decision uncertainty
Anne Urai & Tobias Donner

p116 The neural origin of spatio-numerical associations: A transcranial magnetic stimulation study
Michael Wiemers, Dennis Schutter, Miles Wischnewski, Harold Bekkering & Oliver Lindemann

p117 Temporal and Identity Prediction in Visual-Auditory Events
Thijs van Laarhoven, Jeroen J. Stekelenburg & Jean Vroomen

p118 My error, your loss: Investigating individual differences in monitoring of errors that have consequences for others.
Margit Ruissen, Sandor de Munck, Sandy Overgaauw & Ellen de Bruijn

p119 An MEG Investigation of Repetition and Expectation Effects in Time Perception
Friederike Behrens & Mariska Kret

p120 Altered electrophysiological connectivity during visual word recognition relates scales with reading dysfluency in dyslexic children
Gojko Žarić, João M. Correia, Gorka Fraga González, Jurgen Tijms, Maurits W. van der Molen & Milene Bonte

p121 Attempts to fit the leaky, competing accumulator model
Steven Miletic & Leendert van Maanen

p122 Can brain training facilitate recovery after stroke?
Renate Michelle van de Ven, Ben Schmand, Dick Veltman & Jaap Murre

p123 Social Feedback Processing in Alcohol Dependent Patients
Frederik van der Veen & Ingmar Franken

p124 Contributions of expected sensory and affective action effects to action selection and performance: evidence from forced- and free-choice tasks
Dominique Lippelt, Bernhard Hommel, Roland Pfister & Emine Gurbuz

p125 Task-shielding in dual-task interference
Mark Nieuwenstein, Nico Broers & Sabine Scholz

p126 Sustaining attention for a prolonged period of time decreases attentional control and stability: neural and behavioral evidence
Leon Reteig, Sam Prinssen, Ruud van den Brink, Mike Cohen & Heleen Slagter

p127 Cognitive control in multimedia multitaskers: A replication study
Wisnu Wiradhany & Mark R. Nieuwenstein

p128 Influences of Unconscious Priming on the Rostral Cingulate Zone
Martijn Teuchies, Jelle Demanet, Nura Sidarus, Patrick Haggard & Marcel Brass

p129 In Time with Rhythms - Beat Perception and Sensorimotor Synchronisation
Nadine Schlichting

p130 Infants Use Vision and Proprioception in Action Development
Janny Stapel, Kerstin Rosander & Claes von Hofsten

p131 Laterality and Body Ownership: Effect of Handedness on Experience of the Rubber Hand Illusion
Miranda Smit, Dagmar Kooistra, Ineke van der Ham & Chris Dijkerman

p132 Is there evidence for a mixture of two processes in perceptual decision making?
Suzanna van Baardewijk, Steven Miletić & Leendert van Maanen

p133 Incidental second language learning of grammatical gender in a natural communicative situation
Annika Christine Brandt & Kristin Lemhöfer

p134 Shortcuts in analysing hierarchical data may create spurious effects
Udo Boehm, Maarten Marsman, Dora Matzke, Hedderik van Rijn & Eric-Jan Wagenmakers

p135 Teaching sterile skills in anesthesia: is providing context helpful for robust skill acquisition?
Fokie Cnossen, Katja Paul, Roelof Lettinga & Wietasch Götz

p136 Optimizing functional MRI sequences at 7 Tesla for subcortical nuclei
Gilles de Hollander, Max Keuken, Robert Trampel & Birte Forstmann

p137 A spatial gradient in phonetic recalibration by lipread speech
Mirjam Keetels, Jeroen Stekelenburg & Jean Vroomen

p139 Risky decision-making in adolescent girls: The role of testosterone and reward circuitry
Zdena Op de Macks

p140 Learning and updating of stimulus-reward associations are reflected by electrical brain activity
Berry van den Berg, Benjamin Geib, Rene San Martin & Marty Woldorff

p141 Do we need higher-level image integration during rivalry?
Sjoerd Stuit, Maurits Barendregt, Maarten van der Smagt & Susan te Pas

p142 Revealing neural locus of scanning and reactive saccade adaptation through computational modelling
Daniel van Es, Tomas Knapen & Jan Theeuwes

p143 Spared route learning in Korsakoff's syndrome
Erik Oudman, Stefan Van der Stigchel, Tanja C.W. Nijboer, Jan W. Wijnia & Albert Postma

p144 Effects of Grasp Compatibility on Long-Term Memory for Objects
Ivonne Canits, Diane Pecher & René Zeelenberg

p145 Pupil size reflects semantic brightness of words
Sebastiaan Mathôt, Jonathan Grainger & Kristof Strijkers

p147 Online assessment of cognitive problems associated with cancer and cancer treatment: Validation of a new self-administered online neuropsychological test battery
Heleen Feenstra, Jaap Murre, Ivar Vermeulen & Sanne Schagen

p148 Investigating inhibitory processes within the motor cortex during conflict resolution using paired-pulse transcranial magnetic stimulation
Dilene van Campen, Egbert Hartsra, Katrin Sutter, Markus Ullsperger, Ivan Toni & Rogier Mars

p149 The effect of motor preparation on the temporal processing of auditory information
Jim Maarseveen, Chris L.E. Paffen, Frans A.J. Verstraten & Hinze Hogendoorn

p150 Lateralization of spatial frequency processing: Effects of task factors
Sanne Brederoo & Mark Nieuwenstein

p151 The automaticity of language-perception interactions
Jolien C. Francken, Erik L. Meijs, Peter Hagoort, Simon van Gaal & Floris P. de Lange

p152 Out of da group: linguistic errors made by outgroup members evoke larger error-related processing.
Marte Otten, Kai Jonas & Mahzarin Banaji

p153 Entraining alpha oscillations through tACS to boost creative problem solving
Michael Banissy, Caroline Di Bernardi Luft, Nick Thompson & Joydeep Bhattacharya

p154 Decision-related oscillatory activity in human visual cortex is linked to pupil dilation
Thomas Meindertsma, Niels Kloosterman, Guido Nolte, Andreas Engel & Tobias Donner

p155 Long-term motor adaptation: Time is not what matters
Jeroen Smeets, Krista Overvliet & Katinka van der Kooij

p156 A functional architecture of the brain for vision
Renske van der Hoeven, Nikki Lammers, Selma Lugtmeijer, Anouk Smits, Yair Pinto & Edward de Haan

p157 Viewing faces through apertures
Jennifer Murphy & Richard Cook

p158 Zapping away sustained attention: electrical stimulation of the anterior cingulate cortex impairs vigilance
Ilja Sligte, Michael Giffin & Heleen Slagter

p159 The Effects of Combined Transcranial Direct Current Stimulation and Alcohol Avoidance Training as a Treatment for Alcoholic Inpatients
Tess den Uyl, Thomas Gladwin, Mike Rinck, Johannes Lindenmeyer & Reinout Wiers

p160 A Unified Uncertainty Theory of Consciousness
Sasha Ondobaka & Karl Friston

p161 Creativity and language: neurophysiological correlates of passive conceptual expansion
Karolina Rataj

p162 Disentangling the cortical representations of reward value and probability
Iris Schutte, Ivo Heitland & J. Leon Kenemans

p163 ERP and time-frequency indices of conflict and error processing: convergence across task switching and attentional network paradigms.
Kerwin J.F. Olfers, Ruud L. van den Brink & Guido P.H. Band

p164 Viewing-position effects in meaningless object viewing
Lotje van der Linden, Gregory J. Zelinsky & Françoise Vitu

p165 Pupillary Correlates of Error Awareness and Post-Error Slowing
Sarah Maass, Johanna Kuhr, Simone Sprenger & Hedderik van Rijn

p166 Semantic vector space models predict neural responses to complex visual stimuli
Umut Güçlü & Marcel van Gerven

p167 Neuromodulatory effects of running based on gender differences
Saskia Heijnen, Bernhard Hommel, Armin Kibele & Lorenza Colzato

p168 A case of selective progressive buccofacial apraxia, and the role of motor programming in verbal working memory.
Edward de Haan, Martine van Zandvoort, Sarai Boelema & Ludo van der Pol

p170 Consciousness is mandatory for proactive control, but not reactive control: A somatosensory study
Yael Salzer, Alex Gotler & Avishai Henik

p171 Long term associations and serial recall: Using synaesthesia to probe memory for sequences
Lina Teichmann, Mark Nieuwestein & Anina Rich

Friday, Oral Session 4 (15:30-16:50)

Abdijzaal – Attention 2

t037 There is no attentional global effect: Attentional shifts are independent of the saccade endpoint
Stefan Van der Stigchel & Jelmer de Vries

t038 Voluntary saccadic eye movements ride the attentional rhythm
Hinze Hogendoorn

t039 Evidence for optimal feature integration across saccades
Leonie Oostwoud Wijdenes, Louise Marshall & Paul M. Bays

t040 A role for the ventral striatum in selective awareness: An intracranial EEG study of the attentional blink
Heleen Slagter, Ali Mazaheri, Leon Reteig, Ruud Smolders, P Schuurman & Damiaan Denys

Room 522 – Social

t041 Longitudinal changes in social brain development
Barbara Braams & Eveline Crone

t042 Transcranial Current Stimulation of the Temporoparietal Junction Improves Lie Detection
Sophie Sowden, Gordon R T Wright, Michael J Banissy, Caroline Catmur & Geoffrey Bird

t043 Control your anger! The neural basis of aggression regulation in response to social rejection
Michelle Achterberg, Anna van Duijvenvoorde, Marian Bakermans-Kranenburg & Eveline Crone

t044 The role of feedback in the development of theory of mind
Burcu Arslan, Rineke Verbrugge, Niels Taatgen & Bart Hollebrandse

Lamoraalzaal – Symposium: Knowledge Representation and Concept Learning

s013 The neural dynamics of linguistic conceptual knowledge accumulation and updating
Ruud Berkers

s014 The role of the motor system in memory for objects and words
René Zeelenberg

s015 How your implicit memory is like your explicit one: Effects of time and context
Martijn Meeter

s016 Modeling knowledge formation with deep learning networks
David Neville

Saturday, Oral Session 5 (08:30-09:50)

Abdijzaal – Language

t049 Semantic, not positional distances between dependencies affect sentence processing difficulty.
Fenna Poletiek & Jun Lai

t050 Do Cognitive-Linguistic Findings Extend to Social Psychology? A Registered Multilab Replication Attempt
Rolf Zwaan & Anita Eerland

t051 Influence of reading fiction on connectivity in cortical areas for language and mentalizing
Roel Willems & Franziska Hartung

t052 Semantic influences on visual attention
Floor de Groot, Falk Huettig & Christian N. L. Olivers

Room 522 – Perception 2

t053 Getting more, for less: The benefits of temporal integration for perception and working memory
Elkan Akyurek, Michael Wolff, Sabine Scholz, Nils Kappelmann, Marc Volkert & Hedderik van Rijn

t054 Noradrenergic and cholinergic modulation of late ERP responses to deviant stimuli
Stephen Brown, Nic van der Wee, Martijn van Noorden, Erik Giltay & Sander Nieuwenhuis

t055 The workings of metacognition during perceptual decision-making
Martijn Wokke, Axel Cleeremans & K. Richard Ridderinkhof

t056 Split brain, unified consciousness
Yair Pinto, David Neville, Marte Otten, Edward de Haan, Victor Lamme & Mara Fabri

Lamoraalzaal – Symposium: Neural Network Profiles and Dynamics Begin to Shed Light on Neurocognitive Aging

s017 Does the control of emotion require intact cognitive control? Examples from aging research
Carien van Reekum

s018 Stress effects on (de)activation during emotional inhibition in healthy aging
Nicole Oei

s019 Frontostriatal anatomical connections predict age- and difficulty-related reinforcement learning
Irene van de Vijver

s020 Functional networks and connectivity dynamics in the aging brain
Linda Geerligs

Saturday, Oral Session 6 (11:10-12:30)

Abdijzaal – Decision Making

t061 Kind beyond belief: how norms and second-order expectations influence trust game reciprocity
Jeroen van Baar, Luke Chang & Alan Sanfey

t062 Revisiting the dual-systems model of choice using fMRI: Cognitive engagement and disengagement explain biases in gain/loss framing
Rosa Li, David Smith, John Clithero, Vinod Venkatraman, R. McKell Carter & Scott Huettel

t063 Discovering Processing Stages from EEG Data with Hidden semi-Markov Models
Jelmer Borst & John Anderson

t064 Neural correlates of risky and ambiguous gambling during choice and feedback
Neeltje Blankenstein, Eveline Crone & Anna van Duijvenvoorde

Room 522 – Clinical

t065 A case study of skill development and changes in phenomenology of blind users of a sensory substitution device.
Kate Backhouse, Amir Amedi & Romke Rouw

t066 Alexithymia, not autism, is related to impaired interoception
Geoffrey Bird, Punit Shah, Richard Hall & Caroline Catmur

t067 Autistic traits in people with Synesthesia?
Romke Rouw & H.Steven Scholte

t068 Atypical Working Memory Decline across the Adult Lifespan in Autism Spectrum Disorder?
Anne Geeke Lever, Markus Werkle-Bergner, Andreas Brandmaier, Richard Ridderinkhof & Hilde Geurts

Lamoraalzaal – Symposium: Predicting Human Actions: Specialized and General Mechanisms

s021 The clever Chameleon: evidence for anticipated action
Marcel Brass

s022 The role of action experience for action prediction development
Janny C. Stapel

s023 Predictions at the bowling lane: evidence from behavioral and MEG experiments
Harold Bekkering

s024 The nature and limits of mechanisms in anticipatory language processing
Florian Hintz

Saturday, Oral Session 7 (13:30-12:30)

Abdijzaal – Working Memory

t073 Tyrosine modulates the effect of transcranial direct current stimulation on working memory in healthy individuals
Bryant Jongkees, Roberta Sellaro, Bernhard Hommel, Simone Kühn & Lorenza Colzato

t074 Local and interregional alpha oscillatory dynamics dissociate search template from ordinary working memory
Joram van Driel, Eren Günseli, Martijn Meeter & Christian Olivers

t075 Memory shapes perception: increased BOLD response, higher decoding accuracies and faster access to awareness for visual input that matches the content of visual working memory.
Surya Gayet, Matthias Guggenmos, Chris Paffen, Stefan Van der Stigchel, Thomas Christophel & Philipp Sterzer

t076 Building better brains: modulating working memory capacity and content with electrical brain stimulation
Ilja Sligte

Room 522 – Action

t077 When does the oculomotor competition start?
Jessica Heeman, Stefan Van der Stigchel & Jan Theeuwes

t078 Domain-generality of sensory prediction processes during action: A closer look at the cancellation account
Clare Press & Daniel Yon

t079 A multiple trace theory of temporal preparation
Sander Los, Wouter Kruijne & Martijn Meeter

t080 A cognitive framework for explaining serial processing and sequence execution strategies.
Willem Verwey, Charlie Shea & David Wright

Lamoraalzaal – Symposium: Opportunities and Applications of Ultra High-Field MRI in Cognitive Neuroscience

s025 Ultra high-field MRI: opportunity or challenge?
Wietske van der Zwaag

s026 Studying experience-dependent plasticity with high field MRI
Heidi Johansen-Berg

s027 Processing of natural sound aspects in the human auditory cortex
Michelle Moerel

s028 Imaging representations of quantity in human association cortex
Ben Harvey

Probabilistic Models of Sensorimotor Control and Decision Making

Daniel Wolpert
University of Cambridge

The effortless ease with which humans move our arms, our eyes, even our lips when we speak masks the true complexity of the control processes involved. This is evident when we try to build machines to perform human control tasks. I will review our work on how humans learn to make skilled movements covering probabilistic models of learning, including Bayesian and structural learning as well as the role of context in activating motor memories. I will also review our work showing the intimate interactions between decision making and sensorimotor control processes This includes the bidirectional flow of information between elements of decision formations such as accumulated evidence and motor processes such as reflex gains. Taken together these studies show that probabilistic models play a fundamental role in human sensorimotor control.

K1

Decision Making and Working Memory in Early Visual Cortex

Pieter Roelfsema
Netherlands Institute of Neuroscience

Most theories hold that early visual cortex is responsible for the local analysis of simple features while cognitive processes take place in higher areas of the parietal and frontal cortex. However, these theories are not undisputed because there are findings that implicate early visual cortex in visual cognition in tasks where subjects reason about what they see. I will discuss the contribution of early visual cortex to hierarchical decision-making and working memory. We used a hierarchical decision-making task to examine how monkeys solve a decision tree with stochastic sensory evidence at multiple branching points. We found a first parallel phase of decision making in areas V1 and V4. In this phase, multiple decision were considered at the same time. This was followed by an integration phase where the optimal overall strategy crystallized as the result of interactions between the local decisions. In the working memory task, we examined how visual information is maintained in the different layers of V1. When the monkeys memorized a stimulus, we found a profile of top-down inputs in the superficial layers and layer 5 causing an increase in the firing rates in feedback recipient layers. A visual mask erased the V1 memory activity, but it then reappeared at a later point in time. These results provide new insights in the role of early visual cortex in the implementation of complex mental programs.

K2

The Crisis of Confidence in Psychological Science

Eric-Jan Wagenmakers
University of Amsterdam

In the past few years, psychological science has undergone a paradigmatic revolution. This revolution is the direct consequence of a "crisis of confidence", the increasing realization that many published findings may be fiction rather than fact. The first part of this presentation provides some historical background and describes the defining events that have caused the revolution ("the straws that broke the camel's back"). The middle part of this presentation discusses the current changes and initiatives that seek to promote openness and align the incentives for the field ("truth-finding") with those for individual researchers ("publish, not perish"). The final part of this presentation outlines a vision for the future, illustrated with a hypothetical example: the perfect experiment.

K3

Imaging and Stimulating Adaptive Brain Plasticity

Heidi Johansen-Berg
University of Oxford

Animal studies show that the adult brain shows remarkable plasticity in response to learning or recovery from injury. Non-invasive brain imaging techniques can be used to detect systems-level structural and functional plasticity in the human brain. This talk will focus on how brain imaging has allowed us to monitor healthy brains learning new motor skills, to assess how brains recover after damage, such as stroke, and how they adapt to change, such as limb amputation. Although imaging is useful to detect such adaptations, many brain imaging measures are non-specific and do not allow us to pinpoint the underlying cellular changes that are driving observed effects. The talk will also discuss studies in animal models in which both imaging and histological approaches can be used to shed light on the underlying biological drivers for structural plasticity detected using MRI. Finally, the talk will discuss how brain stimulation can be used to manipulate brain remodelling. For example, using transcranial direct current stimulation (tDCS) to the motor cortex we can speed people¹s learning of a new task, alter their brain chemistry, or improve function in stroke patients. FMRI identifies changes in cortical activity that may mediate these functional benefits. In future, imaging could be used to guide individually targeted brain stimulation to enhance adaptive brain plasticity.

K4

SYMPOSIA

The Brain in Control

Chairs:
Henk van Steenbergen (Leiden University)
Richard Ridderinkhof (University of Amsterdam)

What do we do when we exert control? Cognitive Control increasingly refers to Perception-Action Coordination, and is increasingly seen as integrated with and strongly modulated by learning and reward. This symposium will reveal the latest on control networks by comparative analysis of network connectivity, and by studying the roles of these networks in those control functions that are currently among the most hotly debated (e.g., how does action preparation modulate perception and intention).

s001

Cruise control or in control? Neuropharmacology of biased learning and decision-making
Hanneke den Ouden
Donders Institute for Brain Cognition and Behaviour, Radboud University Nijmegen

s002

The role of outcome encoding and reward processing in action control
Henk van Steenbergen
Institute of Psychology, Leiden University

s003

Is intentional inhibition based on ideomotor processes? Evidence from the readiness potential
Davide Rigoni
Department of Experimental Psychology, Ghent University

s004

Networks of control: Comparing frontal cortex connectivity between humans and macaques
Rogier Mars
Centre for Functional MRI of the Brain, University of Oxford

Computational Cognitive Neuroscience

Chairs:
H.Steven Scholte (University of Amsterdam)
Marcel van Gerven (Radboud University)

Cognitive neuroscience as a discipline is rapidly developing. The last 15 years have seen a transformation towards integrating models of information processing with neurophysiological and fMRI data. In this symposium two of these approaches are highlighted, the first using single-voxel population receptive field estimates to quantify aspects of cognitive processing, the second using correlational approaches to relate the structure of deep convolutional neural network models of information processing to imaging data.

s005

Population receptive field reconstruction in visual cortex
Serge Dumoulin
Experimental Psychology, Utrecht University

s006

The influence of feature-based attention on visual processing in the human brain
Tomas Knapen
Cognitive Psychology, Vrije Universiteit Amsterdam

s007

Probing cortical representations with deep learning
Marcel van Gerven
Donders Institute for Brain, Cognition and Behaviour. Radboud University

s008

Not all stimuli are processed equally. Different optimal architectures for different types of stimuli.
H.Steven Scholte
Department of Brain & Cognition, University of Amsterdam

Towards a cognitive account of human creativity

Chair:
Bernhard Hommel (Leiden University)

Creativity is of outmost importance but how does it work? We review recent developments and discuss: how people identify particularly promising ideas, and how this ability can be improved; how creative performance is affected by task structure, and how this interacts with individual differences; how creativity is related to personality disorders and related motivational subsystems; and how creative processes can be systematically enhanced by means of meditation, neurofeedback etc.

s009

Understanding and Improving the Selection of Creative Ideas
Simone Ritter
Radboud University Nijmegen, Behavioural Science Institute

s010

The Creative Paradox of Autonomy and Constraints: Task Structure and Individual Differences
Eric F. Rietzschel
University of Groningen, Department of Psychology

s011

Mad Genius Revisited: Risk of Psychopathology, Biobehavioral Approach-Avoidance, and Creativity
Matthijs Baas
University of Amsterdam, Department of Psychology

s012

Enhancing Creativity
Bernhard Hommel
University of Leiden, Institute of Psychology

Knowledge Representation and Concept Learning

Chairs:
D. Neville (Radboud University)
J.M.J.Murre (University of Amsterdam)

Goal of this symposium is to delineate the core mechanisms underpinning knowledge acquisition, representation and concept learning. A fundamental question for both memory and language is how abstract mental representations are gradually constructed on the basis of the accumulation of episodic information. From the perspective of memory, the question is how semantic memory which is rule-like in nature and abstracted from a specific spatio-temporal context is acquired based on the gradual accumulation of individual episodic events. From the perspective of language, the question of interest instead is how the 'meaning' of linguistic entities such as words is acquired from linguistic use and exposure and stored in and abstract conceptual representations. In both domains crucial questions such as *'What information is stored in an abstract representation?'* or *'How are abstract representations stored and processed in the brain?'* still remain unclear and unresolved. In this symposium, we want to explore the overlapping brain systems underpinning abstract knowledge and language concepts. By combining cognitive modeling and brain imaging techniques, core computational mechanisms can be isolated that provide further insights in how abstract information is processed in the brain.

s013

The neural dynamics of linguistic conceptual knowledge accumulation and updating
Ruud Berkers
Donders Institute for Brain, Cognition and Behaviour, Radboud University

s014

The role of the motor system in memory for objects and words
René Zeelenberg
Psychology Department, Erasmus University Rotterdam

s015

How your implicit memory is like your explicit one: Effects of time and context
Martijn Meeter
Section of Cognitive Psychology, Vrije Universiteit

s016

Modeling knowledge formation with deep learning networks
David Neville
Donders Institute for Brain, Cognition and Behaviour. Radboud University

Neural Network Profiles and Dynamics Begin to Shed Light on Neurocognitive Aging

Chair:
Richard Ridderinkhof (University of Amsterdam)

Your aunt Betsy is aged 78. She's beginning to demonstrate signs of neurocognitive decline. She seeks to cope, and turns to you (cognitive [neuro]scientist) for answers. Despite the obvious urgency (to individuals and society), we still understand next-to-nothing about neurocognitive aging. However, the analysis of neural network dynamics is beginning to cast some light: Network dynamics (structural and functional connectivity profiles) provide an angle that offers new perspectives on what is changing in our cognitive and affective architecture as we grow older.

s017

Does the control of emotion require intact cognitive control? Examples from aging research
Carien van Reekum
Centre for Integrative Neuroscience and Neurodynamics, University of Reading

s018

Stress effects on (de)activation during emotional inhibition in healthy aging
Nicole Oei
Dept. of Psychology and Amsterdam Brain & Cognition, University of Amsterdam

s019

Frontostriatal anatomical connections predict age- and difficulty-related reinforcement learning
Irene van de Vijver
Behavioural Science Institute, Radboud Universiteit Nijmegen

s020

Functional networks and connectivity dynamics in the aging brain
Linda Geerligs
MRC Cognition and Brain Sciences Unit, Cambridge

Predicting Human Actions: Specialized and General Mechanisms

Chair:
Harold Bekkering (Radboud University)

Predicting others' actions is crucial for smooth social interactions. As such, it is more relevant to be able to predict human actions than for instance the movements of a ball rolling from a slope. However, learning to predict others' actions may or may not be privileged over other types of predictions. The key question of this symposium is whether predictions in different domains, such as action, perception, and language, rely on the same or different mechanisms.

s021

The clever Chameleon: evidence for anticipated action
Marcel Brass
Department of Experimental Psychology, Ghent University

s022

The role of action experience for action prediction development
Janny C. Stapel
Uppsala University

s023

Predictions at the bowling lane: evidence from behavioral and MEG experiments
Harold Bekkering
Radboud University

s024

The nature and limits of mechanisms in anticipatory language processing
Florian Hintz
Max Planck Institute for Psycholinguistics

Opportunities and Applications of Ultra High-Field MRI in Cognitive Neuroscience

Chair:
Max van der Keuken (University of Amsterdam)

In order to sensibly relate cognitive functioning to the brain, it is essential to measure both cognition and the brain in minute detail. In this symposium we will showcase several advantages of using ultra-high field MRI in the field of cognitive neuroscience. Whereas the first speaker will give an introduction on the use of high field MRI, the remaining three speakers will discuss recent work in which 7T MRI proved to be essential for linking cognitive processes to the relevant brain structures.

s025

Ultra high-field MRI: opportunity or challenge?
Wietske van der Zwaag
Spinoza Centre for Neuroimaging, KNAW

s026

Studying experience-dependent plasticity with high field MRI
Heidi Johansen-Berg
FMRIB, Oxford University

s027

Processing of natural sound aspects in the human auditory cortex
Michelle Moerel
CMRR, University of Minnesota

s028

Imaging representations of quantity in human association cortex
Ben Harvey
Department of Psychology, University of Coimbra

ORAL PRESENTATIONS - ABSTRACTS

t001

The influence of sex hormones on brain lateralization and cognitive performance

Tess Beking, Reint Geuze, Baudewijntje Kreukels & Ton Groothuis
University of Groningen / VU Medical Center Amsterdam

Brain lateralization is the phenomenon that both hemispheres of the brain are specialised in different functions. This lateralization differs in strength and direction between individuals and among tasks within individuals, potentially affecting cognitive performance. There is long standing debate to what extent individual differences in lateralization are due to variation in early or later exposure to sex hormones. We use a unique data set to test this. Existing data on prenatal hormone exposure, obtained from amniotic fluid during pregnancy of the mothers, will be correlated with brain lateralization and cognitive performance in a group of healthy adolescents of 13-15 years old (30 boys, 30 girls). Moreover, current testosterone and progesterone levels are measured in saliva and will be correlated with brain lateralization and cognitive performance of the same individuals. Brain lateralization of verbal fluency, mental rotation and facial emotion processing is measured with functional transcranial Doppler sonography (fTCD). In summary, we will address the following topics: 1) The effect of prenatal testosterone on brain lateralization. 2)The effect of current testosterone and progesterone on brain lateralization. 3) The relation between brain lateralization and cognitive performance. Results are being processed at this moment and will be presented at the conference.

t002

Late development of cue integration in childhood co-occurs with emergence of sensory fusion in cortex

Tessa Dekker, Hiroshi Ban, Bauke van der Velde, Andrew Welchman, Martin Sereno & Marko Nardini
University College London, UK / Center for Information and Neural Networks, National Institute of Information and Communications Technology, Japan / University of Amsterdam / Cambridge University, UK / Durham University, UK

Adults can optimise their perceptual precision by averaging multiple sensory estimates (e.g., size via vision and touch, or depth via multiple visual cues). Strikingly, it is not until ~age 10 years that children combine multiple cues to reduce sensory uncertainty. Why do perceptual benefits of sensory fusion emerge so late in life? Existing data cannot distinguish if this reflects surprisingly late changes in sensory processing (sensory integration mechanisms in the brain are still developing), or depends on post-perceptual changes (integration in sensory cortex is adult-like, but higher-level decision processes do not access the information). To distinguish these possibilities, we tested visual depth cue integration in the developing brain using methods that we first validated with adults (Ban et al. 2012, Nat. Neurosci.). We presented children aged 6-12 years with displays depicting depth from binocular disparity and relative motion, and made measurements using psychophysics (n=103), and pattern classification fMRI with retinotopic mapping (n=29). We found that older children (>10.5 years) showed clear evidence for integration of depth cues in visual cortex area V3B, which is also associated with integration in adults. We found no evidence for sensory integration in the visual cortex of younger children (<10.5 years). This significant age difference was paired with the emergence of perceptual integration abilities around ages 10-11 years, and could not be explained by motion artefacts, visual attention, or signal quality differences. Thus, while many basic visual processes mature early in childhood, the brain circuits that fuse cues take a very long time to develop.

t003

The development of haptic 2D shape recognition

Krista Overvliet & Ralf Krampe
University of Hamburg / University of Leuven

As opposed to recognising everyday objects, recognising 2D shapes by touch is quite difficult: recognition rates are generally low and exploration times high. In a previous study, we have shown that older adults show worse performance as compared to young adults in such a task (Overvliet, Wagemans, Krampe, 2013). We explained these results in terms of visual mediation and memory. To further study the underlying mechanisms, we investigated childhood development of haptic 2D shape recognition. We tested 78 participants in 5 age groups: pre-schoolers (4-5 years), first-graders (6-7 years), fifth-graders (10-11 years), young adolescents (12-13 years) and young adults (18-28 years). We asked them to recognise everyday objects, haptic line drawings and to perform a serial visual 'peekhole' version of the haptic line drawing task. The results show that all age groups are excellent at recognising everyday objects. Pre-schoolers and first-graders scored very low in both visual and haptic line drawing tasks. From fifth grade onwards, participants were much better at the visual peekhole task compared to haptic line drawing task. However, accuracy in this haptic task improved only slightly in the young adolescent and adult age groups as compared to the younger age groups. Interestingly, haptic exploration times for correct items increased with age, while visual exploration times were constant over the age groups. The results will be discussed in light of developmental trajectories of visual and haptic external reference frames, visual mediation and working memory.

t004

Healthy Ageing at Work

Marlon de Jong, Monicque Lorist & Jacob Jolij
Department of Experimental Psychology, University of Groningen

Demographic ageing in the Western world means that the average age of the working population is increasing. This has major consequences for the labour process. Growing older is linked to physical and cognitive changes which can influence performance of tasks. We are faced with an important challenge: to keep an ageing population healthy and deployable in the long term. One of the cognitive problems that employee's experience is mental fatigue. Previous research described that after or during a period of mental workload, problems related to cognitive control arise. To prevent these problems, we aim to find objective methods that could detect mental fatigue in an early stage, that is, before a decline in performance emerges. An experiment was developed to examine what problems arise and how different physiological (i.e. brain activity, muscle activity, hart activity and eye movements) and behavioral (i.e. sitting behavior and keyboard and mouse use) parameters change during a period of mental workload. Results show people make more mistakes after a period of mental workload. Some people seem to change their strategy and are able to correct for their mistakes, while others show a stable decrease in performance over time. Further analyses should point out what patterns in behavior and physiology could be related to the decrease in performance. First results point to backspace use as an indicator of mental fatigue.

t005

Emotion Processing in Homo and Pan

Mariska Kret
Leiden University

Evolution prepared group-living species, (non)human primates included, to quickly recognize and adequately respond to conspecifics' emotional expressions. Different theories propose that mimicry of emotional expressions facilitates these swift adaptive reactions. When species unconsciously mimic their companions' expressions of emotion, they come to feel reflections of their emotions that influence emotional and empathic behavior. The majority of emotion research has focused on full-blown facial expressions of emotion in humans. However, facial muscles can sometimes be controlled; humans know when to smile, and when not to. Moreover, the fact that emotions are not just expressed by the face alone but by the whole body is often still ignored. In this talk, I therefore argue for a broader exploration of emotion signals from sources beyond the face or face muscles that are more difficult to control. More specifically, I will argue that implicit sources including the whole body and very subtle autonomic responses including pupil-dilation are picked up by observers and influence subsequent behavior. Across different primate species, seeing a conspecific being emotional and expressing that in one way or another, immediately and automatically attracts attention, yields mimicry and triggers action tendencies in observers. In my research, I take a comparative approach and investigate similarities and differences in the perception of emotions between humans, chimpanzees (Pan troglodytes) and bonobos (Pan paniscus). I will here discuss new, recently collected data and suggest avenues for future research that will hopefully eventually lead to a better comprehension of emotional expressions and how we come to understand each other's emotions.

t006

Self-reinforcing expectancy effects on pain: Behavioral and brain mechanisms

Marieke Jepma & Tor Wager
Leiden University / University of Colorado at Boulder

Self-reinforcing phenomena—so-called 'self-fulfilling prophecies'—are evident in many areas of human endeavor, including placebo and 'nocebo' effects in medicine, education, and consumer behavior. In the case of pain, self-reinforcing expectancy effects are traditionally explained by the modulation of spinal nociceptive processing via top-down influences from cortical areas. We examined another potential explanation for these effects: that prior beliefs bias learning, by enhancing learning from expectancy-confirming relative to expectancy-disconfirming events. In two experiments, we induced expectancies about cue-pain associations by repeatedly pairing different cues with either low or high noxious heat levels. In a subsequent 'extinction' phase, all cues were followed by identical noxious heat stimuli, and we measured trial-to-trial dynamics in pain expectations, pain experience, and (in Experiment 2) fMRI activity. Throughout the extinction phase, subjective and neural responses to identical heat stimuli were stronger following high- than low-pain cues, and these effects were mediated by participants' self-reported pain expectancies. Analyses of learning dynamics revealed that participants updated their pain expectancies more following outcomes that confirmed expectations than those that disconfirmed them, indicating a confirmation bias that maintained disproportionately strong cue-based pain expectancies. Individual differences in the strength of this confirmation bias correlated with dorsomedial prefrontal cortex activation to expectancy-confirming vs. -disconfirming outcomes, suggesting a key role for this region in the regulation of learning rate as a function of prior beliefs. These results can help explain why beliefs in many domains can have persistent effects even in the absence of confirming evidence.

t007

The role of the right posterior parietal cortex in attentional control of emotional task irrelevant stimuli: a 1 Hz rTMS study

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Donders Institute for Brain, Cognition and Behaviour

The right posterior parietal cortex (PPC) is proposed to constitute a central part of the fronto-parietal attention network and has been implicated in both top-down and bottom-up driven attention control. We investigated the causal role of the right PPC in attentional selection of task-irrelevant emotional stimuli. In a sham-controlled crossover design inhibitory slow frequency rTMS was applied to the left and right PPC. Following 1 Hz rTMS, participants performed a visual search task with a task irrelevant color singleton distractor that was either threatening or non-threatening. Threat was established using a fear-conditioning procedure in which one colored distractor (CS+) was paired with an aversive stimulus (US), whereas the other colored distractor (CS-) was not. Results showed the typical reaction time costs of the distractor. That is, reaction time was increased when a distractor was present relative to absent, reflecting bottom-up attentional capture by the distractor. Exclusively after inhibitory rTMS to the right PPC, reaction time cost was larger in the threatening distractor condition than in the non-threatening distractor condition. Moreover, the effect of right PPC stimulation was specific for the emotional distractor, as mean reaction time significantly increased relative to Sham stimulation in the threatening distractor condition. These findings suggest that disrupting the right PPC reduces attentional control over task-irrelevant emotional stimuli. We therefore propose that the right PPC is involved in disengagement of attention from emotionally salient distractors in order to re-orient attention voluntarily to task relevant stimuli that are central for goal-directed behavior.

t008

The effect of emotion on gait initiation

Daniëlle Bouman, John F. Stins & Peter J. Beek
MOVE Research Institute Amsterdam

Emotion theorists agree that emotions activate motivational tendencies, like approach and avoidance. These tendencies have been studied using manual tasks, symbolizing approach and avoidance behaviors. However, there is growing interest in 'whole-body paradigms', as they may represent a more ecologically valid way to study such tendencies. Especially the initiation of gait (GI) from a quiet standing posture is growing in popularity, with forward GI (towards an affective cue) representing an approach-motivated movement, and backward GI (away from a cue) representing an avoidance-motivated movement. By studying kinematic parameters of gait initiation (e.g. peak velocity, step size, reaction time, and postural freezing) in response to emotional stimuli, we can study how motivational tendencies are grounded in the motor control systems responsible for balance and gait. In two recent experiments we studied both forward and backward GI in response to emotional pictures. Results show first that the biomechanical organization of GI is affected by emotional parameters (valence and arousal). Second, an asymmetry seems to exist between affective influences on forward GI compared to backward GI. Specifically, gait initiation parameters are clearly affected with forward GI but hardly so with backward GI. This difference may be explained by backward stepping being less automatized compared to forward stepping, since this movement pattern (a) is relatively uncommon, and (b) is not under visual control. These results shed light on how valence and arousal are coupled to whole body goal directed movements.

t013

Transcutaneous Vagus Nerve Stimulation Enhances Post-error Slowing

Jelle van Leusden, Roberta Sellaro, Daphne Tona, Bart Verkuil, Sander Nieuwenhuis & Lorenza Colzato
Leiden University

People tend to slow down after they commit an error, a phenomenon known as post-error slowing (PES). It has been proposed that slowing after negative feedback or unforeseen errors is linked to the activity of the locus coeruleus–norepinephrine (LC–NE) system, but there is little direct evidence for this hypothesis. Here, we assessed the causal role of the noradrenergic system in modulating PES by applying transcutaneous vagus nerve stimulation (tVNS), a new noninvasive and safe method to stimulate the vagus nerve and to increase NE concentrations in the brain. A single-blind, sham-controlled, between-group design was used to assess the effect of tVNS in healthy young volunteers (n = 40) during two cognitive tasks designed to measure PES. Results showed increased PES during active tVNS, as compared to sham stimulation. This effect was of similar magnitude for the two tasks. These findings provide evidence for an important role of the noradrenergic system in PES.

t014

Control over target selection determines switch costs in multiple-target search.

Eduard Ort, Johannes Fahrenfort & Chris Olivers
Cognitive Psychology, Vrije Universiteit Amsterdam

Visual selection of task-relevant objects is guided by a search template, a mental representation of a current search target that is assumed to be stored in working memory. Currently, it is debated whether one can have more than a single active search template that guides visual selection at any given moment. By demonstrating the absence of costs in fixation duration while scanning a search display for items that match one of two potential search templates, recent evidence suggests that one can look for multiple items simultaneously. Here, we investigated this issue further by applying a recently developed eye tracking paradigm. Crucially, subjects were instructed to look for two targets simultaneously while we manipulated the degree to which they had control over target selection. In a series of three experiments, we (1) show that switch costs disappear when instructing subjects to search for two target colors simultaneously, but only when subjects have full control over target selection (i.e., they choose at will which target color to select from the set of presented stimuli). However, (2) as soon as subjects lose control over the selection process, switch costs appear, showing that the emergence of switch costs depends on the degree to which one is in control of target selection. This suggests that the absence of switch costs in previous two-template experiments is caused by efficient template switching during search rather than having two templates active at the same time.

t015

Through the eyes, slowly

Joanne van Slooten, Tomas Knapen & Jan Theeuwes
Vrije Universiteit Amsterdam

The pupil offers a window into processes that reflect neuromodulatory brain state. For example, changes in pupil diameter are thought to correlate with exploitatory and exploratory behavioural states. While many studies acknowledge that arousal-based pupil responses are important in controlling behaviour, another important source of information is a signal that carries information about the value of the current behavioural state. Such a value-based pupil response might provide a window onto the brain's value-learning processes. Here, we investigated whether value- and arousal-based pupil responses interact and to what extent they reflect dynamics of behavioural control. We performed an implicit reversal learning experiment where we manipulated the probability of receiving reward or punishment. Coloured cues signalled an upcoming reward or punishment with 80% validity. The contingency between colour and reward/punishment would reverse unpredictably, prompting value-based learning of cue-reward contingencies in the participant, who was required to signal these reversals by keypress. Using ridge regression deconvolution, we found pupil signals to index learning differently on separate timescales. Perception of value contingency reversals was tracked by slow pupil signals on a timescale of minutes, whereas instantaneous prediction errors were primarily indexed by fast trial-based signals. This contrasts with a previous study (Nassar et. al, 2012), which found pupil signals related to behavioural state changes only on a fast timescale. Our results hint at the utility of slow pupil size fluctuations as a proxy for brain states relevant to behavioural control.

t016

The effect of atomoxetine on random and directed exploration in humans

Christopher Warren, Robert Wilson, Jos Bosch, Jonathan Cohen & Sander Nieuwenhuis
Leiden University / University of Arizona / University of Amsterdam / Princeton University

The explore-exploit dilemma refers to the question of whether it is better to stick with a known quantity, or explore unknown options that may yield less or more value. Two strategies for solving this dilemma are directed exploration and random exploration. Directed exploration involves computationally-demanding consideration of the value of exploring at any given time, whereas random exploration simply relies on a portion of random choices to discover valuable options. Random exploration may be governed by baseline norepinephrine (NE) levels, with higher NE levels increasing response variability. We pharmacologically manipulated baseline NE levels with atomoxetine, and examined the effect on exploration using a specially designed task that allows extraction of independent random- and directed- exploration indices. At the group level, treatment did not affect either form of exploration. However, we anticipated that any treatment effects might be subtle, due to the modest dose and the timing of the task relative to the time of treatment. Therefore, we obtained salivary cortisol samples as a method of indirectly assessing the strength of the treatment effect in each subject at the time of task performance. This measure correlated with random exploration in several task conditions: participants who showed the most positive treatment-induced change in salivary cortisol showed the largest treatment-related increase in random exploration. In contrast, salivary cortisol did not predict treatment effects on directed exploration. We cautiously interpret this as evidence that baseline NE levels regulate the degree of random but not directed exploration.

t017

Hermann Ebbinghaus' Classic Forgetting Curve from 1880: Replication and Analysis

Jaap Murre & Joeri Dros
University of Amsterdam

As part of a project to replicate classic studies in memory psychology, a single subject spent 70 hours learning lists to a preset criterion and relearning them after 20 min, 1 hour, 9 hours, 1 day, 2 days, or 31 days. Following Ebbinghaus, this experimental phase had been preceded by three weeks of training to become thoroughly familiar with the task. The results were analyzed in terms of savings and

turned out to be similar to Ebbinghaus' original data from 1880. We analyzed the effects of serial position of list items on forgetting and investigated which mathematical equations present a good fit to the Ebbinghaus forgetting curve and its three replications, two of which are by German authors not published in English. We conclude that the Ebbinghaus forgetting curve may indeed be considered as successfully replicated. However, contrary to most text book accounts and to certain curve fitting studies—but in accordance with Ebbinghaus' own interpretation—the classic long-term forgetting curve and its replications are not completely smooth but the data show a clear jump up at the 24 hour data point. We will discuss whether this may be accounted for by the effects of sleep.

t018

Ungoverned and Unstoppable Long-term Priming of Visual Search

Wouter Kruijne & Martijn Meeter
Vrije Universiteit Amsterdam

Studies on intertrial priming have shown that in visual search experiments, the preceding trial automatically affects search performance: facilitating it when the target features repeat, and giving rise to switch costs when they change. These effects also occur at longer time scales: when one of two possible target colors is more frequent during an experiment block, this results in a prolonged and persistent facilitation for the color that was biased, long after the frequency bias is gone. In this study, we explore the robustness of such long-term priming. In one experiment, long-term priming was built up in one experimental session, and was then assessed in a second session a week later. Long-term priming persisted across this week, emphasizing that long-term priming is truly a phenomenon of long-term memory. In another experiment, participants were fully informed of the bias and instructed to prioritize the other, unbiased color. Nevertheless, long-term priming of the biased color persisted in this block. The results support the view that priming results from the automatic and implicit retrieval of memory traces of past trials.

t019

An Individual's Rate of Forgetting is Stable over Time, but Differs Across Materials

Florian Sense, Friederike Behrens, Rob R. Meijer & Hedderik van Rijn
Department of Experimental Psychology, University of Groningen / Department of Psychometrics and Statistics, University of Groningen

One of the goals of computerized tutoring systems is to optimize the learning of facts. Over a hundred years of declarative memory research have identified two robust effects that can improve such systems: the spacing and the testing effect. By making optimal use of both and adjusting the system to the individual learner using cognitive models based on declarative memory theories, such systems consistently outperform traditional methods (Van Rijn, Van Maanen & Van Woudenberg, 2009). This adjustment process is driven by a continuously updated estimate of the rate of forgetting for each item and learner on the basis of the learner's accuracy and response time. In this study, we investigated to what extent these estimates of individual rates of forgetting are stable over time and across different materials, and demonstrate that they are stable over time but not across materials. Even though most theories of human declarative memory assume a single underlying rate of forgetting, we show that, in practice, it makes sense to assume different materials are forgotten at different rates. If a computerized, adaptive fact-learning systems would allow for different rates of forgetting for different materials, it could adapt to individual learners more readily.

t020

Decoding the Future: Single Trial Analysis of Anticipatory Responses in Prestimulus EEG Activity

Jacob Jolij
University of Groningen

Can people ‘feel the future’? According to one of the most controversial papers published in the past decade, Daryl Bem’s ‘Feeling the Future’ (Bem, 2011), participants are in some circumstances able to anticipate on future events. Bem’s paper, though, is only one example of a considerable series of experiments claiming anomalous anticipatory responses to future events, in behaviour, but also in physiological responses. In a recent study using single-trial EEG decoding, we observed a similar effect: we were able to decode the identity of an upcoming stimulus based on unfiltered baseline activity alone. Subsequent analysis, however, revealed that this effect was most likely due to improper randomization. This led us to hypothesize that the anomalous baseline effects reported by others may be due to weak implicit learning in insufficiently randomized trial sequences. In the present study, we contrast pseudo-randomized (randomized with the Mersenne Twister algorithm) versus truly randomized (randomized with a Zener-diode hardware RNG and a Geiger-counter based RNG) sequences. Contrary to our hypothesis, we were able to predict stimulus identity significantly above chance level on basis of single trial prestimulus activity for both pseudo- and truly randomized sequences, despite our best efforts to exclude alternative explanations, such as filter artefacts or participant expectation. Although a direct replication of our study is warranted, our results cannot confirm our hypothesis that anomalous anticipatory activity is the result of improper randomization. In stead, participants seemed to able to ‘feel the future’ even for truly random events.

t025

How individual differences in learning strategies can influence visual attention

Sara Jahfari & Jan Theeuwes
Vrije Universiteit Amsterdam

Reward learning is known to shape how we perceive the world. During this talk, I will present two experiments where we examined how the weight that is put on learning from desired (high-value) or undesired (low-value) outcomes influences what we see through the automatic capture of attention (behavioral experiment), or adaptations in visual cortex (fMRI experiment). Adaptations in automatic attention were investigated with an instrumental learning task that was directly followed by an attentional capture task. In the scanner, learning was directly followed by a test-phase where feedback was no longer present. A hierarchical Bayesian reinforcement model was used to infer individual differences in learning from positive or negative feedback. Results showed a double dissociation where the weight that is put on learning from positive and negative feedback differentially predicted the magnitude of attentional capture by a positive or negative distractor. Preliminary fMRI results complemented these findings by further demonstrating how our ability to learn from value can differentiate and predict activity levels within visual cortex (fusie form face area) during the test-phase. These results show a novel link between learning strategies and visual perception and demonstrate how individual differences in the evaluation of desired or undesired outcomes can influence both automatic attention and the sensitivity of visual cortex.

t026

The impending demise of the item in visual search

Christian Olivers & Johan Hulleman
VU University Amsterdam / University of Manchester

The way the cognitive system scans the visual environment for relevant information – visual search in short – has been a longstanding central topic in vision science. From its inception as a research topic, and despite a number of promising alternative perspectives, the study of visual search has been governed by the assumption that search proceeds on the basis of individual items (whether processed in parallel or not). This has led to the additional assumptions that shallow search slopes (at most a few tens of milliseconds per item for target-present trials) are most informative about the underlying process, and that eye movements are an epiphenomenon that can be safely ignored. We argue that the evidence now overwhelmingly favours an approach which takes fixations, not individual items as its central unit. Within fixations, items are processed in parallel, and the functional field of view determines how many fixations are needed. In this type of theoretical framework, there is a direct connection between target discrimination difficulty, fixations and RT measures. It therefore promises a more fundamental understanding of visual search by offering a unified account of both eye movement and manual response behaviour across the entire range of observed search efficiency, and provides new directions for research. A high-level conceptual simulation with just one free and four fixed parameters shows the viability of this approach.

t027

Neural markers of perceptual integration in visual cortex without conscious access

Johannes Fahrenfort, Jonathan van Leeuwen, Chris Olivers & Hinze Hogendoorn
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The visual system has the remarkable ability to segment fragmented visual input into a perceptually organized collection of surfaces, shapes and objects. This segmentation process is thought to be the result of neuronal integration in visual cortex. A long tradition in psychology attributes such integrative functions to top down attention. In this view, access mechanisms are required for neuronal and perceptual integration. Here we show that perceptual integration continues without conscious access. We tested whether neural markers of perceptual integration (i.e. illusory surface perception in a Kanizsa figure) continue, even when subjects do not report on the resulting percepts due to momentary lapses of attention. Employing a 2 by 2 full-factorial design of masking and the attentional blink, we show that behaviorally, both masking and attention affect the degree to which subjects are able to make perceptual decisions based on integrated percepts. However, when using a multivariate classifier on the EEG, one can decode the presence of integrated percepts equally well for the unattended (blinked) and attended (unblinked) condition, whereas masking selectively abolishes the ability to decode integrated percepts. This study uncovers a fundamental difference in the way attention and masking impact perceptual integration even when their impact on perceptual decision-making is comparable. The brain continues to organize fragmented visual input into perceptually meaningful wholes, even when subjects do not consciously access these perceptual representations.

t028

Reward Alters Perception of Time

Michel Failing & Jan Theeuwes
Cognitive Psychology, Vrije Universiteit Amsterdam

Classic studies have demonstrated an important role of attention in perception of time. Which stimuli enjoy attentional priority has also been shown to be affected by reward. For instance, recent studies showed that stimuli associated with relatively high reward are attentionally prioritized over stimuli associated with low or no reward. The question we addressed in the present study is whether a reward association also affects perception of time. Here participants had to perform a prospective timing task using temporal oddballs. In this task six standard stimuli (e.g. black circle) each displayed for a fixed duration and one colored oddball (e.g. red circle) displayed for varying durations, were shown in succession at the center of fixation. Participants indicated whether they perceived the oddball to last shorter or longer in time than the standard stimuli. In three experiments we manipulated whether the color of the oddball (exp 1 and 3) or the color of the standard (exp 2) signaled whether reward could be earned for a correct response. The color indicated how much reward could be earned (high, low or no). The results showed that participants perceived an oddball signaling relatively higher reward to last longer compared to an oddball signaling lower reward. However, when reward was signaled by the standards and not by the oddball, the duration perception of the oddball remained unaffected. We argue that by signaling a relatively higher reward, a stimulus becomes more salient thus modulating attentional deployment towards it and distorting how it is perceived in time.

t029

Spatial coherence and contrast energy of an image index complexity and signal the need for recurrent processing

Noor Seijdel, Iris Groen, Sara Jahfari, Sennay Ghebreab, Victor Lamme & H.Steven Scholte
University of Amsterdam / National Institutes of Health / VU university Amsterdam

When observing the world around us, perception of everyday scenes feels effortless. Indeed, humans are incredibly fast in perceiving natural images, suggesting that it involves only feed-forward visual processing (Serre, Oliva & Poggio, 2007). However, for complex tasks or under challenging conditions, neural feedback or recurrent processing is assumed to be required (Lamme & Roelfsema, 2000). In the current study, we investigated whether the need for recurrent processing during scene categorization depends on the complexity of an image. To index scene complexity, two image statistics, contrast energy (CE) and spatial coherence (SC) were used. While measuring EEG, participants performed a speed-accuracy task in which they had to categorize images based on the presence or absence of an animal. For simple images, differences in evoked activity between animal and non-animal pictures seem to arise early in time in early visual areas, indicating that feed-forward processing might be sufficient. For complex images, this difference in V1 arises late in time, after a difference in higher visual areas is observed, suggesting that neural feedback or recurrent processing is required. Together with previous findings, this pattern of results suggests that SC and CE index scene complexity and signal the need for recurrent processing. Using SC and CE, the brain seems able to efficiently determine the appropriate visual processing mode.

t030

Deep vision model reveals consistent neural object recognition architecture

Kandan Ramakrishnan, H.Steven Scholte, Arnold W.M.Smeulders & Sennay Ghebreab
UvA

Convolutional Neural Networks (CNN) have achieved state of the art performance on automatic visual recognition tasks. Recent studies have also shown that CNNs can account for brain activity in primate and human visual systems, making them candidate models for representation of the core object recognition architecture (CORA) in the human visual cortex. We hypothesized that if CNNs represent

CORA, they should not only account for brain activity in a large number of subjects but it should also be consistent across subject groups. To test this we recorded fMRI brain responses of 100 subjects while they viewed a short video of natural scenes and objects. We performed a sequence of analysis to determine where fMRI responses correlated to CNN layers are consistent. Consistency due to the lower CNN layers was strongest in early visual brain areas, while higher CNN layers yielded consistency mostly in higher visual areas. These results, for the standard CNN layers, however do not reveal the unique contribution of CNN layers to explain brain activity. The application of variation partitioning to account for correlations between CNN layers, show that the unique CNN layers yield consistency only in the first levels of the human visual hierarchy. These differences in results suggests that CNN layers by themselves do not fully capture the visual representations in the brain. Thus, while CNN forms a suitable computational basis for unravelling CORA in the brain, our findings suggest that capturing the visual representations in higher areas of the human brain still remains a challenge.

t031

Differential representation of man-made and natural images in scene-selective cortex

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Behavioral, computational and electroencephalography (EEG) evidence suggest that man-made and natural scenes are represented differentially (Groen et al., 2013, 2015), but it is unclear which brain regions are involved in computing this global scene distinction. Here, we used high-resolution (7T) fMRI to examine neural representations of real-world man-made and natural scenes. A whole-brain localizer experiment revealed enhanced activity for man-made compared to natural scenes in each of three known scene-responsive brain regions: the parahippocampal place area (PPA), occipital place area (OPA) and the retrosplenial complex (RSC). Given this difference in univariate responses, we sought to investigate what scene information contributes to this difference using multi-voxel pattern analysis across 4 scene (man-made open, man-made closed, natural open, natural closed) and 4 isolated object (man-made, natural, buildings and faces) categories. We found heterogeneous response profiles across the scene-responsive regions. PPA not only separated man-made from natural scenes but also man-made from natural objects, and specifically grouped buildings with man-made, but not natural scenes. In contrast, OPA and RSC distinguished less strongly between the isolated object categories, but did have a selectively distinct representation of closed natural scenes compared with the other scene types. Preliminary results of consecutive transcranial magnetic stimulation (TMS) and fMRI indicate that TMS to OPA reduces activity to both man-made and natural scenes in PPA. Together, these findings suggest that differential neural representation of man-made and natural scenes arises based on distinct scene properties, which may be extracted via a scene processing pathway that involves OPA.

t032

Creating colored letters: Can synesthesia be learned?

Olympia Colizoli, Jaap M. J. Murre, H. Steven Scholte, Daan M. van Es, Tomas Knapen & Romke Rouw
University of Amsterdam / Vrije Universiteit

One of the most astonishing properties of synesthesia is that the additional experiences are perceptual in nature. Is it possible to acquire such experiences by learning cross-modal associations that resemble synesthetic mappings? We examined whether brain activation in early visual areas can be directly related to letter-color associations acquired by training. Non-synesthetes read specially prepared books with colored letters for several weeks and were scanned using functional magnetic resonance imaging. Results showed that training-related activation of area V4 was correlated with differences in reported subjective color experience. Trainees who were classified as having stronger 'associator' types of color experiences also had more negative activation for trained compared to untrained achromatic letters in area V4. We furthermore investigated whether relatives of synesthetes would be more likely to form associations between letters and colors compared to a carefully matched control group. Although no behavioral differences between these groups was obtained, neuroimaging results showed that the familial marker of synesthesia is present in the relatives as seen by brain activation in the right parietal lobe. Activation in this parietal region predicted the strength of the learned associations while participants viewed black letters. This parietal region is considered to be a multi-sensory hub and known to be crucial for the synesthetic experience. We show for the first time that learning letter-color associations affected brain activation during the presentation of colored and achromatic letters. These results are the first step in predicting who can learn synesthesia in adulthood from brain function.

t037

There is no attentional global effect: Attentional shifts are independent of the saccade endpoint

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Many studies have found a strong coupling between selective attention and eye movements. The premotor theory of attention suggests that saccade preparation is directly responsible for such attentional shifts. While it has already been shown that the attentional shift is not directly coupled to the final stages of motor execution, it is currently unknown to what aspect of the earlier stages of saccade preparation the attentional shift is coupled. An important step in this preparation process is resolving the landing point when multiple elements compete for the saccade. Here we ask how such a competition influences the pre-saccadic attentional locus and whether the pre-saccadic shift of attention is coupled to the saccade landing position or the possible saccade goals. To this end, we adopt a global effect paradigm where a target is accompanied by a salient distractor resulting in the majority of eye movements landing in between target and distractor. To determine the allocation of attention, participants are presented with a discrimination task shortly before the execution of the saccade. Despite a strong global effect obtained for saccade endpoints, we find little evidence for attentional facilitation at the location between target and distractor, but strong attentional facilitation at the location of the target and distractor. We argue that attention is coupled to active oculomotor programs, but not part of the resolution of these programs towards the execution of the saccade.

t038

Voluntary saccadic eye movements ride the attentional rhythm

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Visual perception seems continuous, but recent evidence suggests that the underlying perceptual mechanisms are in fact periodic – particularly visual attention. Because visual attention is closely linked to the preparation of saccadic eye movements, the question arises how periodic attentional processes interact with the preparation and execution of voluntary saccades. In two experiments, human observers made voluntary saccades between two placeholders, monitoring each one for the presentation of a threshold-level target. Detection performance was evaluated as a function of latency with respect to saccade landing. The time-course of detection performance revealed oscillations at around 4 Hz both before the saccade at the saccade origin, and after the saccade at the saccade destination. Furthermore, oscillations before and after the saccade were in phase, meaning that the saccade did not disrupt or reset the ongoing

attentional rhythm. Instead, it seems that voluntary saccades are executed as part of an ongoing attentional rhythm, with the eyes in flight during the troughs of the attentional wave. This finding for the first time demonstrates that periodic attentional mechanisms affect not only perception but also overt motor behaviour.

t039

Evidence for optimal feature integration across saccades

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A consequence of making saccades is that information about a single object in the world is received at different retinal locations. We investigated whether internal representations of objects are overwritten with each saccade or if representations are built up across saccades. Participants were instructed to make a saccade while remembering the colour of three items. Upon detection of the saccade, we altered the colour of all items without participants' awareness. After the saccade and a memory interval we asked them to report the colour of one of the items. This enabled us to determine to what extent the pre-saccadically presented colour influenced the representation of the items after the saccade. We found that the reported colours fell in between pre- and post-saccadic values, arguing for updating rather than overwriting in working memory. In a second experiment we manipulated the position of the items relative to the saccade and found that the weights given to pre- and post-saccadic information varied with the relative position of items with respect to the saccade. In a third experiment, we manipulated the reliability of the visual input by adding colour noise to both pre- and post-saccadic displays, and found that the more reliable input received a higher weight when combined. This is consistent with an optimal integration of pre-saccadic working memory with a post-saccadic update signal. We conclude that information is accumulated across saccades whereby the integration takes into account the reliability of the input.

t040

A role for the ventral striatum in selective awareness: An intracranial EEG study of the attentional blink

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The brain is limited in its capacity to consciously process information, necessitating gating of information. While conscious perception is robustly associated with sustained, recurrent interactions between widespread cortical regions, the neural processes controlling access to awareness remain to be elucidated. Here, we tested the idea that conscious perception relies on striatum-dependent gating mechanisms. Using intracranial EEG, we recorded activity of the ventral striatum while 7 patients performed an attentional blink task in which they had to identify two targets (T1 and T2) in a rapid stream of distractors. Patients often failed to perceive T2 when T2 was presented in close temporal proximity to T1: the attentional blink (AB). Yet, they did perceive T2 in some trials, permitting investigation of the mechanisms that are necessary for a stimulus to reach awareness. We found that the failure to perceive T2 was foreshadowed by a T1-induced increase in alpha/beta oscillatory activity as early as 80ms post-T1. This effect may reflect an early alerting signal, and provide support for the idea that the AB is caused by T1-driven attentional capture. Moreover, only consciously perceived targets were associated with an increase in theta activity 215-400ms post-target. As the ventral striatum receives longer-latency input from the hippocampus by means of theta oscillations, this effect might reflect context-dependent gating of prefrontal cortical regions. Together, these findings suggest a crucial role for the striatum in conscious perception. They may help explain the one-winner-takes-all nature of perception by linking conscious perception to basal ganglia-dependent gating mechanisms.

t041

Longitudinal changes in social brain development

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Social skills are of critical importance for humans. Adolescence is an important time for social development. During adolescence perspective taking and mentalizing skills increase, and friendships become closer and more complex. In this study we aimed to test how outcomes for self and friends are processed on the neural level and for the identified regions, test whether neural activation in these regions increases, decreases or shows a quadratic response during adolescent development . We used a longitudinal design in which we tested 299 individuals at the first time point and 254 individuals at the second time point with a continuous age range between 8 and 27 years of age. Participants played a gambling game in the scanner in which they could win and lose money for themselves and their best friend (Braams et al., 2013; 2014). In addition to the fMRI task, perspective taking was assessed at each time point. Results showed robust activity in the social brain network including TPJ, precuneus and mPFC when receiving outcomes for friend relative to self. Age comparisons revealed a decrease in contrast values for Friend > Self over development in TPJ, precuneus and medial PFC. In addition to these age-related changes, activity patterns was mediated by perspective taking. Perspective taking skills showed a positive linear relationship with neural activation in the precuneus. Taken together, the results confirm robust continuous changes in the social brain network across age, and show that social experiences and perspective taking skills further moderate these changes.

t042

Transcranial Current Stimulation of the Temporoparietal Junction Improves Lie Detection

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Conflict in representations of the self and others elicits performance interference effects during simple socio-cognitive tasks (Decety & Sommerville, 2003). Transcranial direct current stimulation (tDCS) of temporoparietal junction (TPJ) improves performance in such tasks which require the control of competing representations of the self and others (Hogeveen et al., 2014; Santiesteban et al., 2012, in press). Little is known about the involvement of 'self-other control' in higher-level socio-cognitive processes such as lie detection, which concerns self and other representations of opinions. Using a video-mediated lie detection task, Experiment 1 (n = 63) demonstrated that, when asked to judge the veracity of another's opinion, individuals were indeed less accurate when the other person expressed a view inconsistent with their own. Experiment 2 then investigated whether excitatory tDCS of TPJ (n = 16) relative to a mid-occipital control site (n = 17) would enable lie detectors to inhibit their own views and more accurately represent those of the other, improving their ability to determine whether the other was presenting their true or false opinion. Experiment 2 confirmed this prediction: excitatory stimulation of TPJ improved lie detection specifically when self and other views were conflicting. In conclusion, participants were unable to inhibit their own opinion when judging the veracity of another's opinion. Moreover, enhanced control via tDCS elicits improved performance on trials requiring the inhibition of one's own opinion and enhanced representation of that of the other; an important mechanism for many aspects of social cognition.

t043

Control your anger! The neural basis of aggression regulation in response to social rejection

Michelle Achterberg, Anna van Duijvenvoorde, Marian Bakermans-Kranenburg & Eveline Crone
Leiden University

Social rejection often generates aggressive feelings and behavior. Prior studies have investigated the neural basis of social rejection, but the underlying neural mechanisms of social rejection related aggression remain largely undiscovered. The current study investigated the relation between being rejected and subsequent aggression using neuroimaging. Participants viewed pictures of peers with their reaction (accept, neutral, or reject) to the participant's personal profile. Next, participants responded to the peer feedback by pressing a button, thereby producing a loud noise towards the peer, as an index of aggression. Rejection led to more aggression (longer noise blasts). Conjunction analyses showed that both acceptance and rejection feedback were associated with increased activity in the dorsal medial prefrontal cortex (dmPFC) and bilateral insula. In addition, more activation in the right dorsal lateral PFC (dlPFC) during rejection versus neutral feedback was associated with shorter noise blasts, suggesting a potential role of dlPFC in aggression regulation, or top-down control over affective impulsive actions. Taken together, these findings highlight an important individual differences parameter that has been largely neglected in prior research, namely how individuals differ in the way they respond to social feedback.

t044

The role of feedback in the development of theory of mind

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How do children go through the reasoning transitions from their own point of view (zero-order theory of mind) to taking into consideration another agent's beliefs (first-order theory of mind), and later to taking into consideration another agent's beliefs about other agents' beliefs (second-order theory of mind)? We constructed a computational cognitive model in order to find an explanation for this question. There were two main predictions of our model: i) unlike the first-order theory of mind development, children do not have "reality bias" in the development of second-order theory of mind; ii) children can learn to apply second-order theory of mind with the help of feedback "Correct/Wrong" without any further explanations. The predictions of our model was confirmed by the results of a training study in which we trained children between the ages 5 and 7 with 31 different second-order false belief stories in two different conditions: i) feedback with explanations, ii) feedback without any explanation (Correct/Wrong).

t049

Semantic, not positional distances between dependencies affect sentence processing difficulty.

Fenna Poletiek & Jun Lai
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Linearly organized structures in language are supposed to be easy, while hierarchical structures are difficult to process. Traditional accounts attribute the difficulty of processing hierarchical sentences (the dog the man walks, barks) to the positional long distances between dependencies (Gibson, 1998). Alternately, linear structures (the man walks the dog that barks) feature short distances between the nouns and the corresponding verbs. In a sentence comprehension study, we manipulated structure (i.e., positional distance between dependencies) (hierarchical versus linear), and congruency between the semantic and the positional, i.e. syntactic, dependencies, being either congruent as in the dog the man walks, barks, neutral, as in the dog the man sees, walks, or incongruent as in the man the dog walks, barks (barks being syntactically dependent on man, but semantically on dog). The data suggest that structure in itself does not, whilst semantic-syntactic congruency strongly affect comprehension, suggesting a striking new perspective on the cognitive versus formal complexity of human language.

t050

Do Cognitive-Linguistic Findings Extend to Social Psychology? A Registered Multilab Replication Attempt

Rolf Zwaan & Anita Eerland
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Linguistic analysis suggests that language users employ grammatical aspect to construe events. Whereas the progressive (e.g., he was skating) opens up the internal structure of the event, the simple past (skated) does not. Cognitive psychology has found evidence for this. For example, event-related information, such as "ice rink" in a sentence about skating, is primed more strongly after "was skating" than after "skated." Social psychologists (Hart & Albarracin, Psych Science, 2009) have taken these ideas into the realm of legal decision making, finding that the progressive (e.g., was shooting) leads to much stronger judgments of intentionality than the simple past (e.g., shot). A remarkable finding with potentially important theoretical and practical implications. But can it be replicated? I'll discuss a recent multi-lab registered replication effort (to be published in Perspectives on Psychological Science) as well as the original authors' response to this. I will then place this discussion in the broader context of the replication debate.

t051

Influence of reading fiction on connectivity in cortical areas for language and mentalizing

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Behavioral evidence suggests that engaging with fiction is positively correlated with empathizing abilities. The rationale behind this link is that engaging in fictional narratives offers a 'training modus' for mentalizing and empathizing abilities. Here we investigate the link between fiction reading and empathizing by looking at connections between brain areas while people listened to literary narratives. Healthy young participants (N=57, 31 female) listened to two literary narratives (~7 minutes per story) while brain activation was measured with fMRI. As a low-level baseline we used reversed speech. Participants answered questions about their reading habits ('How many fiction books do you read per year?', Author Recognition Test), as well as about empathizing abilities (Empathy Quotient), and the Need for Cognition scale. We computed time-course correlations between 96 cortical regions (Harvard-Oxford atlas), and compared the correlation values between listening to narratives to listening to reversed speech. The differences in between-region correlations in correlation were found to be correlated with individual differences measured by the questionnaires. A network of regions including the inferior frontal gyri bilaterally, right middle frontal gyrus, right supramarginal gyrus, left and right cuneus, and anterior medial prefrontal cortex was sensitive to individual differences in amount of fiction reading. This network includes classical language regions as well as regions implicated in mentalizing. The network hardly overlapped with the correlations found with the Empathy Quotient. Our results

indicate that amount of reading is positively related to between-regions correlations within the (extended) language network, as well as in areas related to mentalizing.

t052

Semantic influences on visual attention

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To what extent is visual attention driven by the semantics of individual objects, rather than by their visual appearance? To investigate this we continuously measured eye movements, while observers searched through displays of common objects for an aurally instructed target. On crucial trials, the target was absent, but the display contained objects that were either semantically or visually related to the target. We hypothesized that timing is crucial in the occurrence and strength of semantic influences on visual orienting, and therefore presented the target instruction either before, during, or after (memory-based search) picture onset. When the target instruction was presented before picture onset we found a substantial, but delayed bias in orienting towards semantically related objects as compared to visually related objects. However, this delay disappeared when the visual information was presented before the target instruction. Furthermore, the temporal dynamics of the semantic bias did not change in the absence of visual competition. These results point to cascadic but independent influences of semantic and visual representations on attention. In addition. the results of the memory-based search studies suggest that visual and semantic biases only arise when the visual stimuli are present. Although we consistently found that people fixate at locations previously occupied by the target object (a replication of earlier findings), we did not find such biases for visually or semantically related objects. Overall, our studies show that the question whether visual orienting is driven by semantic content is better rephrased as when visual orienting is driven by semantic content.

t053

Getting more, for less: The benefits of temporal integration for perception and working memory

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Our perceptual system does not try to process the shortest intervals possible, but aims to create longer, more meaningful events out of ongoing sensory experiences. Is such temporal integration a way to increase perceptual efficiency, or is it just a side-effect of perceptual sluggishness? To answer this, we asked observers to identify up to two targets that were presented amidst distractors in rapid serial visual presentation. The targets were chosen such that they could be reported individually, as in classic paradigms, but that they could also be integrated perceptually to form another valid composite target. First, we simultaneously recorded pupil dilation as a measure of mental effort. On the basis of the observers' behavior, we compared reports of a single target, of two targets, and of a single integrated percept consisting of the features of both targets. Pupil dilation was highest for two-target reports, while integrations and single-target reports both elicited less dilation. Integration thus reduced the mental effort needed to process two targets to that of a single target. In a second study, we then recorded the event-related potential. Attentional processing, as reflected by N2pc amplitude, depended on the number of targets, regardless of integration. However, on both the P3 and the contralateral delay activity, the integration of two targets resulted in lower amplitudes, similar to that of a single target. Integration thus seemed to facilitate working memory consolidation. Taken together, the results support the idea that temporal integration affords an easy and cost-effective way of processing visual information.

t054

Noradrenergic and cholinergic modulation of late ERP responses to deviant stimuli

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Researchers have proposed several hypotheses about the neuromodulator systems involved in generating P3 components of the ERP. To test some of these hypotheses, we conducted a randomized placebo-controlled crossover study in which we investigated how the late positive ERP response to deviant stimuli is modulated by clonidine, an a2 agonist that attenuates baseline noradrenergic activity; and scopolamine, a muscarinic antagonist of acetylcholine receptors. We collected EEG data from 18 healthy volunteers during the performance of an auditory oddball task with several active and passive task conditions. We then used temporospatial principal component analysis (PCA) to decompose the ERP waveforms. The PCA revealed two distinct late positive ERP components: the classic parietal P300 and the frontal novelty P3. Statistical analysis of the temporospatial factor scores indicated that in most conditions the amplitude of the classic P300 was increased by clonidine and scopolamine. In contrast, the amplitude of the novelty P3 was decreased by both drugs. The similar pattern of results for clonidine and scopolamine probably reflects the strong interactions between the noradrenergic and cholinergic systems. The results, in combination with previous pharmacological studies, suggest a critical role for both neuromodulator systems in the generation of the P300 and the novelty P3.

t055

The workings of metacognition during perceptual decision-making

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Decision-making is not always accompanied by full-blown consciousness. For instance, medical experts are able to make a diagnosis in a split second and professional tennis players know what to do at the speed of light. In these examples expertise allows for adept goal-directed decision-making, apparently without much conscious deliberation. Even-though explicit knowledge about how our decisions come about can be crucial, e.g., how a diagnosis was established, to date how this knowledge accompanying decision-making emerges remains unclear. Here, I will address how metacognitive knowledge develops during decision-making and how it relates to first order performance (accuracy). I will discuss single-trial EEG data analysis demonstrating that specifically metacognitive accuracy is related to enhanced theta band activity in prefrontal channels. Next, I will discuss our TMS study in which we targeted prefrontal (aPFC) and sensory regions (MT/V5) during a visual discrimination task, while observing its effect on task accuracy and metacognitive performance.

t056

Split brain, unified consciousness

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We all know what happens when the Corpus Callosum is removed. The splitting of the brain causes a splitting of consciousness. Each hemisphere now becomes its own independent conscious agent. The left hemisphere is conscious of the right visual field, and controls language and the right side of the body. The right hemisphere perceives the left visual field and controls the left side of the body. This is exemplified by the curious finding that if a stimulus is presented to the left visual field, the patient says that he saw nothing, yet the left hand indicates that he did see the stimulus. This finding is textbook material and underlies the influential Integrated Information Theory. / It is also untrue. Over the last six years I have tested completely callosotomized split-brain patients. The main finding is that the text book finding described before cannot be replicated. Although we did find an effect of stimulus location (the left or the right visual field), we observed no effect of response mode (verbal, left hand, or right hand). Patients were better at verbally labelling images that appeared in the right visual field, but it did not matter whether this labelling was done verbally, with the right or with the left hand. Similarly, visual memory was improved for stimuli presented in the right visual field, but again, response mode played no role in this effect. These findings radically change our view of split-brain patients, and challenge our ideas about the neural requirements for unified consciousness.

t061

Kind beyond belief: how norms and second-order expectations influence trust game reciprocity

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A well-functioning society depends heavily on trust and reciprocity. Up to now, reciprocity has been explained in behavioral economics by use of guilt aversion models. In these models, guilt is conceptualized as a deviation from second-order expectations that yields negative utility. Apart from second-order expectations, however, there might be other drivers of reciprocity behavior. The role of an agent's own fairness norms, for example, has not yet been considered in models of reciprocity decision-making, in part because fairness norms in the classic trust game are often collinear to second-order expectations. We present a modified trust game, in which fairness norms and second-order expectations prescribe different behavior. We find that both fairness norms and second-order expectations are predictive of reciprocity behavior, but also that these two motivations assume weights that vary heavily between participants. We propose a novel computational model of trust game reciprocity that takes into account both second-order expectations and the trustee's own fairness norms. We present preliminary findings from a functional magnetic resonance imaging study of brain systems underlying fairness-based and guilt-based reciprocity.

t062

Revisiting the dual-systems model of choice using fMRI:
Cognitive engagement and disengagement explain biases in gain/loss framing

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In the classic gain/loss framing effect, describing a gamble as a potential gain or loss systematically biases people to make conservative or risky decisions, respectively. Previous fMRI studies with limited sample sizes ($N \leq 30$) have found amygdala activation during choices made in accordance with the framing effect and concluded that the biases observed in gain/loss framing result from emotional processes. In this study, we integrate a large fMRI sample filtered through stringent inclusion criteria ($N = 143$ humans in the final sample) and the Neurosynth meta-analytic database (data from over 8,000 published studies) in a network-based analysis of choices made with or against the gain and loss framing effect. We found that whole-brain neural profiles during choices consistent with the framing effect were most correlated with activation associated with the resting or default brain, while whole-brain neural activity during choices inconsistent with framing effect most correlated with the task-engaged brain. Our findings refute the common interpretation of decision-making processes as a competition between emotion and control. Instead, our study indicates that the biases observed during gain/loss framing should instead be attributed to differential cognitive engagement.

t063

Discovering Processing Stages from EEG Data with Hidden semi-Markov Models

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We propose a new method for identifying processing stages in human information processing. Since the 1860s scientists have used different methods to identify processing stages, usually based on reaction time (RT) differences between conditions. To overcome the limitations of RT-based methods we used Hidden Semi-Markov Models (HSMMs) in combination with multi-variate pattern analysis (MVPA) to analyze EEG data. This MVPA-HSMM methodology can identify stages of processing and how they vary with experimental condition. By combining this information with the brain signatures of the identified stages one can infer their function, and deduce underlying cognitive processes. To demonstrate the method we applied it to an associative recognition task. The stage-discovery method indicated that three major processes play a role in associative recognition: a familiarity process, an associative retrieval process, and a decision process. We conclude that the new stage-discovery method can provide valuable insight into human information processing.

t064

Neural correlates of risky and ambiguous gambling during choice and feedback

Neeltje Blankenstein, Eveline Crone & Anna van Duijvenvoorde
Leiden University

Risky decision-making is often studied with paradigms that include gambles with known probabilities (explicit risk), but real-life primarily presents unknown probabilities (ambiguity). / Although prior research suggests that attitude towards risk and ambiguity separately influence risky decision-making, neuroimaging research has been inconclusive about whether risk and ambiguity are processed in distinct neural regions. In addition, brain activation during feedback (gain or no gain) after a risky or ambiguous choice remains largely unstudied. Therefore, we administered a two-option choice task presenting a gamble versus a safe option to a young adult sample (N=55, 18-28 years) with both risky (known probabilities) and ambiguous (unknown probabilities) choices, followed by feedback presenting the outcome (gain or no gain after risk or ambiguity). As expected, participants gambled less and responded slower in ambiguous than in risky trials, indicating ambiguity-aversion. We observed largely overlapping neural activation during risky and ambiguous gambling in the insula,

medial prefrontal cortex (PFC), and lateral PFC. Gambling under risk, however, resulted in greater activation in the lateral PFC and parietal cortex. Finally, we observed no differential neural responses in outcomes after risky or ambiguous gambles. Preliminary analyses linking behavioral and brain responses showed that greater ambiguity tolerance (i.e., relatively more gambling in ambiguity) was related to less activation in bilateral insula and medial PFC. Taken together, these first results indicate that risk and ambiguity are coded in partly overlapping brain regions. In addition, individual differences in ambiguity- and risk-attitudes may drive specific neural activation. /

t065

A case study of skill development and changes in phenomenology of blind users of a sensory substitution device.

Kate Backhouse, Amir Amedi & Romke Rouw
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In blindness where the ocular region and not the cortical pathways are dysfunctional, input to the visual cortex can be rerouted through another sensory modality. Sensory substitution devices (SSDs) take visual information and translate it into another form, such as auditory information. This study follows one congenitally and one early blind participant through a longitudinal training program of a visual-to-auditory SSD. It tracked skill development through playing computer games and subjective reports of phenomenology from questionnaire data. After just 5 hours of training both participants were able to recognise line orientations and shapes, and distinguish between five colours. After 10 hours participants were able to successfully play 2D computer games. After 20 hours of training participants could recognise cartoon faces, distinguishing between features. After 30 hours of training participants were able to recognise real life objects and after 35 hours participants were navigating virtual 3D environments. Results from the questionnaire showed that with increased training participants reported experiences to be increasingly visual. Both participants experienced changes in spatial awareness and perspective when using the device, and developed a new understanding of depth perception. One participant reported the perception of light on two separate occasions, once when using the device and once without. This study shows that with minimal training participants can make great progress in using SSDs, both in their skill ability and in changes of phenomenology. In the future this type of structured training coupled with extensive phenomenology testing and neuroimaging may be the key to understanding sensory awareness.

t066

Alexithymia, not autism, is related to impaired interoception

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It has been proposed that Autism Spectrum Disorder (ASD) is associated with difficulties perceiving the internal state of one's body (i.e., impaired interoception). However, research indicates that alexithymia – characterized by difficulties in recognizing emotions from internal bodily sensations – is also linked to atypical interoception. Because elevated rates of alexithymia in the autistic population have been shown to underpin several socio-emotional impairments thought to be symptomatic of ASD, this raises the possibility that interoceptive difficulties in ASD are also due to co-occurring alexithymia. Following this line of inquiry, the present study examined the relative impact of alexithymia and autism on interoceptive accuracy. Across two experiments, it was found that alexithymia, not autism, was associated with atypical interoception. This indicates that interoceptive impairments should not be considered as a feature of ASD, but instead due to co-occurring alexithymia.

t067

Autistic traits in people with Synesthesia?

Romke Rouw & H.Steven Scholte
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In synesthesia, a certain sensation will evoke another, seemingly unrelated sensation. Autism spectrum disorder (ASD) is a condition characterized by persistent deficits in social communication and restricted or repetitive patterns of behavior. Recent studies have suggested genetic and/or developmental commonalities between synesthesia and ASD, based on increased prevalence of synesthesia in autism spectrum disorder (Baron-Cohen et al.2013; Neufeld et al.2013). Furthermore, altered sensory perception is a significant feature of ASD, and for both ASD and synesthesia a bias toward local as opposed to global perceptual processing has been suggested. The two conditions are suggested to share an atypical development of neural connectivity. We tested 24 grapheme-color synesthetes, 20 adults diagnosed with autism, and 23 matched controls. As expected, the 'Autism Spectrum Quotient' was increased in ASD as compared with synesthete and control subjects. However, our study aimed to separate the different symptoms of the conditions. In the social domain, synesthetes showed increased social or emotional performance as compared with the ASD group, both in objective (RT experiments) and subjective (questionnaires) measurements. A 'Navon' task was used to measure perceptual bias. Subjects were better and faster in recognizing the local (smaller) as compared with the global (bigger) properties of the figure. This effect did however not differ between the synesthete and the ASD group. In conclusion, we propose that when comparing these conditions, rather than searching for an explanation of a shared mental disorder as a latent variable, the conditions should be compared as separate sets of particular symptoms.

t068

Atypical Working Memory Decline across the Adult Lifespan in Autism Spectrum Disorder?

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Whereas working memory (WM) performance in typical development increases across childhood and adolescence, and decreases during adulthood, WM development seems to be delayed in young individuals with autism spectrum disorder (ASD). How WM changes when individuals with ASD grow old is largely unknown. We bridge this gap with a cross-sectional study comparing age-related patterns in WM performance (n-back task: three load levels) among a large sample of individuals with and without ASD (N = 275) over the entire adult lifespan (19–79 years) as well as inter-individual differences therein. Results demonstrated that, despite longer RTs, adults with ASD showed similar WM performance to adults without ASD. Age-related differences appeared to be different among adults with and without ASD as adults without ASD showed an age-related decline in WM performance, which was not so evident in adults with ASD. Moreover, only IQ scores reliably dissociated inter-individual differences in age-gradients, but no evidence was found for a role of basic demographics, comorbidities, and executive functions. These findings provide initial insights into how ASD modulates cognitive aging, but also underline the need for further WM research into late adulthood in ASD and for analyzing individual change trajectories in longitudinal studies.

t073

Tyrosine modulates the effect of transcranial direct current stimulation on working memory in healthy individuals

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Transcranial direct current stimulation (tDCS) is an increasingly popular method of enhancing cognitive functions in humans. However, its efficacy remains contested, as many findings fail to be replicated. It is speculated such inconsistency is due to inter-individual variability related to dopamine (DA). However, previous evidence for this hypothesis was correlational in nature, precluding definitive conclusions. In contrast, we present evidence in support of a causal role for DA in the effect of tDCS on cognition. We show that supplementation of DA's precursor L-tyrosine, presumably inducing a modest increase in DA, modulates the effect of tDCS on working memory. Based on these results, we encourage future studies to take into account individual differences related to DA, to provide more consistent and replicable results regarding the efficacy of tDCS.

t074

Local and interregional alpha oscillatory dynamics dissociate search template from ordinary working memory

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Attention during visual search is thought to be guided by an active visual working memory (VWM) representation of the search target. We here tested the hypothesis that a VWM representation used for search among competing information (a "search template") is neurocognitively distinct from regular VWM representations used for simple recognition. We recorded EEG from 20 human subjects while they performed three different VWM tasks with a lateralized WM-cue design. In one task, after a one second delay subjects had to recognize the target without distractors. In two search tasks, the target was embedded among distractors in a pop-out (distinct), or in a serial (non-distinct) search display. Behaviorally, subjects performed worse on non-distinct search, and equally well on simple recognition and distinct search. During the delay period, we observed robust alpha (8–14 Hz) power suppression over parieto-occipital sites contralateral to the WM cue. This oscillatory signature of WM maintenance, however, was stronger for both search tasks compared to simple recognition. Functional connectivity analyses showed reduced inter-regional alpha phase synchrony between a mid-parietal region and the parieto-occipital region contralateral to the cue, mimicking the local alpha power lateralization effect within a posterior-parietal (PPC) network. Moreover, before the WM cue, alpha phase synchrony between prefrontal sites and PPC was stronger for search tasks compared to simple recognition, reflecting anticipatory control of VWM encoding. Directional connectivity analyses confirmed this effect to be in a anterior-to-posterior direction. Together, these results provide evidence for frontally mediated top-down control of VWM in preparation of visual search.

t075

Memory shapes perception: increased BOLD response, higher decoding accuracies and faster access to awareness for visual input that matches the content of visual working memory.

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Visual information that is actively maintained in working memory affects concurrent perception. A growing body of literature suggests that the same neural substrate underlies visual representations that are retained in working memory and visual representations that are engendered by retinal input. We hypothesized that, if a visual representation is already activated by working memory, it will facilitate processing of visual input that matches this representation. In all experiments, participants memorized a specific shape, drawn from three shape categories (rectangles, ellipses and triangles), for subsequent recall. During the retention interval another shape was presented that either matched or mismatched the category of the memorized shape. In the behavioral experiment, the shape that was presented during the retention interval was rendered invisible by continuous flash suppression. We measured the time it took for this shape to overcome suppression, so that participants could report its location. The results showed that simple shape stimuli are released from suppression faster when they match the category of the shape that is concurrently memorized. A subsequent fMRI experiment revealed that those brain areas that respond to the occurrence of the shape stimulus per se (i.e., notably IPS and LOC) respond more strongly to this stimulus when its shape category matches that of the memorized shape. In addition, multivariate pattern analysis allowed for decoding the shape category of a stimulus when it matched, but not when it mismatched, the memorized shape category. Together, our results demonstrate preferential visual processing of stimuli that match the content of working memory.

t076

Building better brains: modulating working memory capacity and content with electrical brain stimulation

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The ability to briefly maintain visual information in mind, in so-called working memory, is of utmost importance to many higher cognitive functions. Besides the fact that people with high working memory capacity seem to have superior IQ, they also tend perform better at school and work. These observations raise the question whether it is possible to artificially enhance working memory using noninvasive brain stimulation as this might have real-life implications. In this talk, I will present data from multiple ongoing projects that provide evidence that the capacity of working memory can be enhanced by electrically stimulating key nodes in the working memory network (posterior parietal cortex, lateral prefrontal cortex). In addition, I will show that electrical stimulation of visual cortex changes the precision with which information is maintained in visual working memory. Thus, it appears to be possible to modulate both the capacity and contents of working memory with weak electrical current.

t077

When does the oculomotor competition start?

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VU / UU

Under specific conditions visually-guided saccades can have latencies that are extremely short. These saccades are called Express Saccades (average latency 110 to 130 ms). Express saccades are visually-guided and should therefore be influenced by the presence of a visual distractor. Even faster saccades, with latencies lower than 80 ms are considered anticipatory and not visually-guided. In the present study we investigated the influence of a distractor on eye movement behavior during Anticipatory and Express Saccades. When

presenting a distractor in close proximity of a target visually-guided saccades tend to land at a location between target and distractor. This effect is known as the Global Effect. During the experiment participants made visually-guided saccades to a target at a known location. In some trials the target was accompanied by a distractor at an unpredictable location. A gap-paradigm and a warning signal ensured the presence of a high percentage of low latency saccades. The experiment gave a high percentage of Express Saccades (M = 42.3%, SD = 6) with latencies between 80 ms and 150 ms. 22% (SD = 4.9) of the saccades had latencies below 80 ms and were thus classified as Anticipatory. Preliminary results show that a Global Effect was present even for anticipatory saccades. This is remarkable since literature tells us anticipatory saccades are driven by a preprogrammed oculomotor vector and therefore an unexpected distractor should not alter the location of the saccade endpoint. This indicates that the oculomotor vector can be moderated very early on by visual input.

t078

Domain-generality of sensory prediction processes during action: A closer look at the cancellation account

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It has classically been assumed that predicted sensory consequences of action are cancelled from perception, allowing agents to process unexpected events which are more likely to require learning or a novel response. The model draws empirical support from studies showing that tactile, auditory and visual signals predictable on the basis of a motor command are perceived as less intense. Interestingly, contrasting findings from vision research often report that events predicted on the basis of other environmental information are detected more readily and perceived with greater contrast – we perceive what we expect. These processes are typically thought to facilitate adaptive perception given that expected events are more likely. Here we test whether action prediction in fact operates differently. We test the model that motor predictions initially facilitate, rather than attenuate, the perceived intensity of expected stimulus features, and that 'cancellation' reflects the operation of later processes. Participants rated the brightness contrast of visual percepts congruent or incongruent with their own finger movements at different timepoints after action. In both experiments, congruent events were perceived to be of higher brightness contrast 50 ms after action, whereas at 200 ms delay the incongruent events appeared of greater brightness. Effects demonstrated specificity to observed actions rather than spatial location. These findings suggest that predicted action outcomes are not simply cancelled, with mechanisms facilitating perception of both the expected and the unexpected optimising the representation of our environment during action.

t079

A multiple trace theory of temporal preparation

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Several lines of research have suggested that what was previously thought of as effects of voluntary, top-down control, is often the consequence of simple learning of associations. We show that this lesson also applies to temporal preparation. Temporal preparation is typically studied in reaction time tasks in which the participant is presented with a warning stimulus (S1) followed by a target stimulus (S2) that requires a speeded response. When the foreperiod (the S1-S2 interval) is varied randomly across trials, the classic finding is that reaction time decreases as the foreperiod increases, which is usually taken to reflect voluntary temporal preparation driven by an increasing hazard over time. In contrast, our recently developed Multiple Trace theory of temporal Preparation (MTP) explains this effect in terms of learned temporal associations. MTP assumes that during the foreperiod, inhibition is applied to prevent premature response, while a wave of activation occurs upon the presentation of S2. On each trial, these actions are stored in a separate memory trace, which, jointly with earlier formed memory traces, will contribute to preparation on subsequent trials. We present the data of recent experiments in which during an acquisition phase, different groups of participants received different distributions of foreperiods. The data showed clear transfer effects of this manipulation in a test phase where all participants received, after explicit instruction, the uniform distribution. These findings cast considerable doubt on voluntary temporal preparation driven by hazard and clearly favor the idea of learned temporal associations, espoused by MTP.

t080

A cognitive framework for explaining serial processing and sequence execution strategies.

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Behavioral research produced many task-specific cognitive models that do not say much about the underlying information processing architecture. Such an architecture is badly needed to understand better how cognitive neuroscience can benefit from existing cognitive models. This problem is especially pertinent in the domain of sequential behavior where behavioral research suggests a diversity of cognitive processes, processing modes and representations. Inspired by decades of reaction time (RT) research with the Additive Factors Method, the Psychological Refractory Period paradigm, and the Discrete Sequence Production task, we propose the Cognitive framework for Sequential Motor Behavior (C-SMB). We argue that C-SMB accounts for cognitive models developed for a range of sequential motor tasks (like those proposed by Keele et al., 2003; Rosenbaum et al., 1983, 1986, 1995; Schmidt, 1975; Sternberg et al., 1978, 1988). C-SMB postulates that sequence execution can be controlled by a central processor using central-symbolic representations, and also by a motor processor using sequence-specific motor representations. On the basis of this framework we present a classification of the sequence execution strategies that helps researchers to understand better the cognitive and neural underpinnings of serial movement behavior.

p001

With peppermints you're not my prince: Aroma modulates self-other integration

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Recent studies showed that self-other integration, as indexed by the joint Simon effect (JSE), can be modulated by biasing participants towards particular (integrative vs. exclusive) cognitive-control states. Interestingly, there is evidence suggesting that such control states can be induced by particular odors: while stimulating odors (e.g., peppermint aroma) seem to induce a more focused, exclusive state, relaxing odors (e.g., lavender aroma) are thought to induce a broader, more integrative state. In the present study, we tested the possible impact of peppermint and lavender aromas on self-other integration. Pairs of participants performed the joint Simon task in an either peppermint- or lavender-scented testing room. Results showed that both aromas modulated the size of the JSE, although they had a dissociable effect on reaction times (RTs) and percentage of errors (PEs). Specifically, whilst the JSE in RTs was found to be less pronounced in the peppermint group, compared to lavender and no-aroma group, the joint Simon effectJSE in PEs was significantly reduced in the peppermint more pronounced in the lavender group, compared to peppermint and no-aroma group. thus reflecting a more focused, exclusive control state induced by this aroma. The present results are consistent with the emerging literature suggesting that the degree of self-other integration does not reflect a trait but, rather, a particular cognitive state, which can be biased towards excluding or integrating the other in one's self-representation.

p002

Grid-cell representations in mental simulation

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Anticipating the future is a key motif of the brain, which may be supported by mental simulation of upcoming events. Single-cell recordings in rodents suggest the ability of spatially tuned cells to represent upcoming trajectories and locations. Using fMRI in humans combined with virtual reality, we show an involvement of grid-cell representations in entorhinal cortex during imagination. Our data imply a role of grid-cell computations in mental simulation and future thinking beyond spatial navigation.

p003

Empathic response to cute and scary robots

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Robots are becoming increasingly important in our daily lives, and people have mixed feelings about this. The aim of this study was to investigate people's empathic response to robot opponents with different levels of anthropomorphism–ranging from standard computer to a real (standard) human–in two economic games. Our findings suggest that there is no relationship between the physical appearance of a robot and empathic behavior, but there is a relationship between empathic behavior and anthropomorphization of the opponent.

p004

Transcranial Alternating Current Stimulation for Modulating Cognitive Functioning: A Literature Update

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The rhythmic oscillatory activity within and between different brain regions is believed to play a causal role in a wide range of cognitive functions and to be involved in producing several cognitive deficits observed in neuropsychiatric disorders. Transcranial alternating current stimulation (tACS) has been proposed to represent a promising tool to probe the casual role of rhythmic oscillatory activity in cognition and to correct abnormal activity patterns in patient populations. Here we provide an update of the state of art of this growing field of research to gain a better understanding of the potential of tACS to modulate cognitive functioning in healthy individuals, and of the factors that may affect the likelihood and the direction of tACS effects.

p005

Investigating the parameters of transsaccadic memory

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A limited amount of visual information is retained between saccades, which is then stored into a memory system known as transsaccadic memory. Selection of relevant information is crucial, as the capacity of transsaccadic memory is limited to three or four objects. This selection of information is modulated by positive attentional processes such as the presaccadic shift of attention. A involuntary shift of attention occurs prior to execution of the saccade and leads to information acquisition at an intended saccade target. The aim of the present study was to investigate the influence that a negative attentional effect, inhibition of return, has on the information that gets stored into transsaccadic memory. Results indicate that information at a location near a saccade landing point is less likely to be integrated into transsaccadic memory when this location was previously associated with inhibition of return. Furthermore, we found evidence which implicates a reduction of the overall amount of elements retained in transsaccadic memory when a location near a saccade target is associated with inhibition of return. These results are interpreted in light of the presaccadic shift of attention being modulated by inhibition of return and thereby reducing information storage into transsaccadic memory.

p006

Reorganisation of mnemonic networks in hippocampus and medial prefrontal cortex

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One of the key features of episodic memory is the integration of multiple events and experiences into coherent mnemonic representations. The hippocampus and medial prefrontal cortex (mPFC) are important brain regions for the formation of mnemonic networks. However, it remains unclear if these mnemonic networks are stable after initial formation, or whether they can still be reorganised when new information comes to light. In this fMRI study, participants were presented with events that were integrated into a narrative on Day 1 and presented with the same events along with new events on Day 2. Here, we observe two mnemonic reorganisation processes: Memory networks of the original events, initially represented in the posterior hippocampus shifted to anterior hippocampus on Day 2. In contrast, the mPFC expanded mnemonic network representations with the newly introduced events. Our results show that episodic memories undergo a systematic transformation in hippocampus and mPFC after reactivation and support the view that mnemonic representations remain highly dynamic after initial formation.

p007

Longitudinal development of neural activity in the frontoparietal network: contributions of age, performance, working memory and brain structure

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Using a large-scale longitudinal fMRI study, we aimed to test growth patterns across childhood and adolescence in frontoparietal network activation during a feedback-based learning task, which relied on multiple executive functions. The first aim was to test for linear and non-linear developmental trajectories of activity in the dorsolateral prefrontal cortex (DLPFC), superior parietal cortex (SPC) and the pre-supplementary motor area/anterior cingulate cortex (SMA). A second aim was to test which factors drive developmental change in the frontoparietal network besides age: Contributions of task performance, working memory and cortical thickness were investigated. To these ends, a developmental sample (N=208, 8-27 years old) was tested twice across a period of two years. The results showed that developmental patterns for neural activity in DLPFC and SPC were best characterized by a quadratic age function leveling off/peaking in late adolescence, and by a linear increase across age in SMA. In addition to age, task performance explained variance in DLPFC and SPC but not in SMA activity. In contrast, cortical thickness explained additional variance in SMA activity, but not in DLPFC and SPC. Together, these findings provide a novel perspective of developmental changes in the frontoparietal network, arguing against a simple dual-systems model with linear development in control regions.

p008

The Hunger Games: Modulation of Salience by Reward in an Experimental Setting

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This study analyses how hunger modulates attentional salience. We hypothesized that a picture representing palatable food would cause stronger attentional capture when observers were hungry than when they were sated. In our experimental task (a version of the additional singleton task), participants searched for a target shape with pictures of food (i.e. fruit) and non-food items as distractors. The question was whether attentional capture by the distractors (and in particular for images that displayed food) would be stronger for hungry than for sated observers. Hungry participants showed slower RTs when distracted by images of food, than with non-food control distractors. Participants in a sated condition showed the same RTs in the presence of food and non-food image distractors. In both conditions (i.e. food versus non-food), hungry participants had slower RTs than sated participants. These results have interesting implications for the role of attention in eating disorders and addiction, and show the potential of the Additional Singleton Task for the diagnosis of these conditions.

p009

Object-based benefit in visual working memory: Is it real?

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It is generally agreed that visual items are stored in visual working memory (VWM) within an object-based representation. For example it has been suggested that features that belong to an object are better retained than features from spatially separated objects. To test this type of object-based benefit, we conducted three experiments involving a change detection task in which the to-be-memorized items were mushrooms (features belong to different parts of an object) or colored triangles (features belong to the same part of an object). Experiment 1 showed that object-based benefit cannot be obtained when the location of the to-be-memorized items were rendered task-irrelevant by a sequential presentation. Experiment 2 and 3 provided evidence that this effect was not result of an increased task difficulty due to the sequential presentation, or due to illusory conjunction errors during the encoding phase. These findings suggest that the object-based benefits reported in previous studies (e.g., Xu, 2002a) may actually be the result of a location-based cost, possibly arising from failures to bind feature and location in visual working memory. We propose that there may be no object-based representation in VWM, but instead that objects stored in VWM benefit from a parallel feature store, but not integrated object representation.

p010

Inhibition of re-fixations can be flexibly adjusted

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Inhibition of saccadic return has been proposed to be an intrinsic property of the visual system: with increased latencies for saccades towards previously fixated locations, saccades towards novel locations can be initiated more quickly and are thus promoted. Although this explanation seems an appealing property that may increase efficiency in visual search, such a mechanism is not efficient in other visual tasks. Interestingly, previous research has suggested flexibility in the temporal inhibition (increased latencies) of saccades to previously fixated locations. Here, we addressed the question whether task requirements affect the number of re-fixations as well (spatial inhibition). We measured the proportion of re-fixations in a paradigm where subjects either searched for a specific target or made free saccades. Our data show that the proportion of re-fixations is influenced by two effects. One effect is related to the number of intervening fixations, where more re-fixations were observed with more intervening fixations as has been observed before. In addition we observed a task specific reduction in the number of re-fixations, specific to the search task. Together these data suggest that there is (1) a low level

mechanism that briefly biases saccades away from previously fixated locations and (2) a mechanism that allows for flexible control over the actual expression of re-fixations.

p011

Lateralized EEG power spectra predict individual differences in visual awareness

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Visual target stimuli can be made invisible by procedures like backward masking. By varying the time interval between the onset of the target stimulus and a subsequent mask, the critical SOA (stimulus onset asynchrony) can be established at which a detection threshold of 75% correct is reached. Individuals, however, largely differ with regard to the obtained critical SOA. These individual differences may very well be related to a variation in the ability to focus attention, which may be estimated with lateralized power spectra (LPS) derived from the raw EEG. A task was designed in which participants first had to attend to the left or the right from fixation. After this orienting interval, a target was presented on the attended side while a filler stimulus was presented on the other side. Subsequently, masks occurred after a variable SOA and participants had to indicate the identity of the target. EEG was measured to derive the LPS for the alpha band. Results revealed that individual differences in visual awareness reflected in different critical SOAs were strongly related to differences in lateralized alpha power. These findings indicate that visual attention and visual awareness are intricately related.

p012

Contrast sensitivity in screen-based office tasks for young and old age groups under various illuminance levels

Paul Lemmens, Jan Souman, Hannelore Herremans, Luc Schlangen & Ambali Talen
Philips Research

In typical office lighting, requirements for illumination are mainly defined such that the amount of light is sufficient for most tasks. For instance, visual performance in terms of acuity (i.e., the size of the smallest details that can be discerned) is considered to be sufficiently supported by an horizontal illuminance of 500 lux at the working surface. However, in this no distinction is made between younger and older office workers, though their visual needs in terms of illumination can be quite different. Contrast sensitivity, for instance, is known to decrease with age, in particular at the higher spatial frequencies needed to see fine detail. Moreover, contrast sensitivity in display work is known to be affected by surround illumination. In this study, we investigate whether contrast sensitivity in display work is differently affected by illumination in old than in young office workers. Contrast sensitivity functions will be measured for participants from two age groups (young, 25-35, and old, 55-65). Using the qCSF procedure, these functions will be determined in a screen-based 2AFC orientation discrimination task, with surround light levels varying in different conditions (300, 500, or 1000 lx horizontally). We test the hypothesis that contrast sensitivity is more affected by the surround illumination level in old than in young participants. We intend to present the first findings.

p013

Posterior alpha EEG dynamics dissociate visual search template from accessory memory items.

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Current models of visual search assume that the brain maintains an active visual working memory (VWM) representation of what we are currently looking for: the "attentional template". Recent evidence suggests that template representations can be dissociated from other, “accessory” memory items in VWM, which do not guide attention. It remains unclear what electrophysiological mechanisms dissociate between templates and accessory memories. Here, we measured EEG during a VWM task where we manipulated the status of the VWM item. Subjects remembered a lateralized item followed by two search tasks. The order of the search tasks determined the status of the memory item: the lateralized item was either needed in the first search task (template) or in the second search task (accessory). Event-related potential (ERP) analysis showed that the contralateral delay activity (CDA) and late positive complex (LPC) were unable to differentiate between the different WM representations. In contrast, using time-frequency decomposition we observed clear differences between different WM states. Posterior alpha-band (8–14 Hz) dynamics showed power suppression and reduced parieto-occipital interregional phase synchronization in regions contralateral compared to ipsilateral to the lateralized WM item. Importantly, these lateralization effects were stronger when the memorised item was a template, consistent with the idea that alpha power suppression reflects a state of increased processing or excitability in task-relevant cortical regions. Our results may thus reflect enhanced cortical prioritization of the memory item when this item has the cognitive status of a visual search template.

p014

Tracking the dynamics of visual working memory representations using steady-state-visual-evoked potentials

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Vrije Universiteit Amsterdam

Recent studies have revealed that items held in visual working memory (VWM) change their status depending on task-relevance. Here, we used steady-state visual evoked potentials (SSVEPs) to track the dynamics of these state changes during a combined visual search and working memory paradigm. Participants memorized two coloured items, followed by a cue that indicated which item needed to be searched for first (creating an attentional template for current task-relevant information) and which second (creating an accessory memory for later use). Peripheral checkerboards that matched the colors of the attentional template and accessory item as well as an irrelevant control color flickered at unique frequencies during a retention interval and the two searches, enabling the simultaneous tracking of both types of memory. We observed differences in occipital SSVEP amplitudes depending on the status (e.g. task-relevance) of the memory items. More specifically, the amplitude of the color matching the current attentional template was higher compared to the accessory and irrelevant colors during both the retention interval and the second search, indicating enhanced activation of the template. However, surprisingly, during the first search we did not find this enhancement of the template. A difference in cognitive demand between the two searches could underlie this difference. Future analyses using wavelet decomposition will further elucidate these temporal dynamics. Taken together, we demonstrate that items held in VWM can adopt a different status depending on task-relevance and that SSVEPs provide a useful tool in studying these dynamics.

p015

Predicted stimuli have increased chance of entering awareness

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There is substantial evidence for the effect of top-down predictions on perception. Yet, little is known about the relationship between predictions and awareness. Here, we explore whether the likelihood that a stimulus reaches awareness is altered when its identity is predicted within the attentional blink task. In two behavioural experiments, we presented subject with a rapid stream of letter stimuli (92ms/stimulus) in which they had to detect target letters. On most trials the first target (T1: G or H) was followed by a second target (T2: D or K) that could appear with varying delays. Crucially, there was a predictive relationship between the two targets. T1 (e.g. G) predicted which T2 was likely (e.g. D) or unlikely (e.g. K) to appear. When no T2 was presented a random distractor letter was presented instead. The subject's task was to indicate the presence/absence of T2 and the identity of T1 and T2. Moreover, in experiment 2 we manipulated visibility of the first target by thresholding its duration. We found that valid predictions about an upcoming stimulus increased the likelihood that the stimulus would be consciously perceived (i.e. they help participants detect a stimulus that is often missed). This may indicate that a prediction validation amplifies the perceptual strength of a stimulus, therefore increasing the likelihood that it crosses the threshold of consciousness. The prediction effect disappeared when the first target was not consciously perceived, even though an attentional blink was still observed.

p016

Updating of visual-spatial working memory across saccades

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Visual-spatial working memory (VSWM) helps us to maintain and manipulate visual information in the absence of sensory input. Recent studies have proposed that it may be an emergent property of the oculomotor system. In the present study we investigated the relative role of retinal and extra-retinal signals in updating of working memory representations across saccades. Participants had to maintain a location in memory while making a saccade to a different location. During the saccade the target could be displaced, which was not perceived by the participants. After the saccade participants had to indicate the memorized location either by a match-to-sample task, a mouse click or by another saccade. The results showed a small but systematic bias of target displacement on localization in all response modalities, suggesting that postsaccadic retinal information has only a small effect on memory updating. The bias was the smallest directly after saccade execution and increased over time. Taken together results suggest that VSWM strongly relies on the oculomotor system in updating working memory representations across saccades.

p017

Attentional guidance tracks the strategic transition of accessory memories between visual working memory and long-term memory.

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Visual working memory (VWM) is assumed to play an important role in guiding attention towards task-relevant visual objects. However, VWM is not the only memory system guiding attention. Visual attention rapidly improves when the target is learned, and guidance shifts from visual working memory (VWM) to long-term memory (LTM). So far learning has been investigated for items that are relevant for the ongoing task. In the present set of experiments we investigated how learning an item that is prospectively held for a future task affects attention. Observers performed a visual search while holding an item in memory for a later memory test. This accessory memory was then repeated for several trials such that it could be transferred from VWM to LTM. When the accessory memory was new and thus presumably in VWM it interfered with the ongoing search. However, with repetition, memory-based interference rapidly diminished. Thus, observers learn to shield the memory from the current task. Interestingly, interference resurfaced again in anticipation of a new memory, suggesting a reactivation of VWM. Moreover, both the initial decrease was well as the re-emergence of memory-based interference were sensitive to task expectations, indicating that the mutual handoff between VWM and LTM is under substantial cognitive control.

p018

Location- and Feature-based inhibition of reward distractor in visual search

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Recent studies have shown that reward-associated color can automatically capture attention even if the reward distractor is task-irrelevant and physically non-salient. Here we investigated the effect of location and feature repetition of reward distractor. Nineteen participants were asked to search for a shape singleton target among six uniquely colored items. In each trial, a task-irrelevant item colored in two of red, green or blue signaled the availability the high or low reward. Based on the color of the reward distractor, participants could earn high-value or low-value points in each fast and correct response, while lose high-value or low-value points in incorrect response. Results revealed a lower search accuracy and slower reaction times in the high reward condition, compared to the low reward condition ($Ps<0.001$). Interestingly, search accuracy was impaired when the location of the reward distractor was repeated ($P<0.05$), comparing with that when neither location of target nor distractor was repeated. Further, we found an interaction on accuracy between previous reward and current reward when distractor location was repeated ($P<0.05$). Search accuracy was higher when current reward color was the same as on the previous trial, compared to when it was different ($P<0.001$). We conclude that the location of previously rewarded distractor becomes more salient and more difficult to inhibit, but repeating its feature helps attention to escape from capture by the reward signal. This result highlights the importance of both location- and feature-based selection history of a reward distractor in visual search.

p019

Phasic arousal determines the accessory stimulus effect: a pupillometry study

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People usually respond faster to a visual stimulus when it is immediately preceded by a task-irrelevant, auditory accessory stimulus. This accessory stimulus (AS) effect occurs even with choice RT tasks, despite the fact that the accessory stimulus carries no information about the correct response. Researchers generally assume that the AS effect is mediated by a phasic arousal burst evoked by the AS.

However, direct evidence for that assumption is lacking, and recent research has cast doubt on the idea that the speed-up of RTs is mediated by phasic arousal. We conducted a pupillometry study to directly test the phasic arousal hypothesis. Participants carried out a demanding choice RT task with accessory stimuli occurring on 25% of the trials. Pupil diameter, a common index of arousal, was measured throughout the task. Standard analyses of task performance and pupil diameter showed that participants exhibited the typical AS effect, and that accessory stimuli evoked a reliable pupil dilation on top of the dilation associated with the imperative stimulus. Importantly, detailed follow-up analyses showed that RTs on AS trials were negatively correlated with the size of the AS-evoked pupil dilation: large-dilation trials were associated with a faster response. The opposite relationship was observed for RT and the pupil dilation evoked by the imperative stimulus, suggesting that our primary finding was specifically due to the AS. These results provide the first evidence that the AS effect is mediated by AS-evoked phasic arousal. On the basis of previous research, we hypothesize that the phasic arousal burst speeds up stimulus encoding.

p020

Adolescent Risky Decision Making: Differential Strategies and Underlying Neural Substrates

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Human decision making is far from optimal. For example, when asked to choose between a sure and risky option of equal expected value, individuals are more likely to choose the risky option in case options are framed as losses, while they are more likely to choose the sure option in case options are framed as gains. At the neural level, this framing effect (FE) has shown to be amygdala driven (De Martino et al., 2006). / Although conceptualized as a universal phenomenon, previous research has revealed that not all individuals are equally sensitive to the FE. We hypothesized that this is due to individual differences in decision strategies, where each strategy is associated with a distinct neural profile. To test this hypothesis, in study 1, a large sample of adolescents performed on a framing task. Latent Class Analysis supported our hypothesis, in that adolescents employed one of nine decision strategies. Importantly, adolescents classified in different decision strategy groups were differentially sensitive to the FE. In study 2, a sub-sample of adolescents from five different decision strategy groups, that were more or less sensitive to the FE, re-performed on the framing task in the fMRI-scanner. Unexpectedly, over two-third of all adolescents used a different strategy while in the scanner. In addition, preliminary analyses of the fMRI-data revealed no FE-related amygdala activation, neither across or within subgroups. Potential explanations and future analyses that aim to resolve these unanticipated behavioural and neural findings will be discussed.

p021

Does the pupil track attentional guidance by visual working memory contents?

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The search template is a specific type of visual working memory (VWM) representation that facilitates search by guiding attention toward matching features when they appear in view. In a series of experiments we tested whether the pupil can be used to track attentional guidance by the search template and differentiate this process from recognition of other VWM contents. Participants memorized either one or two colored circles to be searched for later on. When two circles were presented, a retro-cue indicated which one of the two was relevant for the upcoming search task (the template). Crucially, before the search display appeared, we briefly presented one or two colored probe stimuli. These probes could match the color of either the relevant-template color, the irrelevant color, or it could be a new color unrelated to the items in memory. We measured the pupil response to the probe display as a signature of guidance. Overall, the pupil showed significantly more constriction in response to memory matching probes than for unrelated colors. However, this effect seems to be driven by the recognition of the memory items in the probe display rather than by the relevance of each item. Taken together, the pupil was sensitive to when information was previously presented but it could not distinguish the search template from other VWM representations.

p022

Evaluating moral dilemmas: developmental changes and individual differences

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When facing a moral dilemma, in which one has to choose between right and wrong, the ability to reason about an individuals' feeling or thought helps in understanding a situation. This study used an Empathy-Dictator Game in a sample of 113 participants (aged 7-13; mean age: 10.94) to test how children and adolescents would evaluate social situations by asking them to allocate coins with perpetrators, victims, neutral and prosocial people depicted in images of social exclusion, physical aggression, harm by accident, neutral-, and prosocial situations. Results showed that age was related negatively to punishment of perpetrators of social exclusion, physical aggression, and harm by accident, indicating that adolescents were more punishing towards perpetrators than children. Furthermore, the oldest age groups (aged 10-11 & 12-13) offered considerably more to perpetrators who harmed someone by accident compared to perpetrators of social exclusion, whereas the youngest age group (aged 7-9) did not differentiate. / With regard to individual differences, children and adolescents scoring high on empathy allocated more coins with perpetrators and victims of harm by accident, victims of social exclusion, neutral and prosocial people. A relationship that was absent in situations including physical aggression or when coins had to be allocated with perpetrators of social exclusion. Together, these results proved the influence of age and individual differences in decision-making in moral and social situations. Findings that contribute to the understanding of how people evaluate situations they encounter in their daily live.

p023

The Hyperactive Agency Detection Device is Not Hyperactive in Threatening Situations

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A hyperactive agency detection device has been hypothesized to encourage belief in supernatural agents. A fundamental assumption of this hypothesis is that ambiguous threatening situations (e.g. a dark forest) lead people to over-detect the presence of intentional agents. In six threat inducing experiments (N = 245) we have investigated whether we could find evidential support for the hypothesis that threat-induction leads to agency over-detection. Weak threat manipulations (thought control and IAPS pictures) did not lead to increases in agency detection on a Biological Motion Detection Task. A stronger threat manipulation (horror music) led to over-detection of agents on a Biological Detection Task but not to over-attribution of intentionality on a Geometrical Figures Task. The strongest threat manipulation (virtual reality) did not lead to over-detection of agents on an Auditory Agency Detection Task. Also, we did not find that agency over-

detection was related to supernatural beliefs, arguing against the hypothesized idea that agency over-detection encourages belief in supernatural agents.

p024

Neural correlates of social aggression in young children provoked by negative feedback in a social judgment task.

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In daily life, children experience acceptance and rejection by peers (social judgments), which can be distressing and can lead to aggression (Dodge et al., 2003). Recent studies have investigated behavioral reactions of social acceptance and rejection with a social aggression network task in adolescents (Overgaauw et al., in prep). However, not much is known about the neural correlates of social acceptance and rejection in young children. Therefore, we designed a task to measure the reaction to social judgments in 4-6 year old children. The children chose a cuddly animal that was send to their home two weeks prior to the lab visit. During the lab visit the children performed a task in which they saw positive, negative and neutral social judgments on their chosen cuddly animal by same-aged peers (90 trials). Electro encephalogram (EEG) data was acquired to examine the neural correlates of processing social judgments. In the second part of the task social aggression was measured by a button press with which children were able to destroy balloons of the judging peer (60 trials). In total, we included 50 children (mean age 5.30 years old (SD= 0.88), ranging from 4.21 to 7.04 years old, 23 girls) for 17 of whom we have EEG data for ERP analysis. We will present behavioral and EEG data of these children. The feedback related ERP components MFN and P3 will be analyzed to examine differences between the neural reaction to social judgments.

p025

Role of Partner Pupil size and Pupil Mimicry in the Development of Trust- an fMRI study

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In order to decide whether to trust someone or not, people generally make eye contact. During this process, pupils of interaction partners tend to align which helps in making this decision. Interestingly, previous research shows that if both partner's pupils synchronously dilate, pupil-synchronization promotes trust. The function and neural mechanisms of pupil-synchronization are thus far unknown but two hypotheses are at stake: A) As pupil dilation might indicate arousal, it is possible that pupil-synchronization helps people to recognize socially arousing or 'threatening' situations or alternatively B) it enhances the ability to understand others' emotions-the theory of mind (TOM). To test these hypotheses, we conducted an functional magnetic resonance imaging (fMRI) study where we tested the effect of (virtual) partner's pupil size changes and own pupillary responses on subject's trust decisions during incentive trust games. In line with the second hypothesis, results showed that the mimicry of partners' dilating pupils was associated with higher trust levels and increased neural activity in the TOM network (precuneus, temporo-parietal junction, medial prefrontal cortex) and superior temporal sulcus). These findings indicate that pupil mimicry is involved in higher level social cognition as opposed to being a threat-processing mechanism restricted to subcortical structures (amygdala, hippocampus). By examining the neural mechanisms of pupil mimicry, the current study is the first to provide a neurocognitive link between pupil mimicry and trust decisions. Apart from contributing to the field of emotional contagion, this study provides closer insides into the relative impact and function of pupillary signals in human's social cognition.

p026

Investigation of Theta Oscillation Phase Locking After Attentional Blink Training

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The attentional blink (AB; Raymond, Shapiro, & Arnell, 1992) demonstrates the attention limitations of human visual processing. The AB presents itself as the failure to perceive the second visual target (T2) during rapid serial visual presentation (RSVP) tasks when the target is presented within 500 ms of the first target (T1). It has recently been shown that the AB can be trained away, for example by giving T2 a salient colour (Choi et al., 2012). Our goal is to find out why the attentional blink is trained away with attention manipulations such as those employed by Choi. EEG studies have reported differences in phase-locking between blink and non-blink trials in the alpha, beta, and gamma frequency ranges (e.g. Kranczioch et al., 2007). Slagter et al. (2009) reported a meditation-training-related increase in phase-locking of the theta frequency band in non-blink trials, with a peak in phase-locking around 320ms post T2. They suggested that theta phase-locking reflects a readiness of the perceptual system to perceive targets. In our study we analyzed the EEG results from a group trained with the Choi et al. (2012) training paradigm. We found an increase in theta phase-locking in non-blink trials prior to presentation of both targets, both pre- and post-training. This suggests that Choi training may target a different mechanism than meditation training.

p027

Life is unfair, and so is speed skating: Some athletes can randomly benefit from alerting effects due to inconsistent starting procedures

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The Olympics are the world's largest sporting events, attracting billions of viewers worldwide. An important part is speed skating. In this sport, athletes compete against each other in paired races to determine who wins the gold. At each race's start, the referee waits for a variable interval between cueing athletes to get "Ready" and the starting shot. This closely resembled an alerting experiment, in which reaction times are lowest for an optimal interval, and progressively slower with longer intervals. Here we examine skaters' performance in the 500 meter speed-skating competition at the 2010 Winter Olympics. We demonstrate that the time between "Ready" and the start (the ready-start interval) is a significant predictor of speed skaters' times at both 100 meters and at the finish, with longer ready-start intervals resulting in higher race times. This suggests high-level speed-skating competitions are biased to randomly disadvatage some athletes. This bias could be removed by simple alterations to current starting procedures. The proposed change would greatly improve racing sport fairness, which currently suffers from an injustice that disadvantages not only athletes, but entire nations rooting for them.

p028

Social Status and Rejection in Bargaining Situations: An Event-Related Potential Study in Adolescents and Adults

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Adolescence is a period in which social interactions with peers become more complex and social status becomes increasingly important. However, the role of social status in sensitivity to rejection when bargaining, and its neural correlates are not yet well understood. In this between-subjects Event Related Potential (ERP) study we induced differences in social status by having participants play a reaction time task with two (fictive) players which they either won (high status) or lost (low status). Afterwards, participants played multiple rounds of the Ultimatum Game as proposers with the player of opposing status, during which we measured neural reactions to rejection or acceptance of monetary offers in three age groups (9-11 yrs; 13-15 yrs; 18-22 yrs). Participants divided coins between themselves and the player of opposing status (responder) by making a choice between an unfair distribution (7 coins for proposer and 3 for responder; 7/3) and one of two alternatives: a fair distribution (5/5) or a hyperfair distribution (3/7). Participants mostly made fair offers when the alternative was unfair, but more often made unfair offers when the alternative was hyperfair. Strikingly, social status influenced sensitivity towards rejection, such that low social status participants showed a higher Medial Frontal Negativity (MFN) after a fair rejection compared to high status participants. This sensitivity towards rejection was heightened in adolescents, especially when a fair offer compared to an unfair offer was rejected.

p029

Pavlovian reward learning underlies value driven attentional capture

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Typically, if attending a target stimulus is consistently paired with obtaining a high reward, then that stimulus becomes more likely to capture attention compared to an equally salient stimulus associated with low reward. Recent evidence extends this finding by showing that distractors that signal high compared to low reward availability also elicit stronger capture, even when this is detrimental for task-performance. This suggests that simply correlating stimuli with reward delivery, rather than their instrumental relationship with obtaining reward, drives value driven attentional capture. However, in previous studies, only correct responses were followed by reward delivery and the distractor was always presented at a possible target location during active search. Here we specifically addressed whether the mere correlation between stimuli and obtaining reward, independent of the current task and/or response, was able to elicit value driven attentional capture. During a classical (Pavlovian) conditioning phase participants performed a fixation task while stimuli following high and low reward feedback and delivery were presented in the periphery. Crucially reward delivery was independent of the current task and any response. Thereafter, in a non-reward testing phase, participants performed the additional singleton task while the previously high and low reward-value associated stimuli were presented as distractors. The results show that the reward associated distractors slowed response times relative to distractor-absent trials and crucially that high compared to low reward-value associated distractors captured attention more strongly. This study confirms and strengthens the idea that Pavlovian rather than instrumental learning of stimulus-reward contingencies underlies value driven attentional capture.

p030

Social Status and Risk-Taking in a Gambling Task: An Event-Related Potential Study in Adolescents and Adults

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Leiden University

Adolescence is a period in which on the one hand social interactions with peers and social status become increasingly important and on the other hand risk-taking shows an increase. However, the role of social status in sensitivity to risk-taking, and its neural correlates are not yet well understood. In a between-subjects Event Related Potential (ERP) study we induced differences in social status by having participants play a reaction time task with two (fictive) players which they either won (high status) or lost (low status). Participants of three age groups (9-11 yrs; 13-15 yrs; 18-22 yrs) were tested. Afterwards, participants played a gambling task in which they could choose between a high or low amount of coins, during which we measured neural reactions the moment participants received feedback whether they lost (negative feedback) or won (positive feedback) the chosen amount. We found that 13-15 year olds with low status and 18-22 year olds with high status chose the low amount of coins more often. Overall, we found a more negative Feedback Related Negativity (FRN) after loss compared to win feedback. This negativity after loss was modulated by age and status, such that the FRN for low status participants was more negative compared to high status participants. Strikingly, the biggest difference between low and high status was found for the 13-15 year olds, indicating that 13-15 year olds are more sensitive to differences in social status and feedback after loss.

p031

Selection history determines visual salience

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It has been proposed that selection history constitutes a separate form of attentional contol. The present study compared attentional orienting guided by selection history and by physical salience. Participants searched for an odd colored diamond (red or green) and responded to its shape. The search display was preceded by a cue display that also contained a color singleton unpredictive of the target location. The results showed that the cueing effect was larger when the cue singleton matched the color of the previous target. Interestingly, both cues with target-related color showed a larger and earlier cueing effect than an equally salient cue with a target-unrelated color. Similar effects were observed when the color cue was made non-salient. Salient color singleton also failed to capture attention when the distractors in the cue display had target-related color. The results suggests that selection history determines visual salience and speeds up attentional orienting.

p032

Increasing the role of belief information in moral judgments by stimulating the right temporoparietal junction

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Morality plays a vital role in our social life. A vast body of research has suggested that moral judgments rely on cognitive processes mediated by the right temporoparietal junction (rTPJ), an area thought to be involved in belief attribution. Here we assessed the role of the rTPJ in moral judgments directly by means of transcranial direct current stimulation (tDCS)—a non-invasive brain stimulation technique that, by applying a weak current to the scalp, allows modulating cortical excitability of the area being stimulated. Participants

were randomly and equally assigned to receive anodal stimulation (to increase cortical excitability), cathodal stimulation (to decrease cortical excitability), or sham (placebo) stimulation over the rTPJ before completing a moral judgment task. Participants read stories in which protagonists produced either a negative or a neutral outcome based on either a negative or a neutral belief that they were causing harms or no harm, respectively. Results revealed a selective group difference when judging the moral permissibility of accidental harms (belief neutral, outcome negative), but not intentional harms (belief negative, outcome negative), attempted harms (belief negative, outcome neutral), or neutral acts (belief neutral, outcome neutral). Specifically, participants who received anodal stimulation assigned less blame to accidental harms compared to participants who received cathodal or sham stimulation. These results are consistent with previous findings showing that the degree of rTPJ activation reflects reliance on the agent's innocent intention. Crucially, our findings provide direct evidence supporting the critical role of the rTPJ in mediating belief attribution for moral judgment. /

p033

Neural correlates of prosocial behavior: Compensating social exclusion in a four-player Cyberball Game

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Prior studies demonstrated an overlapping contribution of the insula for both experiencing and / observing social exclusion, but it is not yet well understood how the brain processes the compensation of exclusion, as is observed in prosocial helping. Here, we tested if social brain regions, specifically the medial prefrontal cortex (mPFC) and temporal parietal junction (TPJ) are involved when individual show prosocial behavior towards excluded others. For this purpose, 23 female participants played a four-player Cyberball Game in which participants could toss balls to each other. During the exclusion game, two players excluded one of the other players. When participants observed exclusion by others, they showed elevated activity in the insula, consistent with prior studies. However, when they tossed the ball to the excluded player, they showed increased activation in the TPJ, consistent with the hypothesis that prosocial behavior is associated with social reasoning. In addition, tossing to the excluded player was associated with increased activity in the nucleus accumbens (NAcc). Given that prior studies reported that the NAcc is involved in experiencing rewards, this may suggest a warm glow for showing prosocial compensation behavior when helping excluded others.

p034

The influence of a scene preview on eye movement behaviour in natural scenes.

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A brief preview of a natural scene can improve visual search efficiency even when it is as short as 50 msec. The preview advantage is thought to represent the initial processing taking place during the first fixation on a natural scene and perhaps most strongly, the establishment of contextual and semantic guidance. The present work has two aims, first, to investigate whether an initial scene preview affects attentional guidance in natural scenes outside of visual search (i.e., how does the presence of contextual information influence more general eye movement behaviour?) and second, whether it can override the initial tendency for saccades to target regions of high salience. We manipulated the salience distribution across a scene by selectively reducing the global contrast. We showed participants a brief real or nonsense preview of the scene and looked at the time-course of subsequent attentional guidance. A real preview attenuated, but did not override early effects of salience. However, it decreased the latency and increased the amplitude of initial saccades into an image. We discuss these findings in terms of theories of stimulus-driven control and contextual guidance in natural scene viewing.

p035

Age effects on the transfer of sequence knowledge between different types of movements

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During practice of a discrete sequence production task, participants responded either by unimanual key presses (KP), or by moving a lever with a flexion extension (FE) motion of their right arm. Sequence knowledge was then tested with the non-practiced type of responses. We hypothesized that elderly would be able to transfer sequence knowledge between the two response modes. We also expected more transfer from practice using KP followed by a retention test using FE than vice versa. We tested 32 right-handed elderly (65 – 74) and 32 young people (18 – 30). The MoCA, a visuospatial working memory task, and a digit symbol substitution task were administered. Then, two 6-element sequences were practiced with KP or FE for a total of 288 trials. Following an explicit sequence knowledge questionnaire, the test phase consisted of one block of 24 familiar trials and one block of 24 random trials. Transfer was defined as the percentage speed difference between the familiar and random test blocks. After FE practice, both age groups showed transfer of sequence knowledge. This effect was larger for young participants than for elderly. After KP practice, only young participants showed signs of transfer, which was smaller than the amount of transfer after FE practice. Because there was no difference in the amount of explicit sequence knowledge between the practice conditions, we conclude that there is either more implicit spatial sequence learning in the FE than in the KP response mode, or that KP responses are a more sensitive measure of implicit sequence knowledge.

p036

Frontoparietal alpha band stimulation alters spatial attention

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A frontoparietal network has long been implicated in top-down control of attention. Recent studies have suggested that this network might communicate through coherence in the alpha band. Here we aimed to test the effect of coherent alpha (8-12 Hz) stimulation on the frontoparietal network. To this end, we recorded behavioral performance and electroencephalography (EEG) data while participants were engaged in a spatial attention task. Furthermore, participants received transcranial alternating current stimulation (tACS) over the right frontal and parietal cortex, which oscillated coherently in-phase within the alpha band. Compared to a group of participants that received sham stimulation, we found that coherent frontoparietal alpha band stimulation altered a behavioral spatial attention bias. Neurally, stimulation caused hemispheric-specific changes in parietal-occipital alpha activity and alpha coherence between the frontal and parietal-occipital cortex. Moreover, stimulation increased interhemispheric alpha coherence within the parietal-occipital cortex. These results provide preliminary evidence that alpha coherence in the frontoparietal network might play a role in top-down control of spatial attention. Further research is needed to assess the frequency-specificity of these effects.

p037

Brain potentials highlight stronger implicit food memory for taste than context associations.

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Increasingly consumption of healthy foods is advised to improve population health. Reasons people give for choosing one food over another suggest that non-sensory features like health aspects are appreciated as of lower importance than taste. However, many food choices are made in the absence of the actual perception of a food's sensory properties, and therefore highly rely on previous experiences of similar consumptions stored in memory. In this study we assessed the differential strength of food associations implicitly stored in memory, using an associative priming paradigm. Participants (N=30) were exposed to a forced-choice picture-categorization task, in which the food or non-food target images were primed with either non-sensory or sensory related words. We observed a smaller N400 amplitude at the parietal electrodes when categorizing food as compared to non-food images. While this effect was enhanced by the presentation of a food-related word prime during food categorization, the primes had no effect in the non-food trials. More specifically, we found that sensory associations are stronger implicitly represented in memory as compared to non-sensory associations. Thus, this study highlights the neuronal mechanisms underlying previous observations that sensory associations are important features of food memory, and therefore a primary motive in food choice.

p038

The Social Dominance Paradox

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Dominant individuals report high levels of self-sufficiency, self-esteem, and authoritarianism. The lay stereotype suggests that such individuals ignore information from others, preferring to make their own choices. However, the nonhuman animal literature presents a conflicting view, suggesting that dominant individuals are avid "social learners", whereas subordinates focus on learning from "private experience". Here we discuss the distinction between "social" and "private" learning and evaluate whether the stereotypical view of dominant humans as "private learners" is appropriate.

p039

The difference between looking 'for' and looking 'at' something in a real-world search paradigm

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Previous research claims that we barely memorize the locations of distractor objects we incidentally fixate during search for a target object (Võ & Wolfe, 2012), by showing that these objects enjoy no performance benefits when they later do become the target. However, this phenomenon has only been demonstrated with scenes presented on a computer screen. We intended to replicate these findings in a real world situation, by letting observers search for various physical objects in a bookcase, while we tracked their gaze with a mobile eye tracker. There were three blocks in which each object was target of search once. We found no reduction in the number of saccades made nor total time it took to find targets that were incidentally fixated in previous trials. However, when objects had been target of search before (in blocks 2 and 3), search performance improved drastically. Our results support the notion that there is a distinction between looking at and looking for objects for the degree to which they are memorized. Our study furthermore supports that in certain conditions findings of computer studies can be extrapolated to the real world.

p040

The impact of salience and visual working memory on the monitoring and control of saccadic behaviour: An eye-tracking and ERP study

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In a concurrent eye-tracking/ERP study, we investigated the impact of salience on the monitoring and control of eye-movement behavior and the role of visual working memory (VWM) capacity in mediating this effect. Participants made eye movements to a line-segment target embedded in a search display also containing a salient distractor. Target and distractor salience was manipulated by varying degree of orientation offset from a homogenous background. VWM capacity was measured using a change-detection task. Results showed greater likelihood of incorrect saccades when the distractor was relatively more salient than when the target was salient. Error-related negativity (ERN) occurred earlier and was larger following incorrect saccades to the distractor when the distractor was more (vs. less) salient than the target, demonstrating that stimulus-salience affected the degree of response monitoring. The ERN was further modulated by VWM capacity, whereby participants with higher VWM capacity experienced an earlier-onset and, for salient distractors, a larger ERN. In turn, greater ERN predicted better post-error accuracy and post-error saccadic response slowing. Taken together, when participants erroneously deploy their eyes to a more-salient distractor, results showed a rapid and robust ERN, particularly in individuals with high VWM capacity, and an improvement in subsequent behaviour. However, these effects did not emerge to the same extent when participants made the arguably larger error of deploying their eyes to a less-salient distractor, suggesting that this type of error occurs when performance monitoring has failed entirely.

p041

Trust and Reciprocity Development in Adolescence

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Even though adolescence is often associated with risk taking and rebellious behavior, there are pronounced changes also in social reorientation, which help adolescents towards developing social skills and long term social goals. Some studies have suggested that during adolescence prosocial behavior increases, but others have failed to find this relation and argued that this is dependent on context. Here, we test this hypothesis in 494 adolescents between ages 12 and 17 years, by having them play the Trust Game with anonymous peers. Participants played the game in the role of trustor (player 1) and as trustee (player 2). In addition, on some trials risk for trusting was high, whereas on other trials risk for trusting was low. We found that for trust choices (player 1 choices), participants were less willing to trust in high risk versus low risk trials. No developmental differences were observed. In contrast, for reciprocity choices (player 2 choices), participants were more willing to reciprocate with increasing age. Reciprocity choices correlated positively with self-reported empathy, whereas no such relationship was found for trust choices. Together, these results unravel several contradictory results in the

literature by showing the important roles of contextual sensitivity for age changes in trusting behavior and individual differences in empathy.

p042

Friend versus foe: Neural correlates of sharing considerations with liked and disliked peers in adolescents

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Leiden University / Radboud University Nijmegen

Although the majority of our daily social interactions are with people we know, little research has investigated interactions with personally familiar others. In the current functional magnetic resonance imaging (fMRI) study we examined the influence of real-life relationships with interaction partners on fairness decisions and their neural correlates. We specifically focused on interactions with friends and disliked peers in a group of 51 adolescents (M age = 15). Using a set of three modified dictator games, participants could share coins with another player by choosing an equity or an inequity distribution. The other player was either a familiar peer (i.e., a friend, disliked peer, or neutral peer) or an unfamiliar peer. The results suggest that adolescents were more generous towards their friends and less generous towards disliked peers compared to other peers. On a neural level, preliminary findings show higher thalamus and temporal gyrus activation during social decisions involving friends compared to decisions for disliked peers. There was also higher striatum activation during decisions that involved an inequity distribution that benefit a friend (i.e., prosocial inequity). Adolescents did not show more brain activity during decisions for disliked peers than for friends. Our findings suggest that social decisions as well as their neural correlates are modulated by interaction partners.

p043

The role of visuospatial attention during retention of information in visual short-term memory

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There is ample evidence showing that visuospatial attention plays an important role during encoding of information in visual short-term memory (VSTM). Yet, at present it remains unclear to what extent spatial attention plays a functional role in preserving the content of VSTM after initial encoding. To address this issue, in two EEG experiments, we investigated attentional allocation to former stimulus locations during VSTM retention. Specifically, we frequency-tagged individual stimulus positions and hypothesized that if attention is involved in the maintenance of visuospatial information during retention, this should be reflected in enhanced SSVEP amplitude of stimulus vs. irrelevant locations during VSTM retention. In the first experiment, we manipulated memory load so that we could investigate the degree of attentional modulation of former stimulus locations under a high versus low working memory load. In the second experiment, we investigated whether attention may also actively suppress former irrelevant locations, and manipulated distractor-target discriminability by either giving all distractors the same color or a different color. First findings suggest that attention plays a role during VSTM retention in the presence of distractors, but to a lesser extent when only relevant information is present. Furthermore, we found that individual differences in spatial attention to distractor locations during VSTM retention, as reflected by the effect of distractor-color similarity on the SSVEP, predicted speed of responding to the probe as well as individual working memory capacity. Together, our findings suggest that visuospatial attention might help to preserve memories during VSTM retention, in particular under distracting conditions.

p044

Memorable in a Glimpse: Recognition of Memorable and Non-Memorable Pictures in Rapid Serial Visual Presentation

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Recent research has found that certain images are consistently remembered better than others, across a wide range of viewers (Isola et al, 2014; Byliinski et al, 2015). In those studies, long-term memory was investigated. Here we assessed immediate memory for a set of the most and least memorable images in Isola et al (2014) and tested memory immediately after pictures were viewed in a 6-picture rapid serial visual presentation (RSVP) at 13 to 320 ms per picture. Recognition performance for the most-memorable set was significantly better than for the least-memorable set at all presentation durations. Whereas recognition performance for the more memorable set increased steadily and quickly with increasing duration, approaching an asymptote at 320 ms, recognition of less memorable pictures only increased once duration increased beyond 200 ms. These findings show that memorability as an intrinsic property of a picture influences initial perception and not just long-term memory. The results extend current feedforward models of visual recognition in which a single sweep along the ventral visual pathway is sufficient for conceptual recognition, indicating that the first pass is selective in nature and tuned to more memorable image properties.

p045

Emotional and cognitive characteristics of Misophonia

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Misophonia is a condition that has recently garnered the attention of audiologists, psychologists and neuroscientists. It is characterized by a severe aversive reaction to particular auditory stimuli. Some people with Misophonia also report aversive responses to certain visual and tactile stimuli. The small body of research on Misophonia suggests that individuals suffering from this condition experience extreme autonomic arousal1 when exposed to ordinary auditory stimuli. Sufferers report physical sensations, and actions such as teeth clenching and muscle tightening. Emotional reactions and feeling-states include extreme annoyance, anger, rage, and anxiety. Misophonia is not classified in DSM-V or ICD-10, and most people are self-diagnosed. The current study identifies several cognitive and affective aspects of Misophonia. Phonophilia, depression, anxiety, ADD and PTSD have the highest symptom overlap with Misophonia. Still, the condition should be described as a separate condition2 in DSM-V, based on severity of the symptoms, and the distinctiveness of the combination of symptoms. Our data reveal co-morbidity with PTSD. Subjects with PTSD also report more severe Misophonic complaints than subjects without PTSD. Furthermore, according to our data, almost half of the Misophonics experience ASMR (Autonomous sensory meridian response) to various degrees. In our sample, 66 subjects report severe distress caused by their Misophonia, experiencing panic/rage reactions as well as reporting actual use of physical violence (often self-harming). Given the impairing nature of this condition, further research is clearly warranted regarding etiology, phenotypes, and cognitive and neurological properties of this condition. 1. Edelstein, Brang, Rouw &Ramachandran (2013). 2. Schröder, Vulink, &Denys (2013).

p046

Visual in-car warnings: how fast do drivers respond?

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In-car technology allows for personal feedback on driver behavior. One development is to place beacons that can trigger an in-car warning 500 meters before an upcoming lane closure and 350 meters before road objects (rumble strips) appear. What is not known is whether this is enough to allow an effective and timely lane change. Moreover, it is not known how quickly people respond to in-car signals in general. We investigated this using a desktop based driving simulator task. In a within-subjects study participants drove at both 130 km/h and 80 km/h on a three lane highway. A simulated in-car warning system showed in the bottom of the screen when a lane change was needed. We measured reaction time and lane change distance. The driving task was either combined with an audio task at different levels of conversation complexity or performed without it. The initial reaction time was significantly different between audio conditions, but not between driving speeds. Changing distance was on average larger for higher speeds (M = 140 m at 130 km/h) than lower speeds (M = 100 m at 80 km/h). There was no significant effect of audio conditions. Although this average complies with the intended design of 350 meters, within the testing group (N=24) there were 11 subjects who occasionally failed to change lanes in time (20 trials total) - even in trials without audio tasks. This suggests that providing in-car warnings 350 meters before an obstacle is not always enough to allow a timely lane change.

p047

Functional specialization of the male insula during taste perception.

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The primary gustatory area is located in the insular cortex. Although the insular cortex has been the topic of multiple parcellation studies, its functional specialization regarding taste processing received relatively little attention. Studies investigating the brain response to taste suggested that the insular cortex is involved in processing multiple characteristics of a taste stimulus, such as its quality, intensity and pleasantness. We performed a functional Magnetic Resonance (fMRI) study in which young and older adult male subjects were exposed to four basic tastes in five increasing concentrations. We applied data driven analysis to obtain insular response maps, which showed that the insular cortex processes the presence of taste, its corresponding pleasantness, as well as its concentration. Moreover, the left and right insular cortices are differentially engaged in processing these taste characteristics: the presence of a taste stimulus as well as its corresponding pleasantness dominate in the left insular cortex, whereas taste concentration processing dominates in the right insular cortex. Our results fit well within previous cytoarchitectural studies and show insular lateralization in processing different aspects of taste stimuli in men.

p048

Was that a threat? A classical conditioning study on reinforcement-driven attentional bias

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Stimuli signaling the presence of threats and rewards have been proven to influence attentional and perceptual processing. However, the specific mechanisms driving this effect are largely unknown. The present study investigated the effect of learned signals of threat on attentional allocation. We applied a design combining classical aversive conditioning with a Posner cueing paradigm. Observer's task was to discriminate the orientation of a target following the presentation of a bilateral cue-display, which could contain either neutral cues or a cue associated with the threat of an electric shock. We measured reaction time (RT) and d'. / / By manipulating the cue-target stimulus-onset asynchrony (SOA) and introducing 3 cueing conditions (CS+ Valid, CS+ Invalid, and Neutral), we observed effects of threat cues on RT and d'. The results show that both at the short and long SOA, sensitivity (d') was improved for targets presented at the location of the cue that signaled the electric shock (valid trials). A similar pattern was seen for RTs: observers were faster responding to targets presented the shock associated location (valid) than at the invalid location. These findings suggest that attention is captured by the shock associated cue, and the observation that this effect remains present at the long SOA indicates that attention remains present at that location. The fact that we did not find inhibition of return (IOR) suggest that top-down processing is able to overcome the usually observed inhibition.

p049

The influence of individual differences in action production on identification of others' affective states

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Different affective states have previously been shown to have specific kinematic signatures, for example, sad movements tend to be slow, and angry movements are fast and accelerated. We likely use these kinematic signatures to help us perceive affective states in others. If so, our models of the kinematic-affective state correspondence may be based upon experience of our own actions. We therefore predicted that first, altering the kinematic properties of affective movements should reduce their correct identification, and second, correct perception of others' affective states would be influenced by participants' own action kinematics. To test these hypotheses, affect perception was measured by asking typical adult participants to rate the extent to which happy, angry, sad and neutral point-light walkers expressed happiness, anger and sadness. The affective animations were either un-manipulated (100%), or played more slowly or quickly to bring the movement velocity closer to the velocity of the neutral walker (66%, 33% and 0%, with 0% being equivalent to neutral velocity). The velocity and acceleration of the leg was also measured during a simple walking task. In confirmation of our first hypothesis, we found that as the velocity information was removed from the affective animations, identification accuracy also decreased. Second, we found correlations between identification accuracy and participants' own walking velocity and acceleration, such that participants were better at identifying affective states that were more distinct from their own neutral walking kinematics. These results suggest that individuals may calibrate their perception of others' affective states relative to their own reference kinematics.

p050

Pupil Dilation Reflects Unattended Violations of The Beat

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The perception of music is a complex interaction between what we hear and our interpretation. This is reflected in beat perception, in which a listener infers a regular pulse from a musical rhythm. Although beat perception is a fundamental human ability, it is still unknown

whether attention to the music is necessary for beat perception. In addition, to what extent beat perception is open for learning or dependent on expertise, is still a matter of debate. Our aim was to address these questions by measuring the pupillary response to omissions at different metrical positions in drum rhythms, while participants attended to another task. We found that the omission of the salient first beat elicited a larger pupil dilation than the omission of the less-salient second beat. This result shows that participants not only detected the beat without paying attention to the music, but also perceived a metrical hierarchy of stronger and weaker beats. This suggests that beat perception is an automatic process that requires no or minimal attentional resources. In addition, we found no evidence for the hypothesis that beat perception is affected by musicality, suggesting that elementary beat perception might be independent from musical expertise. Finally, our results show that pupil dilation reflects surprise without attention, demonstrating that the pupil is an accessible index to signatures of unattentive processing.

p051

Title: Imitative and complementary actions in peri- and extrapersonal space

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In the domain of motor cognition several studies have shown both imitative and complementary effects between observed and performed hand gestures (e.g., Liepelt, Prinz, & Brass, 2010). These findings are typically interpreted in terms of a dynamic coupling between perception and action, thereby facilitating either an imitative (i.e. making the same gesture) or a complementary (i.e. making a different gesture) movement. Experimental paradigms have often used low-informative stimuli that do not allow to test the boundary conditions for both gesture type effects. Here we investigated how the perceived ability to mimic or interact with others affects response movement latencies, by instructing participants to make an imitative or complementary hand gesture in response to actors presented in peri- or extrapersonal space. Across two studies, we observed faster reaction times for complementary relative to imitative hand movements in response to open hand gestures (i.e. 'hand-shaking') irrespective of the perceived distance of the actor. No RT difference was found for closed hand gestures. These results suggest that people automatically respond in a complementary fashion to handshaking irrespective of the perceived ability to interact with the other and thereby have important theoretical implications for the role of context and affordances on perception-action coupling.

p052

Attention-Based Perceptual Learning Does Not Influence Conscious Access

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UU / UCL

Performance on perceptual tasks improves with practice. While this phenomenon – perceptual learning (PL) – is extensively studied, its relation to conscious access is less understood. One study, Paffen et al. (2008), investigated the effect of PL on interocular suppression using binocular rivalry. Paffen and colleagues found that improved discriminability of task-relevant stimuli was accompanied by selectively increased interocular suppression of task-irrelevant stimuli. This suggested a functional role of noise-exclusion: performance improved not by enhancing awareness of relevant information, but by suppressing awareness of irrelevant information. Here we test this hypothesis by extending Paffen et al. using a new suppression technique: b-CFS. Participants (n=12) were trained on a speed-discrimination task for 3 days. While discriminating the speed of one (relevant) direction, participants were concurrently exposed to another (irrelevant) direction. Before and after training, coherence thresholds and CFS suppression durations were measured for the relevant, irrelevant and a third neutral direction. Speed-discrimination improved significantly, and coherence thresholds decreased only for the task-relevant direction. Intriguingly, the training had no effect on CFS suppression duration. This seems to contradict a functional role of noise-exclusion from awareness, as measured by b-CFS. Furthermore, the present study suggests that the mechanisms of CFS and binocular rivalry are distinct.

p053

Domain-general motor contributions to duration perception

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Recent decades have seen substantial interest in the role motor processes play in perceiving the actions of others. However, preoccupation with 'action simulation' has overshadowed evidence that the motor system contributes to the perception of numerous physical events extending far beyond others' actions [1]. For example, fMRI and neuropsychological studies have implicated motor structures in the representation of fine-grained duration information. However, the nature of this contribution remains unclear. We hypothesised that activating motor representations needed to produce timed movements would establish prior expectations about the duration of upcoming stimuli (i.e. given that the duration of actions and their effects typically covary), biasing their perception, but regardless of whether or not effects were biological. In Experiment 1, participants executed long (>950ms) or short (<500ms) finger movements while judging the duration of pure tones. Psychometric functions were modelled to responses, and the point of subjective equivalence (PSE) was used to measure whether action duration biased the perceived duration of the tones. Results revealed PSE shifts such that participants were biased to perceive durations closer to performed response durations. Experiment 2-4 were conducted to control for the possibility that non-motor information drives this perceptual bias, and to investigate whether these influences arise from a mechanism primarily adapted for action perception. In sum, our results are consistent with the proposal that motor predictions influence the perceived temporal features of numerous events, and that such contributions do not rely on mechanisms specific to perceived actions. [1] Press & Cook (2015) TICS, 19, 176-178.

p054

Attention for emotions in bonobos (Pan paniscus)

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In social animals, the quick recognition of emotional expressions is crucial for survival and the maintenance of social bonds. The dot probe task is a well-established paradigm in psychology, measuring emotional attention. In the task, an emotional and neutral picture are presented briefly on the left and right side of the screen. One image is then followed by a dot, which participants have to touch. Humans tend to be faster when the dot replaces the emotional rather than the neutral picture, especially when it concerns a threatening stimulus. The current study investigated i) whether bonobos, who have rich social emotional lives, have an attentional bias towards scenes showing affective responses of bonobos or bonobos involved in emotion regulatory behaviors (emotional) as compared to conspecifics showing a neutral expression (neutral) and ii) which emotional behaviors attract most attention. Four individuals took part in the experiment. As predicted, results consistently showed that they were faster in tapping the dot replacing an emotional compared to a

neutral picture. Interestingly, this effect was the strongest for pictures showing conspecifics engaged in copulation, yawning, or grooming, and not for threatening stimuli, as is often observed in humans. The results suggest that protective and affiliative behaviors are pivotal in bonobo society and therefore attract immediate attention in this species. In a follow-up study, we will investigate whether there is an attentional bias for emotional expressions of ingroup-members (familiar) versus outgroups (unfamiliar). We predict that attention for affectionate and threatening emotions differs depending on ingroup/outgroup membership.

p055

Visual selectivity is not enhanced by arousal.

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The arousal level of the brain modulates behavior in many different settings. Most notably, arousal level has consistently affected the speed of decision-making in various cognitive tasks, from simple stimulus-driven dot-motion tasks, to cognitive control tasks such as the Stroop, Simon, and flanker tasks. Less is known about how arousal levels modulate the selectivity of visual attention. Recent and classical theories have proposed that arousal narrows the scope of attention to that which is salient and/or pertinent to achieve current goals. We ran 2 experiments to assess how tonic (white noise) and phasic (IAPS picture set) arousal affect visual processing. Specifically, we tested how the arousal manipulations affected visual processing of briefly presented letters under no, moderate and strong competition from distracting stimuli. Analyses of performance accuracy revealed no significant effects of either form of arousal. However, a rudimentary TVA-model fitted to the pooled data of all participants suggests that the phasic, but not tonic, arousal manipulation increases the speed of stimulus processing, while also reducing the threshold for stimulus recognition. Contrary to our hypothesis, the effect on selectivity was negative. When subjects had been exposed to arousing stimuli they were less effective at selecting a target singleton among distractors. Importantly, arousal benefits disappeared after the first block (144 trials), presumably due to habituation to the emotionally arousing pictures. These preliminary results highlight the need for more elaborate experimental manipulations to separate the effects of arousal on selectivity and other processes of visual attention.

p056

Attentional scope modulates alpha oscillations over occipital areas; consequences for multisensory integration.

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In any given scene, we can selectively attend to either global or local features. Previous research has shown that selecting the scope of processing (global vs. local) is correlated with lateralized alpha oscillations over parietal areas. The left and right parietal lobes seem to be specialized towards the processing of local and global features, respectively. For example, in a recent study, rTMS-induced alpha oscillations in the right parietal lobe disrupted global processing, and vice versa. Here we used a Navon task to investigate how these top-down attentional mechanisms affect alpha activity in occipital areas, where it has been shown to be relevant for, among other things, audiovisual integration. Our EEG data reveal that before stimulus presentation a local attentional set is associated with stronger alpha power over occipital areas than a global attentional set. Additionally, during stimulus presentation, individual alpha-peak frequencies are higher in the local attention conditions compared to the global attention conditions. Consequences of these findings for audiovisual integration will be discussed and preliminary data of a global/local audiovisual integration task will be presented.

p057

Social cognition and its embodied roots

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The idea that cognition is ‘embodied’ has been around for a couple of decades, yet, in mainstream cognitive neuroscience it is usually taken to mean little more than recruitment of sensorimotor areas in a cognitive task. In contrast with this modest interpretation there is a volley of evidence available that cognition surpasses sensorimotor recruitment and depends on actual bodily processes (i.e. processes implemented beyond the central nervous system). Circadian rhythms, trophic, hormonal processes, and proprioceptic feedback all have their impact on cognitive processes. As a result, cognitive decisions, including perceptual judgments and action decisions, emerge from brain-body interaction. I will discuss some of this evidence, and stipulate the consequences for our view on cognition in general, and for social cognition specifically. I will show that for emotion mirroring the dependence on the body is well-documented, and that although for action-mirroring the evidence is less clear, there are clues that also here the body plays an active role.

p058

Streaming conscious movement: is Tai Chi Chuan boosting age-related cognitive & motoric functioning?

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Tai Chi Chuan has recently been coming under increasing scientific investigation. Tai Chi Chuan (TCC) is a mind-body exercise stemming from an ancient Chinese martial art. Earlier investigations have shown effects on physical functioning, mental health and cognition, notably cognitive control, in normal aging groups. In order to assess which of three executive functions (switching, updating and inhibition) might show effects of TCC a Randomized Controlled Trial (RCT) was conducted among participants of 55 years and over. TCC instruction videos were developed. The intervention consisted of twenty lessons of 45 minutes each, followed by participants online, spread over ten weeks. The control group watched health educational videos with the same frequency and for a similar amount of time. Next to the three tasks on cognitive control (task switching, 2-back and stop-signal) motoric measures for speed (finger tapping task) and functional balance (Time to get Up and Go test, TUG) were taken. We expected executive functioning to be enhanced for at least two of the three domains relative to control, as well as a relative performance increase in the motoric tasks. We also expected there to be a relationship between the cognitive and motoric measures. Preliminary results show no difference between the groups on any of the cognitive tasks. However, there is a significant difference between groups on the TUG: the TCC group is remarkably faster on its feet (post-measure) than control. The results will be discussed.

p059

On the relative contributions of multisensory integration and crossmodal exogenous spatial attention to multisensory response enhancement

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Two processes that can give rise to multisensory response enhancement (MRE) are multisensory integration (MSI) and crossmodal exogenous spatial attention. It is, however, currently unclear what the relative contribution of each of these is to MRE. We investigated this issue using two tasks that are generally assumed to measure MSI (a redundant target effect task) and crossmodal exogenous spatial attention (a spatial cueing task). One block of trials consisted of unimodal auditory and visual targets designed to provide a unimodal baseline. In two other blocks of trials, the participants were presented with spatially and temporally aligned and misaligned audiovisual (AV) targets (0, 50, 100, and 200 ms SOA). In the integration block, the participants were instructed to respond to the onset of the first target stimulus that they detected (A or V). The instruction for the cueing block was to respond only to the onset of the visual targets. The targets could appear at one of three locations: left, center, and right. The participants were instructed to respond only to lateral targets. The results indicated that MRE was caused by MSI at 0 ms SOA. At 50 ms SOA, both crossmodal exogenous spatial attention and MSI contributed to the observed MRE, whereas the MRE observed at the 100 and 200 ms SOAs was attributable to crossmodal exogenous spatial attention, alerting, and temporal preparation. These results therefore suggest that there may be a temporal window in which both MSI and exogenous crossmodal spatial attention can contribute to multisensory response enhancement.

p061

Use it or lose it? The case of temporal integration in aging

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As people age, their visual temporal resolution diminishes. For example, they do worse in gap detection or backward masking tasks. Older adults also integrate successive visual stimuli over longer intervals than younger adults. A contributing factor could be that in vision, space is the principal dimension, rather than time. To draw a loose parallel with muscle atrophy; it might be that not using it (much) eventually leads to losing it. In audition, the primacy of time could shield against the decline observed in vision. The evidence is mixed. Some studies show that older people also have less auditory temporal resolution, yet no studies indicate that aging affects auditory temporal integration. One psychophysical study even showed that the temporal integration interval might not change with age (Horvath et al., 2007). To investigate this, we compared visual and auditory temporal integration in younger and older adults directly, minimizing task differences between modalities. Participants were presented with a visual or an auditory rapid serial presentation task, at 40-100 ms/item. In both tasks, two subsequent targets were to be identified. Critically, these could be perceptually integrated and reported as such, providing a direct measure of temporal integration. In both modalities, older participants reported more integrations overall. There was also evidence for integration across longer time intervals with age in both modalities, as older participants integrated more frequently particularly at the longer 70 and 100 ms durations. Decline in temporal sensitivity in audition is thus similar to vision, despite the primacy of time in audition.

p062

Do perceptual biases induced by visual attention follow predictions from a neural model?

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Visual attention is the mechanism through which we are able to select relevant visual information. Attention prioritizes processing of the selected information, generally improving its perception. Gaussian models of attention that capture the effects of attention on neural processing predict that attention attracts receptive fields towards its focus. We have recently demonstrated receptive field attraction in humans and showed that its magnitude is strongly related to receptive field size. Receptive field attraction may have consequences for the perception of stimuli outside the focus of attention. Specifically, they are perceived to be further away from the focus of attention than they really are. Here, we investigate if these biases in perceived position scale with receptive field size as well. Subjects judged the relative positions of Gabor stimuli while we manipulated their focus of attention by exogenous cueing. We varied the sizes of receptive fields involved in processing the Gabor stimuli by varying the eccentricity at which the stimuli are presented and the spatial frequency content of the Gabor stimuli. We find that positional biases do not scale with spatial frequency, but do scale with eccentricity. The latter finding closely follows the predictions of a Gaussian model of attention. This study validates neural models of attention in human perception and demonstrates that they can have direct implications for perception.

p063

Hanging out with the right crowd: Peer influence on risk-taking behavior in adolescence

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“If all your friends jumped off a cliff then would you?” Parents who worry about the negative influence of peers frequently pose this question to their adolescent son or daughter and obviously expect the answer to be ‘no.’ Peer influence seems to play a key role in the increase often seen in risk-taking behavior during the adolescent years. Although both experimental and naturalistic studies generally show support for this notion, the process underlying peer effects on risk-taking behavior is not yet fully understood. The present study examined the effects of peer advice on risk-taking behavior from the social norms perspective. Social norms indicate which social behaviors are accepted in the peer context and whether such behaviors will elicit approval from peers. We used a novel card-guessing task in a sample of 15- to 17-year-old adolescents (N = 76) that was played alone as well as online with peer advice. Results indicated that adolescents showed more risk-taking behavior when peers were present. Moreover, these effects were dependent on the social norms conveyed in peer advice as well as the uncertainty associated with the decision. Our findings demonstrate that the social norms approach is valuable to increase our understanding of peer influence.

p064

Exploiting social-categorical knowledge to predict individual human behavior

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Successful social interaction demands humans to predict others' behavior. To do so, internal models of others are generated based on previous observations. To optimize these models, social-categorical knowledge capturing features that a group of individuals share can be utilized. Social cognition research has either focused on stereotypes about groups in general, or on the neural correlates of predicting traits and beliefs of others at an individual level. We aim to investigate how the human brain exploits social-categorical knowledge that represents a group, in order to predict behavior at the individual level. We developed a social-categorization learning fMRI paradigm in which participants predict others' behavior. Social-categorical knowledge needed to be acquired in order to form accurate individual predictions. We show that predictions of others' behavior that utilize social-categorical knowledge recruit regions linked to predicting individual traits and beliefs (e.g., mPFC and TPJ), together with regions implicated in representing social-categorical knowledge (e.g., aTL). As through learning the predictions of others' behavior become more accurate, mPFC shows heightened connectivity with TPJ and STS, while the aTL increases its connectivity with parts of the precuneus. Based on these results, we propose that mPFC generates predictions of others' behavior by exploiting acquired social-categorical knowledge represented in aTL. Possibly, these predictions modulate posterior regions in the temporal lobe in order to predict behavior at the individual level. This study provides novel insights into how social-categorical knowledge is exploited when predicting behavior of other individuals.

p065

Mismatch Negativity Based Neurofeedback for Cochlear Implant Users

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Cochlear implant (CI) users experience great difficulty when it comes to pitch discrimination. This leads to problems during daily interactions, due to poor speech perception, but also a very low pleasure ratings for music. Improving pitch perception and discrimination in CI users would improve their overall quality of life and quality of personal interactions. The aim of this study is to increase pitch perception in CI users using a single-trial based neurofeedback paradigm. / In a pilot study, we tested three CI users with a paradigm based on Vuust et al (2011), which was designed to test musical ability in normal hearing adults. During the experiment, participants are watching a nature documentary while tone are played in the background. The auditory stimuli are short melodies of 4 tones. Each trial consists of 3 melodies: 2 standard, 1 target. In the target melody the third tone differs from the standard melody by 1 semitone. Participants are asked to neglect the tones and concentrate on the documentary. Throughout the study, EEG measurements are taken. / For all CI users, a clear mismatch negativity can be observed for the target stimuli. This suggests an unconscious perception of the target. When asked to count target stimuli in a control block after the experiment, participants were not able to consciously categorize the target. We believe that it is possible to train CI users' pitch perception with a single-trial based neurofeedback paradigm, aiming at perceptual learning.

p066

Using Numerosity Productions to Study Mathematical Development: Evidence for an Operational Momentum Effect in Preschoolers

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The operational momentum (OM) effect describes the systematic bias to overestimate the outcome of addition as compared to subtraction problems. While this bias has been found in 9-month old infants and adult subjects, the existence of a typical OM effect in preschoolers is controversial. In the present study, 6-year old children were instructed to solve non-symbolic arithmetic problems and to indicate their judgments by producing a dot cloud that matches the outcome in numerosity. In contrast to previous studies using other types of responses, the data from this numerosity production task revealed a typical OM effect in children of this age. Performances in the numerosity productions task were furthermore compared with a number-to-position task. Together, the findings provide new evidence for the validity of the method of numerosity productions to examine approximate number skills and suggest that the OM effect is not disappearing or inverting at the age of 6 and seems to be rather a stable phenomenon occurring at each stage of the mathematical development.

p067

Salivary testosterone and cortisol differentially predict competitive decision-making in predator-prey contests

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This study examined whether and how cortisol (C) and testosterone (T) relate to competitive decision making motivated by either greedy appetite to exploit (predation) or to defend against loss and subordination (prey-defense). Participants made 60 incentivized investment decisions in a Predator Prey Game (PPG). Saliva was taken prior to and following decision-making and assayed for C and T. In the PPG the predator invests to take the endowment of the prey, while the prey invests to protect against the attack of the predator. Results showed that hormones had a significant relationship to investment behavior in the prey role, and that this relationship was largely absent from the predator role. Both C and (to a lesser degree) T negatively correlated with prey investments, possibly indexing reduced fear and increased risk-taking. As a result, prey with higher levels of C (and T) calibrated their investment decisions better to their predators aggression, wasted less money, and survived more predator attacks than prey with lower levels of C (and T). That hormonal modulation is stronger in prey rather than predator decision making resonates with work suggesting that prey-defense is more intuitive and modulated by subcortical circuitries, whereas predation is more calculated and conditioned by prefrontal control. We suggest that especially in prey-defense, cortisol and testosterone may be related to adaptive learning in competitive contests.

p068

Structural development of the social brain and links with social functioning

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In recent years numerous studies have provided support for the prolonged trajectories of structural brain development, particularly in the prefrontal and temporal brain regions, from childhood through young adulthood. One longitudinal study has shown that the 'social brain

regions' involved in social cognition and mentalizing, such as the medial prefrontal cortex [medial Brodmann Area 10 (mBA10)], temporoparietal junction (TPJ) and posterior superior sulcus (pSTS) show developmental changes across adolescence (Mills et al., 2014). In the current study, we replicate these findings in a longitudinal sample of 211 participants, who were scanned twice with two years in between (T1 ages 8-24). Grey matter volume, cortical thickness and surface area in mBA10, TPJ and pSTS decreased from childhood into the early twenties. Furthermore, we explored whether measures of social functioning explained additional variance beyond age in changes in structure of the social brain regions and we will show some preliminary results. Importantly, our results not only replicate prior findings on structural changes in the 'social brain regions', they also link these changes to measures of social functioning. As such, our findings are relevant for our understanding of the developmental changes in social cognition across adolescence.

p069

Does affective bipolarity drive creativity?

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Although many empirical studies have observed an association between affective bipolarity and creativity, it is currently unclear how this link may be explained. Are there theoretical reasons why alternating phases of emotional positivity and negativity may be related to an individual's cognitive capacity to be creative? Here, I propose an account of how emotional and cognitive processes may drive epistemic activities within individuals. In this account, emotion-cognition interactions produce cyclical phases of accommodative and assimilative epistemic activities, called thought experiments and empirical experiments, respectively. During phases of negative mood, individuals ruminate over troubling anomalies in order to generate the theoretical ingredients necessary for constructing new conjectures. During phases of positive mood, they explore exciting conjectures in order to cover the empirical ground necessary to discover new anomalies. Creativity is made possible through sequential alternations of these phases. The main virtue of the model is its specification of a coupled feedback mechanism that explains the dynamics and the temporal dependencies between empirical and theoretical activities underlying creative discovery. Rather than being an epiphenomenon, this suggests that the bipolarity-creativity link may be due to a general mechanism underlying the human ability and desire to explore and understand the world.

p070

The influence of features in visual working memory: effects on posterior brain areas

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The number of visual objects we can store in working memory has been estimated to be about 4 objects, regardless of the number of visual features that need to be memorized per object. This has led to the view that we store visual information as complete integrated objects. More recent studies have shown, however, that the number of to be memorized features per object can in fact influence the amount of objects we can store. This finding suggests that storage in visual working memory is limited by the number of objects as well as the number of features of those objects. In 2 experiments we examined this possible interaction between object and feature-based information in working memory, using the contralateral delay activity in the event-related brain potential (ERP). We specifically examined whether this posterior ERP component is influenced by the number of features, as well as the number of objects kept in visual working memory. Our behavioral results show that visual working memory capacity for the same objects decreases when more features need to be memorized per object. In contrast to the behavioral results, the contralateral delay activity is only affected by the number of memorized objects and not by the number of memorized features within each object.

p071

Prior knowledge of the locations of potentially relevant objects reduces effects of visual salience

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The current work aims to investigate whether the effects of visual salience on early oculomotor selection behavior can be modulated by prior knowledge concerning the locations of potential saccadic targets. In two experiments, participants were asked to search for a singleton target line (e.g. left tilted) that was presented with a singleton distractor line (tilted in the opposite direction) in a homogenous field of background lines. The salience of the target could be either high or low relative to the salience of the distractor. The Stimulus Onset Asynchrony (SOA) between the singletons and the background elements was manipulated to dissociate the presentation of information concerning the locations of the singletons from the salience of the singletons. The singletons were either presented simultaneously with the background lines (Experiment 1 and 2), prior to the background lines (Experiment 1 and 2), or after the background lines (Experiment 2). The results indicate that the salience of the target relative to the distractor has a smaller effect on selection performance when the singletons and background lines were presented asynchronously rather than simultaneous. This decrease in the effect of salience occurred regardless of whether the singletons were presented before or after the appearance of the background lines. The results therefore suggest that the availability of information concerning the locations of potentially relevant objects makes oculomotor behavior less sensitive to relative differences in salience among those objects.

p072

Cognitive flexibility game training in healthy seniors

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The cognitive deterioration associated with aging is accompanied by structural alterations and loss of functionality of the frontostriatal dopamine system. The question arises how such deleterious cognitive effects could be countered. Brain training, currently highly popular among young and old alike, promises that users will improve on certain neurocognitive skills. This has indeed been confirmed in a number of studies, especially those incorporating flexibility and tailoring the training adaptively to the individual level. The current project investigates the effects of a cognitive flexibility game training on executive functions and daily functioning of 140 elderly individuals (ages 60-85). During 12 weeks, consisting of 58 half-hour sessions, participants play a series of adaptive games of memory, attention, and reasoning, and need to constantly switch between games and domains. Before and after the training, a large battery of tests and questionnaires is administered in order to test whether effects of training may transfer to different tasks or domains. Results are currently being analysed. Based on earlier results we expect that participants' performance on flexibility and several other tests of executive functioning will be higher after the flexibility training, compared to participants in a low-switch training condition and the control group.

p073

The Effects of Temporal Integration on Working Memory

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When visual stimuli are presented in quick succession (around 100 ms) at the same spatial location, they are often perceived as a single stimulus: they are temporally integrated. This phenomenon could be attributed to the innate sluggishness of the human perceptual system and seen as a disadvantage; after all, the distinctness of each stimulus is lost. However, temporal integration may also play a more active and beneficial role in visual processing, resulting in a more efficient way of encoding and maintaining visual information because fewer stimuli need to be processed individually. We found that the pupil dilation (which is a correlate of mental effort) was the same when two individual visual targets were temporally integrated as when a true single target was perceived. However, it was higher when the two targets were perceived separately. Furthermore, we found some evidence that information can be better encoded and maintained when the underlying stimuli afford temporal integration by running a visual working memory task using a free recall paradigm. Two lines in specific orientations were either presented simultaneously or with varying stimulus onset asynchronies. We modelled recall accuracy and observed that participants' guess rates were lowest when the lines were presented at the same time, increasing linearly with larger stimulus onset asynchronies. Working memory precision remained unchanged. This effect could be attributed to the increased likelihood of integration of both lines into the same perceptual episode at short durations.

p074

Flickering your attention: Evaluation of temporal attention using SSVEP

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Neural oscillations in the alpha band (~10 Hz) seem to be part of the substrate of temporal attention, and temporal predictability has been shown to improve attention and sensory processing. The amplitude of the SSVEP (the EEG response to flickering visual stimuli) correlates with the amount of attention paid to each flickering stimulus even if the flickering stimulus is irrelevant for the task. However, SSVEP modulation may depend in part on the stimulation frequency. To evaluate whether the SSVEP and its temporal dynamics can be used to study temporal attention, and to evaluate whether attention-modulation of the SSVEP is similar for different frequencies we presented targets foveally with a flickering background (and task-irrelevant) frame at different frequencies (6 Hz, 10 Hz, 15 Hz). Successive target stimuli were separated by an interstimulus interval (ISI) that was either constant (ISIc) or variable (ISIv). Behavioral results show faster reaction times and higher target detection accuracy when background was flickering at 10 Hz, and ISIc compared with ISIv. There were no differences in performance at 6 Hz and 15 Hz for any conditions. SSVEP Signal-to-Noise-Ratio (SNR) results showed higher ratio for all the conditions with target absent as compared with target present, mainly for 10 Hz and 15 Hz as compared with 6 Hz conditions. Significant main effects were obtained for frequency, target and interaction between ISI and target. These findings suggest that modulation of time and stimulus flicker manipulation interfere with ongoing attentional processing, even though both time and flicker were completely task-irrelevant.

p075

Interpreting ambiguity in adolescence: examining interpretation bias for health and social information

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Adults with chronic pain and adults with high levels of health-related anxiety have been shown to be more likely to generate threatening explanations of ambiguous cues and experiences concerning health and bodily sensations. This negative interpretation bias may play a role in the etiology and maintenance of chronic pain disorders, which often begin in adolescence. It is yet to be determined whether adolescents show a similar interpretation bias, and whether or not this bias extends to social cues and experiences. This study was the first attempt to assess interpretation biases towards pain- and health-related information in a sample of healthy adolescents. A total of 120 adolescents aged 11-18 were tested in groups on individual computers. First, they completed the Adolescent Interpretation Bias Task (AIBT), in which they rated how likely 32 different interpretations of ambiguous health-related and social situations came to mind and which interpretations they most believed in. Subsequently, they completed self-report measures of pain- and health-related anxiety, social anxiety, general anxiety and depression. Results showed that in adolescents, as is found in adults, a negative interpretation bias towards pain- and health-related information was associated with heightened levels of health anxiety. Furthermore, this bias seemed partly independent of generalized anxiety. No evidence was found for the bias to be content specific, which contrasts with adult research. Further studies can help to clarify the role of interpretation bias in the etiology, prevention and treatment of chronic pain in adolescents.

p076

Modulating face memory in younger and older adults using non-invasive brain stimulation.

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The ability to extract information about facial identity is a crucial skill. Therefore, enhancing skills such as face memory could be beneficial. Here we sought to investigate the effects of tRNS (a brain stimulation technique that has been shown to improve memory in other domains) on face memory in younger adults and older adults. Across two experiments we investigated performance on the Cambridge Face Memory Test (CFMT) following active high-frequency tRNS or sham stimulation to bilateral ventrolateral prefrontal cortices (VLPFC). The VLPFC was chosen based on brain imaging work showing activation in VLPFC during face memory task and changes in activation pattern during aging. In our first experiment we examined younger adult participants and compared performances before and after tRNS using a mixed design with the factors of Group [stimulation / sham] and Session [Pre/Post]. Participants receiving tRNS significantly outperformed those receiving sham stimulation, implying tRNS may be useful to enhance face memory in younger adults. As VLPFC function in face memory has been linked to declines in face memory during typical aging, we then examined whether these findings extended to older adults. Using a within-participant design participants received active tRNS or sham stimulation across two sessions, prior to completing two versions of the CFMT. In contrast to younger adults, older adults that performed better at baseline showed performed significantly worse relative to sham stimulation. Our findings indicate a crucial role for VLPFC in face memory, but it may play a different functional role for younger and older adults.

p077

The relation between affective touch and pupil size

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Interpersonal touch is known to influence human communication and emotion. Affective touch is defined as soft stroke on hairy skin with a velocity of 1-10cms-1. This type of touch activates specific low-threshold unmyelinated mechanorecepters, known as C-tactile afferents, which have been proposed to play a unique role in processing the hedonic valence and emotion of touch. For different modalities, hedonic emotional processing has been associated with pupil dilation. However, this relation remains unclear for the somatosensory system. The current study investigated how pupil size reacts to both affective (3cms-1) and non-affective stroking (0.3 and 30cms-1) on the dorsal side of the right hand. Pupil size data was obtained with an EyeTribe tracker, and further analyzed with linear mixed-effects modeling (LMER) to check for significant differences between stroking conditions. Additionally, an adjusted version of the Touch Perception Task (TPT) was used to assess subjective touch pleasantness ratings. Repeated-measures ANOVAs revealed that stroking velocity had significant effect on TPT-item scores, showing higher positive and lower negative ratings for the affective touch compared to non-affective touch, thereby replicating results of previous studies. Interestingly, pupil sizes for 30cms-1 stroking were significantly larger than for 3 and 0.3 cms-1 stroking. For affective touch, a 1s lasting effect at 2.8s after stroking onset was found where pupil size was significantly larger than for 0.3cms-1. Results support the view of positive-negative asymmetry, specifically suggesting that negative touch outweighs positive touch for pupil size responses related to emotional arousal.

p078

Liking versus complexity: Decomposing the inverted U-curve by accounting for individual differences

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The relationship between liking and stimulus complexity is commonly reported to follow an inverted U-curve. However, large individual differences among complexity preferences of participants have been frequently observed. The common use of across-participant analysis methods that ignore these large differences in aesthetic preferences of the participants gives an impression of high agreement between individuals. In this study, we collected ratings of liking and perceived complexity from 30 participants, as well as calculating an objective measure of complexity for a set of digitally generated grayscale images. Our results reveal that the inverted U-curve relationship between liking and stimulus complexity comes about as the combination of different individual liking functions. Specifically, after automatically clustering the participants based on their liking ratings, we determined that one group of participants in our sample had increasingly lower liking ratings for increasingly more complex stimuli, while a second group of participants had increasingly higher liking ratings for increasingly more complex stimuli. Furthermore, the average response times for liking ratings, but not for complexity ratings were significantly higher for the cluster that preferred more complex stimuli. This result is consistent with the idea that preference for fluently processed simple stimuli is automatic, while a higher preference for complexity involves more cognitive processing, leading to slower evaluations. Implications of these findings include the need for explaining the basis of these interindividual differences, adoption of alternative analysis methods that would account for these differences and even a need for re-evaluation of established rules of human aesthetic preferences.

p079

Holding hands alleviates pain and reduces pain-specific brain responses

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Social attachment and romantic bonding are powerful reinforcers associated with approach behaviors, openness and stress reduction. Social support (e.g., holding hands with a significant other) has been shown to modulate physical pain in real-life settings (e.g., during childbirth and cancer/renal disease treatment). Despite the beneficial effects of holding hands when coping with pain and stress, this strategy is disregarded in conventional medical settings, possibly due to a lack of objective measures proving evidence for its beneficial effect. For example, does hand holding only affect subjective pain reports due to a reporting bias or does it actually reduce pain-specific brain activity? We assessed the effects of social support from the romantic partner on brain responses to acute thermal pain in healthy women (N=30), using a hand-holding paradigm. Holding hands with the romantic partner (vs. holding a squeezable device) significantly reduced pain-related intensity and unpleasantness, anticipatory anxiety, and increased perceived comfort. fMRI results showed significant reduction of the Neurologic Pain Signature (a multivariate fMRI pattern sensitive and specific to physical pain,). This reduction was specific to pain-activation and did not occur for either anticipation or rating periods. Reductions in pain intensity and unpleasantness were parametrically associated with activation reductions in pain-processing regions and evaluative/self-referential regions. These results suggest that holding hands with the romantic partner in a pain-related context exerts a protective effect that is associated with a reduction in pain-specific brain representations. This is a promising step towards further validating the protective effects of hand holding during acute painful procedures.

p080

Effects of target and reward-signaling distractor proximity on attentional capture

Bronagh McCoy & Jan Theeuwes
VU

In the current study, participants made eye movements to follow a target around the visual field, in a fast-paced, purely oculomotor design. Colored distractors signaling high, low and no monetary reward appear either in close or far proximity from the target, at an equal distance as the target from the current gaze position. Distractors were never used as targets and any eye movement to them resulted in no monetary reward. The data showed reliably lower saccadic onset latencies to the target when distractors were presented in close proximity to the target (30 degrees) compared to distractors presented at two distant locations (120 or 180 degrees). Saccadic onset latencies are also significantly lower when the distractor was presented at 120 degrees compared to 180 degrees from the target. The first half of the experiment displays no differences in the percentage of erroneous saccades made to the high, low or no reward distractor, at any of the distractor positions. In the second half of the experiment however, participants made consistently more erroneous saccades to the high reward over no reward distractor, when that distractor was displayed at both the 30 degree and 120 degree positions. These results suggest that a rewarding distractor in the vicinity of a target does not delay the onset of correct saccades to the target, but has the ability to capture attention in an all-or-nothing fashion at the earliest stage of oculomotor preparation.

p081

Skin conductance distinguishes between familiar and unfamiliar buildings

Richard Jacobs & Rob Van Lier
Radboud University

Earlier research has shown interesting dissociations between implicit and explicit recognition of familiar faces. Prosopagnosic patients, like healthy controls, show heightened skin conductance responses to familiar as compared to unfamiliar faces, despite being unable to recognize these faces. Patients with Capgras delusion show the reverse pattern, with intact recognition but absence of the heightened skin conductance responses for familiar faces. These findings have been interpreted within face processing frameworks, on the grounds that we seem to have dedicated face processing resources, and based on a finding that skin conductance shows no differentiation between familiar and unfamiliar written names. We decided to test another category of stimuli, namely buildings. We presented famous and unknown buildings to passive observers while measuring their skin conductance responses, and found the reverse pattern compared to what is normally found with faces: Skin conductance responses to famous buildings were lower than to unknown buildings. Whether buildings were presented in photographic quality (with texture) or not (black-and-white outline) had no influence. We interpret these findings in terms of action tendencies to the different stimuli. The skin conductance responses may reflect these action tendencies rather than genuine autonomic responses.

p082

Prospective event representation through hippocampal regularity learning

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The ability to anticipate upcoming events based on previous experiences is vital for everyday functioning. The hippocampus is the prime candidate for the prospective representation of anticipated events, not only because of its involvement in memory, but also imagination and event reconstruction. Previous work has shown that the hippocampus can represent learned temporal regularities through increased neural pattern similarity between the associated stimuli. However, it is unclear whether this increase reflects temporal proximity of the stimuli or their relevance for the sequence representation. In this study, we combined a sequence learning task with functional magnetic resonance imaging and representational similarity analysis to investigate what properties of new regularities are represented in the hippocampus. We presented participants with pictures, which were related to each other through statistical regularities. These regularities divided the stimulus set into sequences of three pictures (triplets), of which some were fully predictable (i.e. with transitional probabilities of 1), whereas in other sequences, the last picture was unpredictable (transitional probability of 0.5). This design allowed us to distinguish temporal proximity of stimuli in a sequence from their relevance for sequence representation. We show behavioural facilitation for the predictable sequences, indicating that behaviour is guided on the basis of the learned regularities. Furthermore, hippocampus is sensitive to the sequence predictability during regularity learning. Finally, we show that hippocampal stimulus representations become more similar after learning for predictable, but not unpredictable, sequences. These findings highlight the importance of the hippocampal system in the representation of sequence regularities.

p083

Cue-elicited food-seeking in an obesogenic environment

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UvA

Food-associated cues can trigger food-seeking. In two studies, we investigated this phenomenon using a Pavlovian-instrumental transfer (PIT) paradigm. In this computerized task, participants pressed keys for food rewards (e.g. left for chocolate and right for popcorn), and were occasionally presented (Pavlovian) cues on the computer screen that had previously been associated with those same rewards. We found that those Pavlovian cues biased responding towards the associated food (e.g. a cue for chocolate will bias responding towards the left key). Study 1 showed that this PIT effect is undiminished by satiation on the associated food. Study 2 showed that in obese individuals – but not in lean controls - the PIT effect is stronger for high-calorie food rewards than for low-calorie. These results will be discussed with reference to research showing that PIT engages brain regions implicated in inflexible, habitual behavior. Taken together, these results provide evidence that this associative mechanism plays a role in the obesogenic effect of our environment that constantly reminds of palatable, high-calorie food.

p084

Controlling the Avatar: Dysfunctional Mechanisms in Third Person Body Control

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Introduction: Humans increasingly use of virtual environments in which they control the body of a virtual avatar. Applications such as Kinect use the human body as a controller for the virtual body. Recent findings from our lab suggest that third person body control (3PBC) is associated with loss of motor control and is accompanied by disembodiment of the real body. Method: Four studies were conducted to investigate impairments in motor control and disembodiment in 3PBC. Participants were seated behind a table and performed a block-sorting task while wearing a head-mounted display (HMD). The HDM presented the live feed from a camera that was placed at an elevated position (left or right) behind the subject (studies 1 and 2) or at a position directly above the workspace in (eight) different angles of view (studies 3 and 4). Subjects used their left or right hand in different blocks. Results: Performance (speed, accuracy), self-report (agency, body ownership, sensation, self-body dissociation), and pain-threshold measures revealed problems of motor control and disembodiment to increase as a function of the angle of view (AOV) between the camera perspective and the orientation of the hand. This implies that within a particular camera orientation, markedly different levels of impairment can be found for the left and the right hand, depending on their angle of use. Conclusion: Performance, self-report, and pain-threshold revealed similar effects of AOV. This suggest that disembodiment effects and loss of motor control are closely related and that both originate from multisensory conflict that is caused by the shift in perspective in 3PBC.

p086

The Mental Whiteboard Hypothesis on Serial Order in Working Memory

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Various prominent models on serial order coding in working memory build on the notion that serial order is achieved by binding the various items to-be maintained to fixed position markers. Despite being relatively successful in accounting for empirical observations and

some recent neuro-imaging support, these models were largely formulated on theoretical grounds and few specifications have been provided with respect to the cognitive and/or neural nature of these position markers. Here we outline a hypothesis on a novel candidate mechanism to substantiate the notion of serial position markers. Specifically, we propose that serial order WM is grounded in the spatial attention system: (I) The position markers that provide multi-item WM with a serial context should be understood as coordinates within an internal, spatially defined system, (II) internal spatial attention is involved in searching through the resulting serial order representation, and (III) retrieval corresponds to selection by spatial attention. We sketch the available empirical support and discuss how the hypothesis may provide a parsimonious framework from which to understand a broad range of observations.

p087

An event-based Account of Conformity

Diana Kim & Bernhard Hommel
Leiden University

People often change their behavior and beliefs when confronted with deviating behavior and beliefs of others, but the mechanisms underlying such phenomena of conformity are not well understood. Here we suggest that people cognitively represent their own actions and others' actions in comparable ways (theory of event coding), so that they may fail to distinguish these two categories of actions. If so, other people's actions that have no social meaning should induce conformity effects, especially if those actions are similar to one's own actions. We found that female participants adjusted their manual judgments of the beauty of female faces in the direction consistent with distracting information without any social meaning (numbers falling within the range of the judgment scale) and that this effect was enhanced when the distracting information was presented in movies showing the actual manual decision-making acts. These results confirm that similarity between an observed action and one's own action matters. We also found that the magnitude of the standard conformity effect was statistically equivalent to the movie-induced effect.

p088

γ-Aminobutyric acid (GABA) improves action selection processes:
Evidence from transcutaneous vagus nerve stimulation (tVNS) and synthetic GABA administration

Laura Steenbergen, Roberta Sellaro, Ann-Kathrin Stock, Christian Beste & Lorenza Colzato
Leiden University / TU Dresden

The ever-changing environment we are living in requires us to apply different action control strategies in order to fulfill a task goal. When confronted with multiple response options it is fundamental to prioritize and cascade different actions. So far, very little is known about the neuromodulation of action cascading. In this talk, I will present two studies. In the first study, we applied transcutaneous vagus nerve stimulation (tVNS), a new non-invasive and safe method to stimulate the vagus nerve and to increase GABA and NE concentrations in the brain. Results showed that active, as compared to sham stimulation, increased response selection functions during action cascading and lead to faster responses when two actions were executed in succession. In the second study, we assessed the specific causal role of the GABA-ergic system in modulating the efficiency of action cascading by administering 800 mg of synthetic GABA or 800 mg oral of microcrystalline cellulose (placebo). Results showed that the GABA group, compared to placebo group, increased action selection when an interruption (stopping) and a change toward an alternative response were required simultaneously. These findings provide the first evidence for a possible causal role of the GABA-ergic system in modulating performance in action cascading.

p089

A single bout of meditation biases cognitive control but not attentional focusing: Evidence from the global-local task

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Recent studies show that a single bout of meditation can impact information processing. We were interested to see whether this impact extends to attentional focusing and the top-down control over irrelevant information. Healthy adults underwent brief single bouts of either focused attention meditation (FAM), which is assumed to increase top-down control, or open monitoring meditation (OMM), which is assumed to weaken top-down control, before performing a Global-Local task. While the size of the global-precedence (reflecting attentional focusing) was unaffected by type of meditation, the congruency effect (indicating the failure to suppress task-irrelevant information) was considerably larger after OMM than after FAM. Our findings suggest that engaging in particular kinds of meditation creates particular cognitive-control states that bias the individual processing style towards either goal-persistence or cognitive flexibility.

p090

Neurotransmitters as food supplements: the behavioral effect of GABA

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The food supplement version of gamma-aminobutyric acid (GABA) is widely available online. Although many consumers claim that they experience benefits from the use of these products, it is unclear whether these supplements confer benefits beyond a placebo effect. Currently, the mechanism of action behind these products is unknown. It has long been thought that GABA is unable to cross the blood brain barrier (BBB), but the studies that have assessed this issue are often contradictory and range widely in their employed methods. Accordingly, future research needs to establish the effects of oral GABA administration on GABA levels in the human brain, for example using magnetic resonance spectroscopy. There is some evidence in favor of a calming effect of GABA food supplements, but most of this evidence was reported by researchers with a potential conflict of interest. We suggest that any veridical effects of GABA food supplements on brain and cognition might be exerted through BBB passage or, more indirectly, via an effect on the enteric nervous system. We conclude that the mechanism of action of GABA food supplements is far from clear, and that further work is needed to establish the behavioral effects of GABA.

p091

Action Selection as a Source of Visual Bias

Davood Gozli
Leiden University

We plan and execute our actions in order to fulfill certain sensory goals. It is, therefore, generally believed that sensory anticipation is an essential feature of action selection. In this presentation, I will describe a series of experiments that examined the role of actions in the

guidance of visual attention. Each experiment began with an initial learning phase, in which observers learned to associate two actions (e.g., left/right button press) with two visual outcomes (e.g., red/green color). After the learning phase, observers performed in a test phase, in which they continued to perform the same actions while their attentional bias was measured for features that matched or mismatched the anticipated action-outcome. The findings clearly demonstrate that learned action-outcome association contributes to the guidance of attention. This guidance, furthermore, seems to be due to activation, rather than inhibition, of the predicted action-outcomes. The findings help situate processes of visual attention in the broader context that includes action control and action-outcome associative learning.

p092

Dissociating sensory from decision processes in human perceptual decision making

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A key question within systems neuroscience is how the brain translates physical stimulation into a behavioral response: perceptual decision making. To answer this question, it is important to dissociate the neural activity underlying the encoding of sensory information from the activity underlying the subsequent temporal integration into a decision variable. Here, we adopted a novel approach to empirically assess this dissociation in human magnetoencephalography recordings. We used a functional localizer to identify the neural signature that reflects sensory-specific processes, and subsequently traced this signature while subjects were engaged in a perceptual decision making task. Our results revealed a temporal dissociation in which sensory processing was limited to an early time window and consistent with occipital areas, whereas decision-related processing was longer-lasting and involved parietal and frontal areas. We found that the sensory processing accurately reflected the physical stimulus, irrespective of the eventual decision. Moreover, the sensory representation was stable and maintained over time when it was required for a subsequent decision, but unstable and variable over time when it was task-irrelevant and unattended. In contrast, decision-related activity exhibited a stereotypical ramping pattern. Together, our approach dissects neuro-anatomically and functionally distinct contributions to perceptual decisions.

p093

Evolving the keys to visual crowding

Erik van der Burg, Christian Olivers & John Cass
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Peripheral vision can be severely impaired by nearby clutter. Decades of research using sparse displays have established that this phenomenon, known as visual crowding, follows Bouma's law: Interference occurs for target-distractor separations up to half the target's eccentricity. Although considered a fundamental constraint on human vision, Bouma's law has never been tested in more dense visual environments. Using a genetic algorithm we investigated crowding in densely cluttered displays. Participants were instructed to identify the orientation of a target line (6° eccentricity) among 284 distractor lines. Displays supporting highest accuracy were selected ("survival of the fittest") and combined to create new displays. Performance improved over generations, predominantly driven by the emergence of horizontal flankers within 1° of the near-vertical target, but with no evidence of interference beyond this radius. We conclude that Bouma's law does not necessarily hold in dense displays. Instead, a nearest-neighbour segmentation rule provides a better account.

p094

The Full Body Illusion in Action

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Recent studies in cognitive neuroscience suggest that experimentally induced body illusions might affect several aspects of body awareness. Our knowledge of these disembodiment effects is primarily based on studies using passive induction by the experimenter. To create a more complete account of these effects we investigated whether an actively induced full body illusion (FBI) affected spatial tactile resolution. Participants stood between two mirrors and induced the FBI by stroking their neck for four minutes while looking at their backside. To measure spatial tactile resolution, participants repeatedly judged whether two-pointed stimuli of varying sizes felt as one or two points. A questionnaire was completed as measure of illusion strength. In three studies we found that 1) the FBI can be self-induced through action 2) the FBI affected spatial tactile resolution to some degree 3) effects of the FBI might spread to unstimulated locations of the body and 4) the actively induced FBI reduces feelings of agency.

p095

The influence of a scarcity mindset in every day decision making

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An essential component of everyday life is grocery shopping. Despite its pervasiveness, not much is known about how a scarcity mindset, the feeling of not having enough, influences our consumer choices. In the current study we investigated whether consumer decisions are affected by a scarcity or abundance mindset and if they are dependent on product type. During an fMRI scanning session, we alternately induced a scarcity and abundance mindset in participants in counterbalanced order. During these mindsets, we asked participants to perform an unrelated shopping task: participants indicated how much they are willing to bid for various supermarket products in an auction mechanism. In a behavioral session one to two weeks later, participants indicated how hedonic and utilitarian they considered each product, how much they wanted the product and how often they bought the product. Results from a mixed model analysis show that participants placed higher bids for products they rated as more hedonic and products they wanted more. Moreover, participants were willing to pay more for products they found less hedonic in the scarcity mindset compared to the abundance mindset. Imaging data are currently under analysis. These behavioral results are especially interesting because participants experienced scarcity mindset in a domain unrelated to shopping behavior. This points to the impact that the sense of not having enough has on everyday life.

p096

Convergent and divergent thinking in creativity associate with differences in EEG delta power

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The ability to be creative allows humans to adapt to rapidly changing environments and is the driving force behind progress and innovation. The relation between psychological traits and states (e.g., positive affectivity, approach motivation) and creativity is well

understood. However, recent efforts to uncover creativity's neural correlates produced inconsistent results, possibly due to a large variability in available paradigms. The present EEG study dissociated brain activity associated with convergent and divergent creative processes. In a novel paradigm, that simultaneously measured convergent and divergent thinking to increase comparability, we asked participants to generate new names for various objects given three examples of possible new names. Results indicate that convergent (vs. divergent) thinking associated with stronger delta power over frontal and parietal brain areas, suggesting that convergent thinking requires more effortful internal processing and memory retrieval than divergent thinking.

p097

Norepinephrine modulates resting-state MRI functional connectivity in the human brain

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The resting-state is characterized by patterns of correlated neural activity across networks of brain regions. The spatial structure (topology) of these correlations is reflective of endogenous principles in large-scale neural functional organization. However, much uncertainty exists about which factors modulate the topology of intrinsic correlations. Given the widespread projections of the norepinephrine (NE) releasing neurons of the locus coeruleus, NE has been proposed to affect the structure of intrinsic correlations. Thus, the aim of this study was to characterize how NE affects resting-state dynamics, assessed through functional connectivity. We manipulated NE activity by administering placebo or atomoxetine, an NE reuptake inhibitor, and measured resting-state functional connectivity using fMRI. Graph-theoretical analysis revealed that the global degree (average number of connections within the network) and measures of segregated processing (clustering coefficient and transitivity) were significantly reduced following atomoxetine, both globally and between networks. Further, atomoxetine reduced the strength of coupling between visual cortical regions. Importantly, condition-averaged connectivity strength was negatively correlated with the change in connectivity strength following atomoxetine. That is, strongly coupled regions generally became less strongly coupled following atomoxetine, and vice versa. Moreover, drug-induced changes in functional connectivity correlated across space with changes that occurred when pupil size was large compared to when it was small. These findings suggest that NE is a strong modulator of the topology of correlated fluctuations during the resting-state.

p098

The relationship between physiological arousal and inhibitory control in adults with autism spectrum disorder.

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Two recent meta-analyses (Geurts, van den Bergh & Ruzzano, 2014) have shown that people with ASD have inhibitory control difficulties, especially with regard to prepotent response inhibition (effect size: 0.55). However, these meta-analyses revealed a significant amount of heterogeneity. This suggests that there is an unknown factor that influences inhibitory control. Cardiac autonomic functioning (physiological arousal) has been suggested to modulate inhibitory control (e.g., Krypotos et al., 2011; Raymaekers et al., 2004). The aim of this study is to investigate 1) the relationship between physiological arousal and inhibitory control in adults with autism spectrum disorder (ASD), compared to a matched control group; 2) whether emotional highly arousing pictures lead to heightened physiological arousal and 3) the relationship between autism characteristics (sensory sensitivity and social skills), inhibitory control and physiological arousal. The participants of this study will be 40 male adults (18-45 years of age) with ASD and 40 healthy control male adults. Inhibitory control is measured through an emotional stop-signal task (Krypotos et al., 2011) using emotional pictures (IAPS, Lang et al., 2005). Physiological arousal, indicated by respiratory sinus arrhythmia (RSA), is measured in baseline and during the stop-signal task. Data collection is expected to end in October. Results can be presented in December.

p099

Integrative or Lexicographic Decision Strategies? A Drift Diffusion Model Study

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An important controversy in the decision making literature entails whether people use integrative or lexicographic decision strategies. When using integrative strategies (e.g., Kahneman & Tversky, 1979), people would integrate all option attributes into a subjective value, choosing the option that yields the highest subjective value. When using lexicographic strategies (e.g., Slovic, 1995), people would assess the merit of each option by sequentially comparing them on different attributes. Support for both strategies is inferred from studies on choice behaviour, which do not consider process data. However, process data are needed to differentiate between different strategies (e.g., Johnson et al., 2008). Therefore, we here present a series of four studies in which we applied the Drift Diffusion Model, that renders information on underlying processes, in order to differentiate between lexicographic versus integrative decision strategies in the situation where two option attributes are presented sequentially. / Results of this series of studies suggest that, in such a sequential context, people seem to adopt a combined lexicographic-integrative strategy. More specifically, in most instances, people tend to adopt a strategy in which (1) their choices are biased towards the option that is favoured by the firstly presented attribute and (2) conflicting information on both attributes slows their decision process. Together, these studies render support for both parties of the traditional controversy, showing that people tend not to use either, but both, integrative and lexicographic decision strategies.

p100

Learning from internal and external error signals in second language acquisition

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In order to master intricate details of a second language, beginning learners mostly rely on external feedback to improve future behaviour and develop an internal performance monitoring system to signal their own errors. Electrophysiological evidence indicates that second language learners learn from feedback, as reflected by a Feedback Related Negativity (FRN) in response to unexpected feedback. Yet, there is little evidence for internal monitoring in language learning, as indicated by the absence of an Error Related Negativity (ERN). It is not clear, however, if examined learners so far were proficient enough to have formed stable representations. In the present study, we therefore examine how prior knowledge present in relatively proficient second language learners shapes performance monitoring. The development of FRN and ERN of German learners of Dutch was studied in a gender decision task; targets were Dutch-German cognate nouns whose gender is incongruent between the two languages that are known to generate many errors. Every response was followed by feedback and the same stimuli were repeated in three rounds. EEG data show FRN and P3 effects in response to unexpected feedback across all three rounds, as well as an ERN for errors compared to correct answers that increases in the course of the experiment. Furthermore, the magnitude of the feedback response seems to be a predictor for subsequent behavioural adjustment. These results

indicate that the brain can readily develop an internal monitoring system during learning and that persistent errors can be corrected rapidly.

p101

When failure doesn't matter: Second chances promote risky investments

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Although the most momentous decisions in life may be those we make only once in a lifetime, the large majority of the decisions we make come with the prospect of having a second chance in case a decision works out badly. Not much is known however about the effects that these second chances have on human judgment and decision making processes. In the current study we investigated the effects of a second chance on investment behaviour and risk preference on a first investment opportunity. To this end we used an investment game based on a model of study time investment on a simulated multiple-choice exam, for either a scenario with a single or two chances to obtain a passing grade. Participants chose the amount of study time to invest and consequently chose the passing probability they were willing to accept. A lower passing probability amounted to a higher possible pay-off, and vice versa. The results showed that providing a second chance causes an increase in risk-taking on a first chance, and this effect was stronger for participants who scored high on the cognitive reflection test, a test of analytical thinking associated with rational behaviour. In addition, we found that the increase in risky behaviour was mitigated when failure on the first chance entailed losing points or when access to the second chance was probabilistic. Taken together, these results show that second chances lead to risky investments on a first chance.

p102

What is the Effect of Economic Anticipation on Behavioral Risk Taking?
An Experimental Study on the Impact of Economic Messages.

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Existing literature on the relation between economic news and the financial markets has put forward the assumption that news about the economy can shape financial decisions and as a result boost an economic crisis. However, a psychological account for this phenomenon is lacking. We present experimental data in support of the hypothesis that anticipating possible economic changes impacts individuals' risk-taking choices, prior to any realized changes. Using a within-subjects design, messages about (positive or negative) possible changes in riskiness of future trials during a known decision-making game (BART task) had a direct effect on risk taking of participants (N=40), in the absence of any actual changes. The effect was found significant for both the negative and the positive message conditions. Post-hoc testing suggested a stronger effect size for the case of negative messages. Further, analyses of reaction times indicated differences in behavioral performance, with negative anticipation eliciting slower reaction times for making increasingly riskier decisions. We discuss these findings in relation to the psychological concepts of anticipation and affect, next to the idea that especially negative news can have a major impact in the many small economic choices from ordinary citizens that, taken together as a whole, can result in macro-level financial bursts.

p103

A novel algorithm for action component substitution

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In performing everyday manipulation activities, there are numerous reasons why robots (and humans, of course) could be prevented from successfully completing an action plan. In traditional AI planners such as STRIPS, the unavailability of a necessary action component would cause the subaction to fail, and control to be returned to the higher-level planner for replanning or catastrophic failure. In the context of cooking, when a robot cannot find a necessary ingredient, traditional action plans will fail, and the user would have to give new instructions. In order to have truly flexible robots, substitution and generalization must somehow be implemented in a robot. We have implemented in a robotic framework, an algorithm capable of such substitution based on holographic reduced representations (HRRs), working in O(n log n) time. HRRs are a form of distributed representation that can hierarchically encode information from diverse sources in a single format. The high-dimensional, distributed nature of HRRs makes them robust against input noise and memory degradation. By training our model on the complete WikiHow corpus containing over 35,000 recipes, we built both a semantic and a context space, allowing us to get different results for the same probe. In semantic space, probing the model with a word returns words that often co-occur in recipes. In order space, a probe returns words that commonly replace each other in a sentence without them co-occurring. Our algorithm and ROS service are provided on GitHub with a permissive open-source license, and can be used in any ROS-compatible robotic architecture.

p104

Risk-taking in teens with autism spectrum disorders (ASD) on the Balloon Analogue Risk Task (BART) (working title)

Linda Olde Dubbelink & Hilde Geurts
Dr. Leo Kannerhuis / University of Amsterdam

Adolescence is a developmental period characterized by physical, cognitive and psychosocial changes. These changes lead to, among other things, advances in executive functioning such as inhibition and impulse control (Best & Miller, 2010; Romine & Reynolds, 2005). Due to timing differences across the development of these skills, specific adolescent behavior can emerge (Steinberg, 2010). Such a characteristic behavior is increased risk-taking, which is strongly associated with adolescence (Sturman & Moghaddam, 2011). To date, there is little research on risk-taking in teens with atypical development, such as autism spectrum disorders (ASD). People with ASD follow a different, often delayed, developmental trajectory as compared to their typically developing (TD) peers without ASD. Therefore, we hypothesize that teens with ASD will show less risky behavior as compared to their TD peers. In the current study, we will experimentally test this hypothesis. To do this, we administered the Balloon Analogue Risk Task (BART), a well-known experimental paradigm to assess risk-taking behavior, to teens with ASD and their age- and gender matched TD peers. Preliminary analyses of the data (12 teens with an ASD diagnosis and 15 TD peers, aged 12 to 17 years) indicate, in line with our expectations, that teens with ASD take fewer risks than their peers without ASD. We are still in the process of data collection, and therefore intent to present the most up-to-date data at the NVP winter conference. Key words: adolescence, risk-taking, autism spectrum disorders (ASD), Balloon Analogue Risk Task (BART)

p105

Visual information processing during recovery from prolonged disorders of consciousness: Comparing behavioural indices to brain responses. (Part one of two)

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Auditory stimulation is regularly used to evoke brain responses in patients with Disorders of Consciousness (DOC patients) who suffered from severe brain injury. However, to learn about possible information processing and consciousness in these unresponsive patients, a multimodal approach is necessary. We investigated visual information processing by measuring Visual Evoked Potentials (VEPs) and visual behavioural responses during recovery to consciousness. Flash VEPs were examined longitudinally in 12 young DOC patients (aged M=16.6 years; SD=5.3) every two weeks for an average period of 2.6 months, and were compared to a healthy norm group. Behavioural responses included visual tracking, comprehension of written commands, and object manipulation. Long-term outcome was assessed 2-3 years using the Disability Rating Scale and the Glasgow Coma Scale Extended. / VEP responses did not change along with recovery to consciousness. VEP amplitudes were significantly smaller, and latencies were longer in the patient group when compared to controls. VEPs characteristics at first measurement were able to predict long-term outcome up to three years after injury. Visual responding significantly increased during recovery to consciousness for all stimulation items: visual tracking, comprehension of written commands, and object manipulation. VEP responses are present in DOC patients, yet poorer than in healthy controls, and remain poorer when DOC patients have been recovered to consciousness.

p106

Ten to Twelve Years After Early Intensive Neurorehabilitation of Young Patients with Severe Disorders of Consciousness: Research and a Documentary (Part two of two)

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Long-term outcome after severe acquired brain injury, particularly 5 years or more post injury, is a largely neglected area of research. We investigated long-term outcome of young patients with disorders of consciousness (DOC patients) that received intensive neurorehabilitation in the ten to twelve years earlier. A cross-sectional cohort study was performed, in which the survival rate, level of consciousness, functional independence, mobility, communication, and living situation were determined by means of a structured questionnaire. The cohort consisted of 44 children and young adults, originally either in a Vegetative State/Unresponsive Wakefulness Syndrome (VS/UWS, N=32), or a Minimally Conscious State (MCS, N=12) 1-6 months post-injury. Response rate was 72% (34 of 44). Eleven patients were deceased, 10 of who were in VS/UWS or MCS at discharge from the program. Of the remaining 23 patients, 19 were conscious, of which 7 had recovered to functional independence. Twelve lived independently, of whom 6 required some household support. Two of three MCS patients had recovered into full consciousness, albeit without any functional recovery, and two of three VS/UWS patients had recovered into MCS. Only one conscious patient lived permanently in a long-term care facility. All other patients lived either independently, or with their parents. Two long-term outcome scenarios can be recognized. Two-thirds of the participating patients who were conscious at program discharge were able to live independently, whereas almost two-thirds of the participating patients who were in VS/UWS or MCS at discharge subsequently died. Additionally to these results, a short documentary will be presented.

p107

Should I Stay or Should I Go? How Reward Functions Influence Discretionary Task Interleaving

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Multitasking occurs frequently. For example, office workers switch tasks every two to three minutes. However, little is known about the efficiency of such frequent switching. Do people interleave tasks in a way that maximizes rewards? We investigated this in an experiment. Participants had to divide their time between two identical tasks: "whacking moles" that appeared in a 3 by 3 grid by pressing corresponding buttons on the numeric keypad. Each mole contributed points towards the total score and a trial ended as soon as 50 moles were hit. The two tasks differed in how rewarding each mole was, as defined by mathematical functions. A model showed how the exact combination of rewards affects the difficulty of finding the optimal interleaving strategy. Three unique scenarios emerged. In easy scenarios, many strategies (for interleaving tasks) achieved optimal performance. Participants therefore varied in the strategies that they applied. In difficult scenarios, the optimal strategy was hard to identify (e.g., due to local maxima), and participants spent longer searching for it. This also resulted in high variation of strategies. Finally, in constrained scenarios there was a well-defined optimal strategy, which participants consistently applied. This work demonstrates how reward functions influence the ability to optimize task interleaving in general. Future work will investigate how this ability changes under different circumstances (e.g., time pressure). By identifying when multitasking is challenging, we can inform the design of safe multitasking systems that maintain productivity, while reducing dangerous situations.

p108

Tyrosine incorporated in a protein source enhances inhibitory control in healthy adults

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Very recently studies have shown that the administration of the amino acid tyrosine (precursor of dopamine) is able to refill resources required for cognitive control operations which depend on dopaminergic supplies. However, the strategy of administering tyrosine in more naturalistic settings when incorporated in a protein source is unclear and debated. We studied in a within-subject design, in a healthy population, whether the administration of tyrosine incorporated in whey protein concentrate improves stopping overt responses, a core cognitive-control function. One hour following the administration of 33.75 grams of whey protein concentrate containing 1 gram of tyrosine (corresponding to the beginning of the 1h-peak of the plasma concentration) or placebo, participants performed a stop-signal task—which taps into response inhibition and response execution speed. Participants in the tyrosine incorporated condition were more efficient in inhibiting unwanted action tendencies but not in reacting to go signals. This is the first demonstration that even in more naturalistic settings (incorporated in a protein source) the supplementation of tyrosine selectively enhances the ability to stop overt responses.

p109

Should I stay or should I go? Individual differences in effects of methylphenidate on the affective biasing of instrumental action

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Motivational valence influences behavioural activation in a seemingly Pavlovian manner, such that a reward context promotes activation and a punishment context promotes inhibition. Both human and animal research has shown that dopamine modulates these affective biases. In this study we aimed to assess whether i) dopamine-induced changes in affective biases should be understood as altered action execution (activation/inhibition) or as altered learning (credit assignment), and ii) how these effects depend on individual differences in measures predictive of baseline dopamine function. We tested 102 participants once after placebo and once after administration of the dopamine/noradrenalin transporter blocker methylphenidate (MPH). MPH-induced changes were predicted by individual differences in working memory (WM) capacity; MPH strengthened the Pavlovian biases proportional to WM capacity. These changes were explained by altered global activation/inhibition rather than credit assignment. In this poster session, I will discuss the differential influence of MPH on affective biases and instrumental learning, and thereby emphasise the importance of taking into account individual differences when understanding the effects of methylphenidate.

p110

Interrupt me! Comparing self-interuptions with external interruptions and creating an interruption management system

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We conducted an eyetracking experiment that compares self-interruptions and external interruptions. Self-interruptions turned out to be more disruptive than external interruptions and pupil dilation data suggested that the decision to switch was responsible for increasing disruptiveness. We then constructed an interruption management system (IMS) that interrupts users based on changes in their pupil dilation. Studies suggest that interruptions on low-workload moments are less disruptive than on high-workload moments. Pupil dilation is a well-known indicator of cognitive workload. Our IMS succeeded in interrupting users on low-workload moments, however it did not succeed on improving performance when compared to random interruptions.

p111

The perspective structure of visual space: computations and experimental results

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Retinal images are perspective projections of the physical environment. The current study explores perspective transformations of Euclidean space as a model for visual space. Computations show that the geometry of perspective spaces is considerably different from that of Euclidean space. Col-linearity but not parallelism is preserved in perspective spaces and angles are not invariant under translation and rotation. Similar relationships have shown to be properties of visual space. Alley experiments performed early in the nineteenth century have been instrumental in hypothesizing curved visual spaces. Here alleys were computed in perspective space and compared with experimental alleys of Blumenfeld (1913). Parallel alleys were accurately described by perspective geometry. Accurate distance alleys were derived from parallel alleys by adjusting the inter-stimulus distances according to the size-distance invariance hypothesis. Agreement between computed and experimental alleys shows that perspective space is an appropriate model for how we perceive orientations and angles in depth. Perspective angles, i.e. angles having an orientation in depth, were judged between rails of a straight, disused, railway track. Subjects also judged perspective angles from pictures taken from the same point of view. Perspective angles between real and depicted rails ranged from 27% to 83% of their angular sizes in the retinal image. Distances of vanishing points computed from judged perspective angles were shorter than six meters! The incongruity between inferred and perceived depths of visual space is huge but apparently so unobtrusive in human vision, that it has remained unnoticed until now.

p112

The "Semantic P600" in Second Language Processing: When Syntax Conflicts with Semantics

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In sentence processing, semantic reversal anomalies (e.g., "The mouse that chased the cat…") fail to elicit an expected N400 effect in the EEG, but show a P600 effect instead (e.g., Kolk et al., 2003). This is likely to be caused by a conflict between syntactic parsing and heuristic processing built on semantic information. We made use of this effect to investigate the claim that sentence processing in second language (L2) learners is based more on semantic heuristics and less on syntactic information than in native speakers (Clahsen & Felser, 2006). We recorded event-related potentials (ERPs) in German learners of Dutch and Dutch native speakers while they read sentences containing reversal anomalies (e.g., "Het hondje dat tegen het meisje praatte speelde met de bal." [The dog that talked to the girl was playing with the ball.]) and made plausibility judgments. Additionally, individual participant characteristics like L2 proficiency and working memory (WM) were measured. The results revealed that a) it was more difficult for L2 learners to detect semantic reversal anomalies than for native speakers; b) in general, native speakers showed a P600 effect, replicating previous findings, whereas the effect was largely attenuated in L2 learners; c) when L2 learners successfully detected and resolved the conflict between syntax and semantics, they also showed a native-like P600 effect. The results suggest that L2 sentence processing differs from that in L1 in terms of syntactic processing. The observed L1-L2 differences are further discussed in terms of the roles of language proficiency and WM.

p113

On the dimensionality of representations measured with fMRI

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The brain is organized anatomically and functionally at different scales, from ensembles of neurons within cortical columns to interacting regions in networks spanning the entire brain. Multivariate pattern analysis (MVPA) is an increasingly popular method to investigate how information is represented neurally, but little is known how information is represented at these different levels of organization in the brain. Often, MVPA studies restrict their analyses to local patterns of voxels, thus assuming a localized, voxel-level representation of information. While this local organization is neurobiologically plausible for representations of low-level psychological concepts such as visual stimulus-features, studies on high-level psychological concepts such as emotion, motivation, and decision-making suggest that

these are encoded at a larger spatial scale within globally distributed functional networks. The current study aims at investigating the spatial scale and dimensionality of high-level representations, using existing data from a study investigating the representation of self-focused emotion experience. We hypothesized that we could accurately model these high-level neural representations as a multivariate set of clusters, instead of local voxel patterns, using a linear classifier. Results demonstrated that high-level representations could indeed be accurately modeled at cluster-level. However, additional exploratory analyses showed that, in addition to cluster-level networks, the investigated high-level representations were also encoded locally as voxel-level patterns in multiple spatially-contiguous regions in the brain, suggesting a multiscale organisation of information. We believe that our study shows that high-level representations should be analyzed at different spatial scales in the brain, as it may give insight into different sources of information.

p114

Probing short-term face memory in developmental prosopagnosia

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It has been proposed that the face recognition deficits in neurodevelopmental disorders / may reflect impaired face memory. For example, introducing a brief delay between the presentation of target and test faces appears to disproportionately impair matching or recognition performance in people with autism (see Weigelt, Koldewyn, & Kanwisher, 2012). We therefore sought to investigate whether deficient short-term face memory contributes to impaired face recognition observed in developmental prosopagnosia – also known as 'face-blindness' (Susilo & Duchaine, 2013). To determine whether people with developmental prosopagnosia show impaired short- term face memory, we used a computerised match-to-sample procedure. Memory demand was manipulated by utilising a short or long delay between the presentation of the target face, and the six test faces. Importantly, the perceptual demands remained identical in both conditions, therefore allowing the independent contribution of short- term face memory to be assessed. Individuals with developmental prosopagnosia showed evidence of a category-specific impairment for face-matching in both conditions; they were slower and less accurate than controls. However, they exhibited no evidence of disproportionate face recognition impairment in the long-interval condition. While people with developmental prosopagnosia have deficits with the perceptual encoding of faces, it appears that their representations are stable over short durations. These results suggest that the face recognition difficulties reported in developmental prosopagnosia and autism may be qualitatively different, attributable to deficits of perceptual encoding and perceptual maintenance, respectively.

p115

Eye-opener: pupil signals decision uncertainty

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During perceptual decision-making, orbitofrontal neurons signal uncertainty in a pattern predicted by signal detection theory: uncertainty about successful decision outcomes decreases monotonically with the strength of sensory evidence on correct trials, but follows the opposite pattern on error trials (Kepecs et al. 2008). Orbitofrontal cortex sends top-down projections to brainstem centers, in particular the noradrenergic locus coeruleus, which in turn send widespread, modulatory projections to the cortex. Here, we used pupil dilation at constant luminance as a proxy for neuromodulatory brain state. During a perceptual decision making-task, we asked whether pupil-linked neuromodulation signals decision uncertainty, and how such uncertainty signals influence behaviour. We measured pupil diameter in 27 observers performing a perceptual decision-making task, varying the strength of sensory evidence from trial to trial. Even though participants were not explicitly instructed to monitor their confidence, reaction time, a known proxy of decision uncertainty, matched the uncertainty pattern predicted by the model. We found that pupil responses scaled with decision uncertainty, predicting the probability of an upcoming reward. This pupil-linked uncertainty signalling was sustained throughout the reward anticipation period, starting around decision formation. Moreover, high pupil-linked uncertainty predicted a reduction in sequential response biases, the tendency to repeat choices. Our results indicate that pupil-linked neuromodulation reflects decision uncertainty, and has specific effects on response biases beyond the current trial. Neuromodulation might be ideally suited to broadcast uncertainty throughout the cortex, signalling the need for adjusting behaviour.

p116

The neural origin of spatio-numerical associations: A transcranial magnetic stimulation study

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While behavioral research has shown overwhelming evidence for a tight cognitive coupling of numbers with sagittal and horizontal space, the neural origins of these spatio-numerical associations are still poorly understood. The intraparietal sulcus (IPS) has been proposed as a candidate region for a coupling of numerical magnitude and spatial representations. The present study investigates the neuronal mechanisms underlying sagittal and horizontal associations using repetitive transcranial magnitude stimulation (rTMS) to the right IPS. Real or sham offline rTMS was applied to rIPS to cause a transient disruption of cortical activity. Subsequently, participants performed a parity judgment task with sagittally or horizontally aligned responses to quantify the size of the individual number-response compatibility effect (SNARC effect). Importantly, the analysis revealed a modulation of the sagittal but not the horizontal SNARC after rTMS. While the sagittal SNARC effect disappeared after rTMS, the horizontal SNARC effect was present in both rTMS and sham condition. This finding suggest that IPS merely plays a role in associations of numbers and space along the sagittal dimension and thus is in line with the idea that horizontal spatio-numerical couplings do not reflect numerical magnitude associations, but a spontaneous mapping of horizontal space and stimulus order in working memory (van Dijk, & Fias, 2011).

p117

Temporal and Identity Prediction in Visual-Auditory Events

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The amplitude of the auditory N1 component of the event-related potential (ERP) is attenuated when sounds can be predicted by vision or self-generated motion. In both the visual-auditory (VA) and motor-auditory (MA) domain, rare omissions of a predictable sound induce an early negative omission ERP response (oN1). While both the N1 attenuation effect and oN1 response are considered to be electrophysiological indicators for automatic predictive processing, it is not yet fully understood if auditory prediction is primarily driven by foreknowledge based on temporal- or physical characteristics of the anticipated stimulus. Here, we examined the neural correlates of auditory prediction by vision using a stimulus omission paradigm. First, the influence of audio-visual congruency on prediction-related auditory omission responses was investigated. Audio-visual congruency was manipulated block-wise in two separate conditions. Auditory

omissions in congruent and incongruent conditions induced prediction-related neural responses of similar latency and amplitude. This demonstrates that audio-visual congruency is not a necessity for auditory prediction by vision. Second, the relative contribution of temporal and identity prediction to omission responses was examined by varying the timing between visual and auditory onset and the identity of the sound, respectively. Auditory omissions induced an oN1 response and subsequent oN2 and oP3 responses when both the timing and identity of the sound could be predicted. No significant omission responses were observed when either temporal or identity prediction was disrupted. This suggests that auditory prediction in the VA domain is not solely based on timing or identity, but on a combination of both.

p118

My error, your loss: Investigating individual differences in monitoring of errors that have consequences for others.

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Leiden University

An advanced performance monitoring system makes it possible to quickly detect errors and subsequently adjust behavior in order to reach intended goals. As humans are social in nature, goals are often related to the people we interact with. Integrating the social context in performance monitoring is thus essential for efficient social interactions. People differ in the extent to which they engage in performance monitoring, and based on their main symptoms, socially anxious individuals may excessively monitor their behavior, especially in a social context. The aim of the present EEG study is to investigate individual differences in performance monitoring in the context of social consequences. Participants performed a social version of the Flanker task in which errors had consequences only for the participant (non-social errors) or also for another person (social errors). The error-related negativity (ERN) and post-error slowing will be compared for these two types of errors. Because of enhanced error relevance, we expect social errors to result in larger ERNs and increased post-error slowing on subsequent trials. These effects are expected to be modulated by individual differences in social anxiety symptoms, as well as measures of self-focused attention, empathy, and psychopathic traits. Results will be discussed in light of contemporary theories on social performance monitoring and their relevance for clinical disorders.

p119

An MEG Investigation of Repetition and Expectation Effects in Time Perception

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The aim of the study was to investigate the relationship between behavioural and neural responses to repetition and expectation effects in time perception. MEG data were recorded while participants performed a duration discrimination task indicating whether a second face was presented for a shorter or longer duration than the first one. The second face was either the same or a novel face and the rate of repeat and novel trials was manipulated changing the expectation of encountering the former or latter. The results revealed that repeating a stimulus led to a shortening of perceived duration, whereas making the repetition more predictable lengthened subjective time. This pattern was mirrored in the neural responses suggesting a positive relationship between subjective duration and overall neural response magnitude. These results contradict findings of previous repetition suppression studies showing enhanced neural suppression when repetitions become predictable. A new perspective is presented that considers the functionality and neural mechanisms of the discrepancy between temporal and non-temporal stimulus-feature processing in the context of predictive coding. Particularly, predictions of non-temporal stimulus features foster suppression of neurons encoding predictions that have been shown to mismatch the sensory input at earlier processing stages. On the other hand, predictions of temporal stimulus features enhance the accuracy of time estimations by compensating for initial biases due to repetition (contraction) effects. The compensation is obtained by enhancing the response of cells encoding predictions from higher-order processes, which results in an overall increase of neural activity and consequently in a lengthening of subjective time.

p120

Altered electrophysiological connectivity during visual word recognition relates scales with reading dysfluency in dyslexic children

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Reading involves a distributed brain network including visual and language-related regions. Disruptions of anatomical and/or functional connectivity between these regions have been related to developmental dyslexia. Here we investigate whether the alternations in functional connectivity scale with the level of reading dysfluency, by examining effective connectivity measures (directed transfer function; DTF) in 9-year-old typically reading children and two groups of dyslexic children: severely dysfluent (SDD) and moderately dysfluent (MDD) dyslexics. We assessed connectivity in electroencephalographic signals recorded while the children processed visual words and false font strings. In the visual word condition, our analysis indicated a weaker forward connectivity from early to higher-order visual sites in both dyslexic groups. In contrast, dyslexics showed stronger backward connectivity from higher-order frontal and central regions. Interestingly, the severity of reading dysfluency influenced altered connectivity patterns in dyslexics, with stronger backward connectivity being related to poorer performance on reading related behavioral tasks. Conversely, stronger forward connectivity was related to better behavioral performance. In the false font condition, differences between typical and MDD readers were strongly diminished, whereas both groups differed substantially from the SDDs. The observed pattern of functional connectivity patterns and their relation to behavioral measures of reading skills further stress the need to consider individual differences across the entire spectrum of reading skills in addition to group differences between typical and dyslexic readers.

p121

Attempts to fit the leaky, competing accumulator model

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Formal sequential sampling models (SSMs) of perceptual decision-making are frequently used to account for a variety of findings in reaction time data. It has been argued that standard SSMs are neurally implausible, and neurally plausible extensions have been proposed. One such model, the leaky, competing accumulator (LCA) model, includes mechanisms of leakage and competition. These mechanisms increase the complexity of the model, and although fits have been shown in the literature, an extensive investigation on the identifiability of the LCA has not yet been reported. In the present paper, numerous attempts are done to perform a parameter recovery on the LCA using several fitting procedures. It is shown that a reasonable parameter recovery can be performed with a very large data set.

p122

Can brain training facilitate recovery after stroke?

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Background: Stroke survivors frequently suffer from executive dysfunction even long after stroke. One way of retraining executive functions is by computer-based cognitive training. A review by our group suggested that cognitive flexibility may be a key element for an effective training. Focusing on cognitive flexibility results not merely in improvements on trained tasks but also seems to improve everyday functioning. Aims: To investigate the behavioral and neural effects of a computer-based cognitive flexibility training in stroke patients. Methods: Patients were randomly assigned to computer-based cognitive flexibility training, mock training, or a waiting list. Participants trained five times per week half an hour per day for 12 weeks. Behavioral outcome measures included cognitive flexibility (switch task), executive functioning (Tower of London, Trail Making Test), working memory (Operation-span, n-back task), attention (PASAT), and reasoning (Raven matrices, Shipley). MRI techniques included resting-state functional MRI, Voxel Based Morphometry, and Diffusion Weighted Images. Results: Results on the cognitive effects of the training will be presented. Conclusion: This study provides valuable insight to whether computer-based retraining of executive functioning is possible. The design is unique with a long training period, many outcome measures, and a follow-up. Most importantly, the two control groups account for the retest effects, placebo effects, and Hawthorne effects (i.e., the effect solely attributed to study participation).

p123

Social Feedback Processing in Alcohol Dependent Patients

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This study examined how social feedback processing was affected by alcohol dependence on the behavioral and electro-cortical level. A group of 22 abstinent alcohol dependent patients in treatment for their alcohol addiction and a group of 23 matched controls performed a social feedback task. In this task, they had to predict whether a virtual peer presented on a computer screen liked them or not. After the prediction, the actual judgment was shown and behavioral and electro-cortical responses to this judgment were measured. The group of abstinent alcohol patients showed a more negative bias in the task, resulting in more predictions that are negative. Moreover, patients showed more depressive symptoms as measured with a self-report questionnaire, but these symptoms were not related to the negative bias or electro-cortical measures. In line with previous studies it was found that, the feedback related negativity (FRN) was largest for incongruent (unpredicted) judgments and P300 was largest for predicted 'like' judgments. FRN amplitude did not differ between groups. P300 amplitude showed the expected larger P300 amplitude to expected 'like' judgements as compared to unexpected 'do not like' judgments in healthy controls, but this difference could not be found in patients. This finding can possibly be explained by reduced attention to positive, more rewarding stimuli and enhanced attention to negative information in the patient group. It was concluded that alcohol addiction leads to a negative bias in social interaction and subtle changes in attention to different types of feedback stimuli as reflected in changed P300 amplitude.

p124

Contributions of expected sensory and affective action effects to action selection and performance: Evidence from forced- and free-choice tasks

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While ideomotor approaches to action control emphasize the importance of sensory action effects for action selection, motivational approaches emphasize the role of affective action effects. We used a game-like experimental setup to directly compare the role of sensory and affective action effects in selecting and performing reaching actions in forced- and free-choice tasks. The two kinds of action effects did not interact. Action selection and execution in the forced-choice task was strongly impacted by the spatial compatibility between actions and expected sensory action effects, while the free-choice task was hardly affected. In contrast, action execution, but not selection, in both tasks was strongly impacted by the spatial compatibility between actions and highly-valued action effects. This pattern suggests that sensory and affective action effects serve different purposes: the former seem to dominate rule-based action selection while the latter might serve to reduce remaining action uncertainty.

p125

Task-shielding in dual-task interference

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When observers are asked to memorize a first target (T1) and to respond as quickly as possible to a trailing second target (T2), the results typically show accurate T1 recall and a psychological refractory period (PRP) effect for response times to T2. In recent work, we found that if T2 is present on only 50% - as opposed to 100% - of the trials, the processing of T1 is disrupted by T2 and there is little or no PRP effect for T2. One explanation for this reversal of interference is that the direction of dual-task interference reflects the extent to which T1 processing is shielded against interference from T2, with the extent of shielding being dependent on T2 probability. Consistent with this account, we show that if the risk of interference with T1 processing is increased by embedding the targets amongst distractors, the results again show accurate T1 recall and a PRP effect for T2 even when T2 probability is 50%. In addition, we contrast two hypotheses regarding the task-shielding mechanism by which T2 probability is assumed to modulate dual-task interference. According to the attentional-suppression account, such shielding occurs by means of suppressing attention for new targets during the processing of T1. In contrast, the task-suppression account proposes that task-shielding occurs by suppressing the task-set for T2. The results of experiments contrasting these hypotheses will be presented.

p126

Sustaining attention for a prolonged period of time decreases attentional control and stability: neural and behavioral evidence

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Our ability to stay focused is very limited: prolonged performance of a task typically results in a decline of performance and the experience of mental fatigue. This time-on-task effect is often attributed to depletion of attentional resources, though other factors such as

mind wandering and reduced motivation may also play a role. This study examined the neural mechanisms that underlie the time-on-task effect by recording EEG while participants performed a sustained attention task for 80 minutes without breaks. If performance decrements are mainly due to resource depletion, well-known neural measures of top-down attentional control should attenuate with time-on-task. Second, sudden increases in motivation – in the form of an unexpected monetary incentive to do well on the task – should not be able to restore performance and neural markers of top-down control to initial levels. We found that performance on the task declined rapidly and reached a stable level well before the monetary incentive was introduced. Thereafter, performance did in fact increase, but only briefly and not up to the initial level. This pattern of performance changes was correlated with the trial-to-trial consistency of the phase of theta oscillations, which we interpret to reflect the stability of attentional control. Other electrophysiological measures of attention, such as modulations of alpha power and the P1/N1 event-related potentials, showed no or unspecific changes over time. In sum, we conclude that the time-on-task effect is accompanied by a decline of some facets of attentional control, which cannot be fully brought back online by increases in motivation.

p127

Cognitive control in multimedia multitaskers: A replication study

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The act of consuming several streams of media simultaneously has become ubiquitous due to the increasing availability of multimedia devices. This behavior, known as multimedia multitasking, was recently shown to be related to impairments in selective attention, working memory, and task-switching (Ophir, Nass, & Wagner, 2009). However, subsequent replication attempts reported conflicting findings. Here, we tried to replicate the original findings using the exact paradigms from the original study. Altogether this replication attempt yielded 14 tests of effects reported by Ophir et al. Even though the average power of these tests was .74, only two out of 14 tests produced a replication of a finding by Ophir et al. Taken together with previous findings, these results lead us to question the association between multimedia multitasking and impairments in objective measures of human information processing.

p128

Influences of Unconscious Priming on the Rostral Cingulate Zone

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Making choices is a complex activity and every day we face an uncountable number of choices. Being able to make voluntary, or free, choices is fundamental for what it means to be a human. A key brain region that supports this behavior is the rostral cingulate zone (RCZ), which is part of the medial frontal cortex. Previous research has shown that activation in this brain region can be modulated by previous experiences while making free choices, such that biased choices lead to less activation compared to unbiased choices. The current study extends those findings and is the first study to show that, while making free choices, activation in the RCZ can also be modulated by subliminal information. We used a response priming paradigm to bias free choices completely outside of the awareness of the participants. We observed more activation in the RCZ when participants made a free choice that went against the prime information, compared to when they chose in accordance with the prime information. This shows that the RCZ plays an important role in overcoming (unconscious) conflict between different response options while making a free choice. Apart from the RCZ we found that the subliminal information also modulated activity in the anterior insula and the supramarginal gyrus. Both these areas have been associated with making free choices as well by previous research. The current study shows that activity in brain regions that are important for voluntary action can indeed be modulated by subliminal information.

p129

In Time with Rhythms - Beat Perception and Sensorimotor Synchronisation

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Music and beat perception are strongly connected to movement, a phenomenon known as sensorimotor synchronisation. Neurophysiologically, simple metronome-like beat sounds entrain neural oscillations, so that the brain oscillates with the same frequency as the beat frequency. The usefulness of being entrained to a beat lies in the increased accuracy of predicting crucial future events (e.g. the next beat). However, in our everyday environment beats rarely occur without being embedded in rhythmical and metrical structures (e.g. music). The present work seeks to examine how more complex rhythmical sounds are creating temporal expectancies and how multiple explicit metrical structures are represented in the brain. Electroencephalogram recordings were obtained while participants listened to beat-sounds varying in metrical complexity (low vs. high) and tempo (fast vs. slow). Their task was to synchronise finger movements to the lowest metrical level beat. We found that high metrical complexity facilitates synchronisation to slower beats. Looking at the frequency spectres of the obtained EEG data, entrained oscillations not only emerged at the lowest metrical level beat frequencies that occurred in every experimental condition, but also at higher metrical level beat frequencies in the high complexity conditions. Being entrained to multiple metrical structures could provide additional temporal information which can be used to improve synchronisation performance. Taken together, results highlight the dynamic, proactive and predictive character of brain functions.

p130

Infants Use Vision and Proprioception in Action Development

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When acting, we rely on noisy signals stemming from multiple sensory organs. Combining information from different modalities is a good strategy to get a reliable estimate of world states which is necessary for action. The current study investigates to which extent infants combine vision and proprioception for reaching. Six- to 7-month-old infants were to reach for a light-weight ball (diameter: 5 cm), which was placed on one of their upper legs. Visual (non-occluded versus occluded by means of a foam-filled bib) and tactile access (ball on bare leg versus ball on soft strap around upper leg) to the ball's location were manipulated within-subjects. Infant's hand movements were registered with one regular and eight motion tracking cameras (Qualisys, Sweden). A repeated measures ANOVA on the percentage of successful reaches showed that reaches were more frequently successful when infants had visual access to the object ($F(1,10) = 54.8$, $p < .001$) and tended to be more frequently successful when the ball was placed on the bare leg rather than on the strap ($F(1,10) = 4.5$, $p = .059$). Infants did not seem to combine both sensory modalities. That is, the frequency of successful reaches when the infants could see and feel the ball's location was not higher than when they could only see but not feel it. Infants can thus use both vision and proprioception as a basis for action. However, infants were not found to combine these sensory modalities. Rather, the data show that vision is the dominant cue for action.

p131

Laterality and Body Ownership: Effect of Handedness on Experience of the Rubber Hand Illusion

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Body ownership has mainly been linked to the right hemisphere and greater interhemispheric connectivity has been shown to be associated with greater right hemispheric activation. Mixed handed participants tend to have more interhemispheric connectivity compared to extreme handed participants (Christman et al., 2008; Prichard et al., 2013). The aim of this study was to examine whether feelings of ownership are differentiated by handedness. In addition, we examined whether the RHI differed for the left and right hand. Three groups of participants were subjected to the rubber hand illusion: 21 sinistrals, 21 mixed handed and 21 dextrals. Stroking was synchronously and asynchronously performed on the left and right hand of the participant and on a left or right rubber hand. Outcome measures were the score on an embodiment questionnaire and proprioceptive drift. Our results show a similar experience of ownership for sinistrals, mixed handed participants, and dextrals. In addition, experience of the RHI is similar for the left hand and right hand in all participants. In contrast to previous results, ownership is thus not influenced by handedness. Plasticity of body ownership and embodiment are similar for the left and right hand in a healthy population. These results suggest similar representation of both hands in the brain, what might be useful to keep a coherent sense of the body in space.

p132

Is there evidence for a mixture of two processes in perceptual decision making?

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Studying the time-related properties of evidence accumulation is often done by manipulating the duration of the decision process. However, sequential sampling models that are used to analyse this process are typically only applied to tasks that yield mean response times of around one second. It has been suggested that longer tasks engage multiple or repeated decision making processes (e.g., Ratcliff & Smith, 2004; Ratcliff, 2006). This study tested if perceptual decision making tasks with slow evidence accumulation engage a different process than an evidence accumulation process as described in the literature. We developed a task where participants had to choose which of three flashing lights flashed most often on average. Data was collected over different ranges of presentation speeds, which we hypothesized allowed for the recruitment of the slower process on different proportions of trials. We analyzed the fixed point property to test whether there was evidence for a mixture of processes. In case of a binary mixture, we would expect to find one shared density point in the response time distributions of all conditions. Evidence was found that the decision making process in longer perceptual decision making tasks differs from the decision making process in shorter tasks in terms of the mixture proportions of hypothesized processes. These results suggest that perceptual evidence accumulation per se can only be observed using short perceptual decision making tasks. This raises the question whether the use of sequential sampling models in longer tasks is valid, and whether other models would be more appropriate.

p133

Incidental second language learning of grammatical gender in a natural communicative situation

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Many people spend a period of their life immersed in a second language (L2) environment. Although most of them improve at their L2, they rarely ever reach native-like proficiency. This persistence of L2 errors has been referred to as second language 'fossilization'. Interestingly, fossilization occurs despite being exposed to correct L2 input. Therefore, the question arises if and under which conditions natural corrective input leads to L2 improvement. The present study examined L2 learner's sensitivity to implicit corrective feedback in a dialog-like situation. Errors under study were grammatical gender errors in German learners of Dutch, which result from incorrect L1 transfer (Lemhöfer et al., 2010). We used a simulated dialog-game to examine the effect of implicit corrective feedback in a fairly natural, but experimentally controlled situation. For the current purpose, participants were not interacting with real conversation partners, but received input via audio recordings. We examined whether an initial gender error by the participant would be corrected after hearing the correct phrase uttered by the virtual 'partner'. Further factors under investigation were initial error stability and the time lag between corrective feedback and the participant's anew production of the phrase. Results indicate that grammatical gender accuracy improved after receiving correct L2 input. Learning rates depend on the length of the manipulated lag as well as on the correct L2 determiner. The study does not only provide insights into mechanisms of fossilization and incidental L2 acquisition, but also demonstrates the suitability of a new paradigm to study incidental L2 learning.

p134

Shortcuts in analysing hierarchical data may create spurious effects

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Experimental data in psychological research often have an inherent hierarchical structure where trials are nested with participants (participant-level) who are nested within experimental groups (group-level). Although the analysis of such data might seem straightforward, the correct hierarchical analysis is surprisingly complex and shortcut strategies have seen repeated use in practice. One popular shortcut way of analysing such data is to ignore the participant level completely, compute a mean for each participant, and enter these means into an ANOVA-type analysis (i.e., Within-Participant Mean strategy). Another shortcut analysis that has increasingly been used in recent years is to fit a hierarchical Bayesian model to the data and use participant-level estimates in an ANOVA-type analysis (i.e., Two-Step strategy). Despite the popularity of these two strategies, previous theoretical work suggests that they can be strongly biased. To illustrate this point we conducted a Monte Carlo simulation study in which we generated realistic reaction time data for a two-group experiment. We then entered the data into Bayesian and frequentists t-tests, using either a correct hierarchical, a Within-Participant Mean, or Two-Step strategy; this process was repeated 200 times. In line with the theoretical arguments, our simulations show that the Within-Participant Mean strategy biases Bayesian and frequentists analyses towards the null hypothesis whilst the Two-Step strategy leads to a bias towards the alternative hypothesis. Only an analysis strategy that is faithful to the hierarchical data structure leads to correct results.

p135

Teaching sterile skills in anesthesia: is providing context helpful for robust skill acquisition?

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Epidural anesthesia is an invasive medical procedure for pain relief. However, current teaching methods are not sufficient for acquiring proper aseptic technique in this procedure (Friedman et al., 2008). In the present study we examined whether a context-providing method, previously successfully used for training Boeing pilots (Taatgen, Huss & Anderson, 2008), might be superior to the current practice of teaching the steps in the procedure as a list of actions. We taught 37 undergraduate medical students the preparation and execution of the first part of the epidural anesthesia procedure with either List instructions or Context instructions. In the List condition, the order of the actions had to be remembered and executed in that particular order. In the Context condition, participants were given instructions with photographs that showed the pre-conditions of a set of actions ("before") and the post-condition ("after"), together with a description of the actions to be performed within the set. Thus, the List approach relies heavily on memory, whereas in the Context method at least part of action control should be delegated to the environment to prime the appropriate actions. However, contrary to expectations, participants in the Context condition performed worse than participants receiving the more traditional List instruction: they made significantly more sterility errors. We conclude that a better instruction method to learn a procedure does not necessarily lead to better aseptic technique and suggest that the concept of sterility be taught separately as well.

p136

Optimizing functional MRI sequences at 7 Tesla for subcortical nuclei

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The substantia nigra (SN) and subthalamic nucleus (STN) are thought to be important, distinct nodes in a cortico-basal ganglia loop implementing cognitive functions such as perceptual decision-making and cognitive control. The STN is the main target of deep brain stimulation (DBS), a popular and effective treatment of Parkinson's Disease. This treatment can lead to serious side-effects and the underlying mechanisms are not well-understood. Ultra high-resolution functional MRI could help elucidate both the function of the STN in the healthy population, as well as lead to a better understanding of the side-effects of DBS, as these might be related to functional subdivisions within the STN. / However, deriving a functional MRI signal from these subcortical nuclei remains a challenge. Anatomical specificity requires a very high spatial resolution, due to the small size and close proximity of the two nuclei. In addition, the signal-to-noise-ratio is hampered by the fact that the SN and STN show highly elevated concentrations of iron, which lead to greatly reduced baseline T2* values. Also, the nuclei lie deep in the brain, far from, and approximately equidistant to the different receive elements of a multi-channel array coil. The resulting increased g-factor reduces the performance of parallel imaging sequences and ultimately the signal-to-noise ratio in those regions. We present a set of functional imaging studies at ultra-high field (7T), measured while participants performed the stop-signal paradigm. Different spatial resolutions, echo-times, and acceleration factors were acquired in an effort to optimize signal-to-noise ratio and anatomical specificity of functional MRI in the iron-rich human basal ganglia including the SN and STN.

p137

A spatial gradient in phonetic recalibration by lipread speech

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Exposure to incongruent audiovisual speech can recalibrate auditory speech identification, a phenomenon known as phonetic recalibration (Bertelson, P., Vroomen, J., de Gelder, B. (2003). Visual recalibration of auditory speech identification: A McGurk aftereffect. Psychological Science, 14, 592-597). Here, we examined whether phonetic recalibration is spatially specific. Participants were presented an auditory ambiguous sound halfway between /b/ and /d/ (A?) combined with lipread /b/ or /d/ at either the left or right ear/side, and were subsequently tested with auditory-only test sounds at either the same or the opposite ear/side. Phonetic recalibration was always strongest if test sounds were presented at the same ear/side than a different one. Phonetic recalibration thus has a spatial gradient, highlighting the stimulus-specific and non-linguistic factors that contribute to this phenomenon.

p139

Risky decision-making in adolescent girls: The role of testosterone and reward circuitry

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Adolescence is a period in development characterized by a greater tendency to take risks. Existing neurobiological models have proposed that the rise in sex steroids during puberty—which marks the onset of adolescence—influences the function of brain regions involved in reward processes, and thereby alters decision-making. However, research on the role of pubertal hormones in adolescent risk taking is limited. Here, we tested the relation between pubertal hormones and adolescent risky decisions using a probabilistic decision-making task. In this task, participants could choose on each trial to play or pass based on explicit information about the risk level and the stakes involved in their decision. We administered this task to 11–13-year-old adolescent girls (n = 58) while functional MRI images were obtained to examine reward-related brain processes associated with their risky choices. We focused on activation of nucleus accumbens based on its key role in reward processing. Results showed that individual differences in risk taking were associated with saliva-based testosterone, but not estradiol level. In contrast to our expectations, the relation between testosterone and risk taking was not mediated by increased nucleus accumbens activation, but instead by increased medial orbitofrontal activation. These findings provide insight into the relation between pubertal hormones and adolescent risk taking, and offer a potential neural mechanism to explain why some girls engage in more risk taking compared to others.

p140

Learning and updating of stimulus-reward associations are reflected by electrical brain activity

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In gambling tasks, learning to associate stimuli with reward requires the continuous monitoring of gains and losses. Previous research (San Martin et al., 2013) identified feedback-related brain responses associated with learning stimulus-reward associations. While the feedback-related negativity (a frontocentral negative-polarity ERP deflection peaking ~250ms after feedback onset) distinguished losses from gains, the P3a (a frontocentral positive-polarity ERP at ~350ms) predicted whether participants were going to change their bet on

the subsequent trial. A major unanswered question, however, is how the updating of stimulus-reward associations is actually implemented in the brain. Here, we sought to utilize the temporal resolution of EEG to map the cascade of processes underlying such learning and updating. Participants were presented with mini-blocks of 20 trials. On each trial, participants had to choose (and wager on) either a face or a house. On each mini-block, either the face or the house was more likely to lead to a gain. Behaviorally, participants were able to learn in each 20-trial block whether the face or house was the more likely object to be rewarded. Neurally, we replicated that the P3a is larger when participants were going to switch their choice on the next trial, including that this general enhancement effect does not indicate the direction of the switch. Following this effect oscillatory EEG activity over the face area reflected the specific direction of stimulus-reward learning. Collectively, these results delineate the neural cascade underlying the learning and updating of stimulus-reward associations during probabilistic decision-making tasks.

p141

Do we need higher-level image integration during rivalry?

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Binocular rivalry occurs when the information presented to the two eyes is inconsistent. Instead of fusing into a single stable image, perception alternates between multiple interpretations over time. Integration across space during rivalry can be affected by image content. Visual information presented to the same eye tends to be integrated into a dominant percept most of the time, however. This suggests that integration across space during rivalry occurs mostly at an early monocular level of processing. The question remains whether integration across space during rivalry that is based on image-content occurs at a later stage of processing than eye-based integration. Since later visual areas have increasingly larger receptive fields, image-based integration should continue to facilitate dominance durations for image-parts that are presented further apart. Eye-based integration, on the other hand, should decrease at larger image-part (IPD) distances. We investigate eye- and image-based integration as a function of image-part distance (IPD). The results reveal the same relation with IPD for both eye-based and image-based integration. This suggests that both image-based and eye-based rivalry occur at the same early level of processing.

p142

Revealing neural locus of scanning and reactive saccade adaptation through computational modelling

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In order for saccades to keep landing at their intended targets, the brain must continuously calibrate motor commands based on visual feedback. The loci of this adaptive process are thought to rest at different sites in the brain, depending on what type of eye movement is required. Patient and lesioning studies have shown that exogenously cued eye movements, or 'reactive saccades', can be generated by the superior colliculus (SC) in concert with the cerebellum alone. Endogenously generated eye movements, or 'scanning saccades', on the other hand, require supervision from higher order cerebral regions such as the intra-parietal sulcus (IPS) and the frontal eye fields (FEF). Meanwhile, computational models have suggested that overall adaptation is driven by the combination of a fast and a slow process. The slow process is suggested to reflect changing motor commands originating from the higher levels of cerebral cortex, while the fast process is suggested to reflect adaptive control of the cerebellum. In the current study, we aim to combine these lines of research. We therefore hypothesise that adaptation of scanning saccades should be mainly driven by the slow process, reflecting the supervision of IPS and FEF. Conversely, we expect that adaptation of these saccades will be mostly driven by the fast process. We present the results of several experiments to unravel these components, in which observers performed identical saccade trajectories but saccades were either reactive or scanning.

p143

Spared route learning in Korsakoff's syndrome

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Korsakoff's syndrome (KS) is characterized by severe declarative amnesia, but relatively spared nondeclarative memory. The objective of this study was to assess to what extent Korsakoff patients can acquire information while performing a spatial navigation task. Also, we examined whether residual spatial acquisition in KS was based on automatic or effortful coding processes. Therefore, twenty patients diagnosed with KS and twenty age- and IQ- matched healthy control participants performed six tasks on spatial navigation after they navigated through a residential area. Ten participants per group were instructed to pay close attention, while ten received mock instructions. Performance was hampered compared to healthy control participants on a majority of tasks, but was spared on the route distance estimation task. Moreover, patients with KS exhibited task performance superior to chance level on a route time and distance estimation tasks, a map drawing task and a route walking task. Acquisition in KS was automatic rather than effortful, since no significant differences were obtained between the task performance of patients that were instructed to pay close attention and the patients that received mock instructions. For healthy control participants, the intention to learn was beneficial for the map drawing task and the route walking task. To conclude, despite severe declarative amnesia and generally lower wayfinding performance, patients with KS are still able to acquire spatial information during navigation on multiple domains. Residual acquisition in KS is likely to be based on automatic coding processes.

p144

Effects of Grasp Compatibility on Long-Term Memory for Objects

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Previous studies have shown action potentiation during conceptual processing of manipulable objects. In three experiments, we investigated whether these motor affordances also play a role in long-term memory. Participants categorized objects that afforded either a power grip or a precision grip as natural or artifact by grasping cylinders with either a power grip or a precision grip. In all experiments, responses were faster when the affordance of the object was compatible with the type of grip response. However, a subsequent free recall task revealed no better memory for objects pictures and object names for which the grip affordance was compatible with the grip response. The present data therefore did not support the hypothesis that motor actions play a role in long-term memory.

p145

Pupil size reflects semantic brightness of words

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An embodied view of language holds that, to understand a word, you must prepare associated actions (e.g., prepare finger movement to understand "typing"), and simulate associated sensory input (e.g., simulate perception of brightness to understand "light"). To test this, we investigated whether words can elicit physiological responses that are associated with their meaning; specifically, we measured pupillary responses to words that convey a sense of brightness (e.g. "day") or darkness (e.g. "night"). Because brightness triggers pupillary constriction, we predicted that the pupil would be smaller after reading a brightness-conveying, compared to a darkness-conveying, word. Participants (N = 30) read single words and pressed a key when the word was an animal name. The remaining (non-animal) words were associated with brightness or darkness, or were neutral (not associated with a specific brightness). Words were shown for 3 s, and were matched on lexical and visual properties. We collected normative ratings to control for the valence and emotional intensity of the words. Crucially, from about 1 s after word onset, the pupil was largest for darkness-conveying words, intermediate for neutral words, and smallest for brightness-conveying words. This finding is consistent with an embodied-language view, and suggests that, at least in some cases, word comprehension involves automatic, physiological responses; for example, understanding that the word "sun" refers to a bright object induces, or may even rely on, pupillary constriction.

p147

Online assessment of cognitive problems associated with cancer and cancer treatment: Validation of a new self-administered online neuropsychological test battery

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Objective: Online tests often allow for more efficient cognitive data collection compared to traditional neuropsychological assessments, but thus far their psychometric properties have been poorly studied. The primary focus of the current study was to assess the usability and validity of a new self-administered online neuropsychological test battery. Methods: We developed an online test battery based on seven traditional neuropsychological tests. Usability was assessed through participant feedback from questionnaires and technical reports. Convergent validity was assessed using Spearman correlations to compare online scores to scores from equivalent traditional face-to-face and computer-assisted tests. A total of 201 (112 female) cancer patients (mean age 53.02 years) completed both an online unsupervised assessment and a supervised traditional assessment. Results: Technical problems occurred in 3.5% of the online assessments. The larger part of the participants (67.8%) favored an online home assessment. Comparing online test and traditional tests, we observed moderate to strong convergent validity (r= .37 to .70). Correlations were influenced – as expected – by the similarity between the traditional test and its online counterpart. Conclusion: Cancer patients can successfully complete our online neuropsychological test battery in an unmonitored setting. Validity studies indicate that most of the tests are a valid tool to measure cognition online. Data on test-retest reliability and criterion validity are currently analyzed to comprehensively identify psychometric properties. Furthermore, norms scores are generated to interpret individual test scores. If adequately reliable, the online test battery would allow us to gather large-scale research data on patients' cognitive functioning in the near future.

p148

Investigating inhibitory processes within the motor cortex during conflict resolution using paired-pulse transcranial magnetic stimulation

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In daily life, we often need to deal with situations in which multiple actions are possible, situations of so-called 'response conflict'. Several brain regions have been identified as key nodes of a network involved in resolving response conflict. However, how and by which physiological mechanism those nodes finally affect the 'output station' of the brain, the primary motor cortex, is unknown. A potential mechanism is the involvement of inhibitory interneurons, which can be directly tested using paired-pulse transcranial magnetic stimulation (TMS). Here we test how inhibitory processes within the primary motor cortex change over time during the resolution of response conflict. / Participants performed an arrow version of the Flanker task. The arrows were arranged such that they either elicit one response with no conflict (e.g., all arrows point to the same direction) or two competing responses (e.g., the target arrow points towards the opposite direction as the flankers). To track the involvement of inhibitory processes over time short intra-cortical inhibition (SICI) was measured as the change in the amplitude of the motor-evoked potential over the left motor cortex elicited by a single supra-threshold pulse and by a supra-threshold pulse preceded by a sub-threshold pulse. This enabled the identification of time-specific physiological patterns of inhibitory processes at the level of primary motor cortex. Preliminary analyses show specific changes in SICI over time dependent on the level of response conflict, suggesting involvement of primary motor cortex inhibitory interneurons when resolving situations of response conflict.

p149

The effect of motor preparation on the temporal processing of auditory information

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During preparation of a motor action the duration and temporal frequency of a visual event are perceived as respectively longer and slower. It has been suggested that these effects are caused by an increased processing rate for sensory information. However it is unclear whether this increase in processing rate is specific for vision. Here we investigated whether motor preparation also influences the processing of temporal aspects of auditory signals. We used a duration judgment task in which participants compared either the duration or the flutter frequency (sinusoidal intensity modulations) of two auditory tones. During presentation of the second tone they either prepared to release a button and perform an action after the tone had ended, or simply maintained the button press until the end of the trial. Results showed an increase in perceived duration during motor preparation. We also found a marginally significant decrease in perceived temporal frequency during motor preparation. However, both effects were much smaller then those found for visual stimuli. Additionally, we found a significant correlation between the size of the effect of motor preparation on perceived flicker frequency and duration, supporting the suggested relation between the two effects. Together these findings suggest that motor preparation influences the perceived duration and possibly the perceived temporal frequency content of an auditory event similar to the effects reported for visual information. This further supports the idea of a general increase in processing rate of sensory information during motor preparation.

p150

Lateralization of spatial frequency processing: Effects of task factors

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The existence of hemispheric asymmetries, or lateralisation, has been shown for a wide range of cognitive and perceptual functions. The current study focuses on the lateralisation of spatial frequency processing in vision. In a series of experiments, participants were presented with images that were filtered to contain only high or low spatial frequency information. By presenting the stimuli in either their right visual field (RVF) or left visual field (LVF), we controlled which hemisphere had first access to the information (known as the visual half field technique). We tested the hypotheses that the right hemisphere is specialised in processing of low frequencies, while the left hemisphere does well at processing high frequencies (Peyrin, 2006). Our data indeed support this: participants were quicker to respond to high spatial frequency images when presented in their RVF, and to low spatial frequency images when presented in their LVF. However, this was the case only under certain conditions. Moreover, we did not replicate these results in all experiments run. This indicates that the surfacing of lateralisation effects for spatial frequency processing in reaction time data is highly influenced by task factors. Specifically, stimulus duration, response (go/no-go versus two-choice) and the number of practice trials seem to play a role. In addition to the behavioural experiments, we ran an EEG study contrasting high and low spatial frequency information embedded in images of faces. The results of this study are being analysed at the moment.

p151

The automaticity of language-perception interactions

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Previous studies have shown that language can modulate visual perception, by biasing and/or enhancing perceptual performance. However, it is still debated where in the brain visual and linguistic information are integrated, and whether the effects of language on perception are automatic and persist even in the absence of attention to and awareness of the linguistic material. In two separate experiments, participants engaged in a visual motion detection or discrimination task. Before each trial, a word prime was briefly presented that implied upward or downward motion (e.g., "rise"). In one experiment, participants ignored the words, while in another experiment they had to pay attention to the linguistic stimuli. We also manipulated awareness of the words by means of backward masking. Even when words were unattended, participants were faster and more accurate when the direction implied by the motion word was congruent with the direction of the visual motion stimulus. Attention to and consciousness of the words greatly amplified their influence on motion discrimination, but unconscious language still interacted with motion perception. When the motion word and stimulus were congruent, neural activation was larger in the left middle temporal gyrus, an area that is involved in semantic processing of verbal material. The location and extent of activation were similar for attended and unattended conditions. These effects were only observed when the motion word was consciously perceived. Together, our results suggest that language-perception interactions may rely on automatic feed-forward integration of perceptual and semantic material in language areas of the brain.

p152

Out of da group: linguistic errors made by outgroup members evoke larger error-related processing.

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In multicultural societies like ours, the cultural and racial backgrounds of our neighbours might differ, but we all speak the same language. In three experiments we explored whether differences in group membership of a speaker or writer (i.e. being autochtoon or allochtoon) influenced the way their utterances were perceived. In study 1, we recorded the Electro-Encephalogram (EEG) of native speakers of English from the US while they read sentences written by Hispanic and White writers. Even though Hispanic writers made exactly the same number of errors as their White counterparts, errors made by outgroup writers evoked larger changes in error-related components (N400 and P600) compared to ingroup writers. We replicated this effect with a sample of native Dutch speakers reading sentences written by Moroccan or Dutch writers. Errors made by outgroup writers evoked a larger P600 compared to ingroup writers. In a final experiment, we focused on accented speech as an indicator of ingroup- or outgroup membership, comparing street language to canonical Dutch. Participants listened to speakers of street language or canonical Dutch pronouncing sentences with correct or incorrect use of grammatical gender (street language is well-known for its lack of grammatical gender). Again, these errors evoked larger P600 effects for outgroup speakers than for ingroup speakers. These results show language errors made by outgroup members have a larger impact on language processing that ingroup errors. This suggests that outgroup speakers and writers might be judged more harshly than ingroup members for making similar errors.

p153

Entraining alpha oscillations through tACS to boost creative problem solving

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Amongst the most remarkable capacities human beings possess is the ability to create. A common neural correlate of creative problem solving is temporal alpha oscillations. In this study, we tested whether it is possible to improve creative problem solving by entraining alpha oscillations in the right anterior temporal cortex through applying transcranial alternating current (tACS) brain stimulation (a non-invasive brain stimulation technique that can be used to modulate brain oscillations in a frequency specific manner). Participants took part in three experimental sessions in which they completed the remote associate test (RAT) while receiving: 1) alpha stimulation at right anterior temporal cortex; 2) alpha stimulation at left anterior temporal cortex; 3) sham stimulation. On each RAT trial, participants had to come up with a solution word that makes a compound word with each of the three words presented on the screen. Our findings showed that right alpha tACS was associated with a larger proportion of correct solutions on the RAT compared to left and sham stimulation, but that this effect was larger for harder items. We also observed that right tACS improved solving problems that had a shared wrong association. We conclude that right temporal alpha tACS can boost creative problem solving, especially when these problems involve overriding more obvious wrong solutions.

p154

Decision-related oscillatory activity in human visual cortex is linked to pupil dilation

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Behavioral report of the disappearances of salient visual targets is accompanied by a transient, retinotopically global modulation of population activity in human visual cortex. This signal is contingent on behavioral report of the (illusory or physical) target disappearance. We used magnetoencephalography (MEG) to test if this novel top-down signal is associated with (i) the perceptual decision or the resulting motor response, and (ii) a transient boost of neuromodulation. We used pupil dilation at constant luminance as a non-invasive proxy of central neuromodulator release. We performed simultaneous MEG and pupil diameter recordings during the spontaneous ("motion-induced blindness" illusion) or physical temporary disappearances of a salient visual target. Subjects reported these perceptual changes by overt motor response (button press), or covert counting (report of total after run). We characterized the effects of (i) motor report and (ii) pupil dilation amplitude on the modulations of MEG power over visual cortex around perceptual changes. A transient modulation of MEG power in the beta frequency range (12-36 Hz) over visual cortex reflected the content of behavioral report. An analogous modulation occurred in the alpha range (8-12 Hz). Both modulations occurred at the median response time (from the overt report condition) during both overt report and covert counting. The alpha modulation was enhanced under high pupil dilation. We conclude that the power modulation in visual cortex reflects a global top-down signal linked to the perceptual decision, irrespective of the overt motor action. This modulation overlaps with pupil-related modulation, suggesting an origin in neuromodulatory brainstem centers.

p155

Long-term motor adaptation: Time is not what matters

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In this study we investigated how motor adaptation progresses over six sessions, performed over a two-week period. Motor adaptation is generally studied within sessions of about half an hour and its sub-processes have been found to occur on different time-scales. A fast process learns and forgets rapidly whereas another process learns slowly but has good retention (Smith et al., 2006). When repeating the experiment, some retention manifests itself as a changed initial baseline performance whereas other learning manifests itself as faster relearning, or savings (Krakauer & Shadmehr, 2006). However, it is not very well known how learning at different timescales compares to adaptation over the time course of days rather than minutes. We tested adaptation in a 3D pointing task in which subjects aligned their (unseen) hand with virtual red target cubes that were projected one by one at pseudo-random locations in 3D space. Terminal feedback was given by projecting a virtual feedback cube once a movement had ended. To introduce a bias that subjects had to adapt to, the tracked position of the hand was rotated by ten degrees around the cyclopean eye before rendering the feedback cube based on this position (equivalent to wearing wedge-prisms). A session consisted of five alternating blocks without and with feedback that allowed us to assess both learning from the feedback and forgetting of what had been learned. We analyzed the rate of learning and retention by fitting a two state - gain independent - multi rate model (Smith et al., 2006) to the data in the individual sessions. Our paradigm produced similar learning and retention as observed in earlier studies. Foremost, we found that forgetting (return to baseline) between sessions was much smaller than that predicted by a time-dependent retention rate, albeit somewhat larger than the forgetting that would be predicted by a trial-dependent retention rate. Second, we found that subjects improved their asymptotic level of adaptation by a small amount within each additional session of adaptation. We found no evidence of savings. Long-term adaptation could not be predicted by the retention and learning rates of the first session, because retention appeared to be affect both by trial-dependent and time-dependent forgetting (which had a different time-constant).

p156

A functional architecture of the brain for vision

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Rationale: In the last decades, electrophysiological and neuroimaging studies have identified more than 40 separate maps in the brain that are selectively tuned to specific visual features, such as colour or motion. Brain-behaviour relationships based on electrophysiology and functional neuroimaging are per definition correlational. We need neuropsychological research with patients who suffered focal brain damage to show us which brain structures are necessary (e.g. Catani & Stuss, 2012). Moreover, the proposed research programme will investigate how these necessary maps are linked together. As a theoretical perspective, this programme adopts a critical position towards the "what and where pathways" model developed by Goodale & Milner (1992). Objective: The primary objective of this research programme is to develop a new functional architecture of the visual brain based on two concepts: the methodology to establish necessity and the theoretical framework of cortical networks. In addition, this project will investigate the frequency and severity of specific visual impairments following ischemic stroke. Study design: This is a large-scale cohort study involving four academic medical centres in the Netherlands. We aim to include 1200 patients with ischemic stroke lesions and a control group of 200 subjects. Participation involves an intake including a neuropsychological screening, a MRI scan, and computerised tests of specific visual abilities. Single cases with selective deficits will be studied in depth using ad hoc developed testing procedures to explore the constellation of impaired and spared abilities. Lesion overlap analyses will be performed to investigate structure-function relationships.

p157

Viewing faces through apertures

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Orientation inversion is thought to disproportionately disrupt the processing of faces; for example, observers are slower and less accurate when identifying individuals depicted in upside-down photographs. The detrimental effects of inversion are widely attributed to a loss of holistic representation. When viewed upright, facial features (eyes, nose, mouth) are thought to be fused into a unified whole, permitting accurate and efficient interpretation. However, when viewed upside-down, facial features may recruit a slower and less accurate, piecemeal analysis. We sought to test this popular account of the face inversion effect using a novel paradigm where observers made binary judgements about morphed facial images, presented upright or inverted, either viewed in their entirety (permitting holistic representation), or through a aperture window that shifted incrementally over the image (blocking holistic representation). As expected, observers' facial judgements were poorer i) when images were viewed upside-down and ii) when faces were viewed through apertures, than when viewed upright in their entirety. Critically, however, the aperture manipulation had similar detrimental effects when viewing upright and inverted images. This pattern of results was replicated for a range of binary judgements, including identity, gender and expression discriminations. The finding that the detrimental effects of aperture viewing are insensitive to facial orientation, suggest that upright and inverted faces may both show a holistic advantage. Contrary to the prevailing account of the face inversion effect, it appears that some forms of holistic processing survive orientation inversion.

p158

Zapping away sustained attention: electrical stimulation of the anterior cingulate cortex impairs vigilance

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The ability to sustain attention over an extended period of time, or so-called vigilance, is a requisite skill for myriad tasks in everyday life. Vigilance is associated with a predominantly right-lateralized frontoparietal network of brain structures comprised of the anterior cingulate cortex (ACC) and the dorsolateral prefrontal cortex (DLPFC) (Langner & Eickhoff, 2013). In the present study, we aimed to determine the efficacy of transcranial electrical brain stimulation in enhancing sustained attention. Specifically, with a single-blind, sham-controlled, between-subjects design, we tested whether anodal stimulation of the right dorsolateral prefrontal cortex (DLPFC) or of the anterior cingulate cortex (ACC) could enhance performance on a sustained attention task. To our surprise, we found no significant effect of right DLPFC stimulation on sustained attention, and a significant negative impact on performance in the ACC condition after splitting our sample into high and low decrement groups. We conclude that anodal stimulation of the ACC causes a reduction of sustained attention, but only when the task is relatively taxing on a subject's attentional resources. This study has two important implications: 1) it seems possible to modulate the attentional focus of the subject with weak electrical current, and 2) electrical brain stimulation can have adverse effects on important cognitive abilities such as vigilance.

p159

The Effects of Combined Transcranial Direct Current Stimulation and Alcohol Avoidance Training as a Treatment for Alcoholic Inpatients

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In two large studies a form of cognitive bias modification (CBM), in which patients learn to avoid alcohol pictures (by pushing them with a joystick), has been found to be effective in reducing approach bias and increasing treatment outcome for alcoholic patients. It is hypothesized that stimulation of the prefrontal cortex with transcranial direct current stimulation (tDCS), a brain stimulation technique that can increase plasticity, may improve this training. Inpatient alcohol addicted patients were randomly assigned to 3 different experimental groups (final sample: n = 91). The experimental group received 4 sessions of CBM while receiving 2 mA of anodal tDCS over the left DLPFC. There were two control groups: One received sham stimulation (30 seconds. 2 mA) during CBM and one received real stimulation at a different moment in time (and received sham tDCS during CBM). Before and after the treatment sessions there was a pre and post assessment testing craving and implicit reactions, relapse after 3 months was also included. There was a reduction in craving and approach bias over time; however no group effects. There was an indication of a beneficial effect of tDCS on approach bias only early in the training, from the first to the second session. Relapse rates were slightly lower in the experimental group, but this effect was only significant in a direct comparison to the sham stimulation control group. This study suggested a possible beneficial effect of tDCS on training efficacy and treatment, but does not permit strong conclusions.

p160

A Unified Uncertainty Theory of Consciousness

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Numerous theories of consciousness have tried to explain its nature, purpose and mechanisms; yet, consciousness still remains an ambiguous phenomenon. Here, we propose a theory of consciousness that tries to clarify this fundamental human aspect by considering consciousness in relation to the free energy formulation of brain function and behaviour. The ensuing unified uncertainty theory (UUT) of consciousness offers a relatively simple explanation for the physical nature of consciousness (what is it?), its biological mechanisms (how does it work?) and teleological questions (why does it exist?). First, we suggest that consciousness constitutes changes in free energy gradients generated by neuronal activity that represents the model of internal (physiological) and external (behavioural) states and processes. Second, we propose that the purpose of consciousness is minimisation of (variational) free energy that represents unified uncertainty about expected internal and external states and processes. Lastly, consciousness depends on saliency and attentional neurobiological mechanisms – processes that dynamically change free energy gradients that are essential for inference of unified uncertainty in self-organisation. Specifically, we suggest that conscious inference and self awareness are induced by – and resolve – uncertainty in deep (hierarchical) models of the (internal and external) world embodied by the brain. The UUT is consistent with current views of consciousness and specifies empirically testable hypotheses regarding biophysical, neurobiological and psychological aspects of consciousness. In short, Unified uncertainty theory of consciousness may provide a novel way to understand this core aspect of our experience.

p161

Creativity and language: neurophysiological correlates of passive conceptual expansion

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Most neurophysiological research investigating creativity has focused on the changes in the alpha band in tasks involving divergent thinking (Jauk et al., 2012). A somewhat different approach has been recently suggested by Rutter et al. (2012), who introduced a modified version of the alternate uses task. In combination with EEG, such tasks offer a good tool to measure the precise time course of brain activity related to creative thinking. Although novel figurative language involves creative thinking, the direct link between these two domains has rarely been discussed in the context of neurophysiological research. Previous studies into novel metaphor have focused on the differences in comprehension between figurative and literal, as well as novel and conventional language. A graded effect has been observed with lowest N400 amplitudes for literal utterances, larger for conventional metaphoric and the largest for novel metaphoric utterances (Arzouan et al., 2007). More inconsistent results have been observed for the late positive complex (LPC), with reduced (Arzouan et al., 2007) or increased LPC (De Grauwe et al., 2010) to metaphoric utterances. We designed studies involving novel metaphor comprehension tasks and a modified version of the alternate uses task. In line with Kr□öger et al. (2013), we argue that the underlying cognitive process of conceptual expansion is common to both tasks and crucial for creating meaning. We draw special attention to differences in cognitive processes underlying anomaly and novelty processing, and discuss the observed ERP components, the N400 and LPC, as markers of creative thinking.

p162

Disentangling the cortical representations of reward value and probability

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Human behavior is greatly affected by expected utility, the combination of subjective value (SV) of the outcome of an act (is it rewarding?) and the subjective probability (SP) of that outcome. The present study examined electro-cortical representations of the anticipation of SV and SP during a cued Go/NoGo experiment. During this task cue letters signaled upcoming target letters to which participants had to respond. The probability of target letter appearance after the cue letter and the amount of money that could be won for correct and fast responses were orthogonally manipulated across four task blocks. Our main aim was to investigate whether SV and SP are separately processed in the cortex, which would be indicated by SV and SP modulating separable ERP components. In line with our predictions we show that a prefrontal P200 was sensitive to manipulations of subjective value. A more centro-parietal P300 was also sensitive to manipulations of subjective value, which is in line with previous research showing sensitivity of the P300 to motivational aspects of stimuli. Furthermore, an interaction between SV and SP was found between 281-403 ms after cue presentation. This interaction was fronto-centrally distributed. These results show that value and probability are partially separately processed in the cortex.

p163

ERP and time-frequency indices of conflict and error processing: Convergence across task switching and attentional network paradigms.

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Performance in everyday life relies on cognitive control, the ability to: inhibit responses to irrelevant information, adapt to conflicting stimuli and rule-changes, and learn from mistakes. Strong links have been found between these aspects of cognitive control and electrophysiological (EEG) measures, in particular in the time-domain (ERP) components relating to early visual processing (N2), attention (P3b) and error processing (error-related negativity, ERN). However, more recent studies have stressed the importance of time-frequency EEG analysis, as an added source of information regarding conflict and error processing, in particular delta/theta frequency power (~2-8 Hz). Because these findings are often based on relatively small samples and simple reaction time tasks, a relevant question is whether such indices are reliable across paradigms, across multiple sessions, and across measurement techniques. We addressed these questions by reanalyzing a sizeable dataset of cognitive task performance and concurrent EEG recordings. The dataset was originally acquired for an analysis of game training effects in a pre-post comparison across three intervention groups. A sample (N=75) of young adults performed in two identical sessions divided by five weeks, on a task switching paradigm, an attentional network test and a visual short term memory task. We compare the contributions of performance analyses (congruency effects, conflict adaptation), traditional ERP component analyses (e.g. N2 and ERN), and time-frequency analysis (e.g. midfrontal theta) to highlight the merits and convergence of multiple conflict and error processing measures.

p164

Viewing-position effects in meaningless object viewing

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During reading, the eyes show a preferred viewing location (PVL): Observers tend to send their eyes towards the center of words, or slightly to the left of it. Initial-viewing positions, in turn, influence subsequent within-word eye movements. Initially fixating near a word's center results in a lower probability of making within-word refixations (an optimal-viewing-position, or OVP effect), but also longer initial-fixation durations (an inverted OVP, or I-OVP effect), as compared to initially fixating nearer to either end of a word. Interestingly, PVL, OVP and I-OVP effects generalize to object viewing. Although researchers debate about the underlying mechanisms, there is consensus that at least part of these effects is due to low-level perceptual and oculomotor constraints, rather than higher-level cognitive processes. The most convincing evidence for this claim comes from reading research showing that all viewing-position effects generalize to the scanning of meaningless letter strings. However, a comparison with meaningless object viewing was lacking. The current study provides this missing link, by investigating whether PVL, OVP and I-OVP effects also generalize from real objects to meaningless non-objects. Objects were Hemera pictures that were matched on pixel area (mean width = 1.51°, height = 1.44°). Non-objects were matched to the corresponding real objects on pixel area and texture (by applying a texture-synthesis algorithm), but had no semantic content. Both types of stimuli revealed similar PVL, OVP and I-OVP effects. Therefore, we conclude that viewing-position effects are indeed universal tendencies that depend on low-level oculomotor constraints instead of higher-level object (or word) recognition.

p165

Pupillary Correlates of Error Awareness and Post-Error Slowing

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Making an error on a decision task often leads to an increase in reaction time (RT) on the subsequent trail. This post-error slowing (PES) effect is often explained by an adjustment of response caution. However, it is unclear whether (1) we need to be aware of the error for PES to occur, (2) PES is an adjustment solely driven by making an error, or if difficult-but-correct trials result in a similar effect, and whether (3) measures of cognitive effort index the response caution adjustments. To answer these questions we ran a lexical decision experiment with target words and pseudowords (fake-words that conform to relevant orthographic rules) embedded within trials of filler-words and filler-nonwords while recording pupillary responses. Furthermore, we assessed error awareness by allowing participants to correct a manual response by a vocal utterance. A reliable PES was found in response to errors. As expected, pseudo-words elicited larger pupillary responses than words, and errors evoked a large pupillary response. However, an even larger pupillary increase was observed when the subject was aware of making an error. Trials with uncorrected errors showed a similar pupil response as correct trials from the same category, suggesting that pupil dilation reflects error awareness rather than the magnitude of the PES effect. Interpreting these results in terms of diffusion models suggest that the decision boundaries are not stable over time.

p166

Semantic vector space models predict neural responses to complex visual stimuli

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Encoding models have as their objective to predict neural responses to naturalistic stimuli with the aim of elucidating how sensory information is represented in the brain. This prediction is achieved by representing the stimulus in terms of a suitable feature space and using this feature space to linearly predict observed neural responses. Here, we investigate to what extent semantic vector space models can be used to predict neural responses to complex visual stimuli. We show that these models provide good predictions of neural

responses in downstream visual areas, improving significantly over a low-level control model based on Gabor wavelet pyramids. The outlined approach provides a new way to model and map high-level semantic representations across cortex.

p167

Neuromodulatory effects of running based on gender differences

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Whereas frequent runners used to be a model for chronic stress research, they are now considered to have various advantages over the sedentary. The clinical potential of running is a hot topic, and appears to depend on various factors relating to both training regimen and to inter-individual factors. The potential for cognitive enhancement are being explored more and more, and are also subject to both exercise regimen and inter- and intra-individual differences. One of the determining factors is gender. Evidence from both human and animal studies has shown that females respond differently to stress, and this extends to physical stress. This is at least in part due to the interaction of sex hormones and hypothalamus-pituitary-adrenal activity, and in addition, the cognitive enhancement may be affected by interactions between sex hormones (specifically estrogen and progesterone) and several neurotransmitters (dopamine, serotonin, GABA and norepinephrine). An example of the HPA-sex hormone interaction is found in higher levels of vasopressin, adrenocorticotropic hormone and glucose following exercise in the mid-luteal phase compared to the follicular phase. These variations will have implications for the cognitive benefit females may experience from running. I will review the state of current research on gender differences in response to running, and draw conclusions on how running could be best applied for the enhancement of mood and cognition based on hormonal status.

p168

A case of selective progressive buccofacial apraxia, and the role of motor programming in verbal working memory.

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The syndrome of primary progressive aphasia (Mesulam, 1982) or fronto-temporal dementia (Hodges, et al., 1992) concerns a degenerative illness that may present at onset with a number of different symptoms. Although verbal dysfluencies are often observed, only a few cases have been described in which dysarthria as a result of buccofacial apraxia is the sole symptom (Broussolle, et al., 1996; Kertesz et al., 2003; Roth et al., 2006). From 2011 until 2015, we followed a 60 year old female who was referred to us because of complaints about deteriorating speech. It became apparent that she suffered from a very selective buccofacial apraxia. Her praxic deficit worsened from impaired but understandable speech to a complete inability to speak and mild limb apraxia. We followed the progression of the disease over a five year period looking at the deterioration of praxic abilities, comorbidity, and the secondary effects of severe dysarthria. Interestingly, from the first assessment on, she complaint that reading had become difficult. Her reading deteriorated during the following years, and in addition, testing showed a reduced verbal working-memory performance. This pattern of impaired and spared abilities is reminiscent of dyslexia. As she had been a normal reader, we need to consider the possibility that her reading deficit resulted from her buccofacial apraxia. This leads us to the intriguing hypothesis that a deficit in the motor programming of speech movements may also affect inner speech in the articulatory loop of working memory, which in turn impedes the reading proces.

p170

Consciousness is mandatory for proactive control, but not reactive control: A somatosensory study

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In order to adjust our behavior to our intentions, we are required to overcome conflicting information by recruiting control processes. Some have argued that a stimulus has to be consciously perceived before it activates conflict-based high-level control processes, while others have argued that unconscious information may also initiate high-level control processes. The present study attempts to explore this debate using a novel somatosensory metacontrast spatial-conflict task. In this task, the vibrotactors were situated inside a strap worn around the torso of the participant conveyed either spatially congruent or incongruent information. This information was presented either in a masked condition (i.e., subliminal) or unmasked (i.e. supraliminal). In four experiments, the proportion of congruent trials (50%, 80%) was manipulated factorially with the masking condition (masked /unmasked). Results suggested that congruency effect was modulated by proportion of congruent trials in the unmasked but not masked condition. In addition, congruency effect was modulated by the congruency of trial n-1 following both masked and unmasked conditions in trial n-1. We concluded that (a) subliminal somatosensory stimulation creates a conflict, (b) proactive control (i.e., strategy) may be modulated by supraliminal events, but not subliminal events, and (c) reactive control mechanism is activated by both supraliminal and subliminal events.

p171

Long term associations and serial recall: Using synaesthesia to probe memory for sequences

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Different sequences such as numbers and letters form ordered categories that are important to recall correctly in everyday life. Recent interest in the field of serial recall has highlighted that long-term memory interacts with our ability to accurately recall sequences. In the current study, we used a novel staircase approach manipulating presentation duration to examine this interaction. Our results show that participants encode structured, overlearnt sequences (e.g., 1-2-3-4-5 or A-B-C-D-E) faster than non-structured, novel sequences (e.g., 5-1-8-3-9 or D-O-Q-Y-L). Additionally, we tested digit-colour synaesthetes to investigate whether they have an enhanced ability to recall specific colour sequences. For digit-colour synaesthetes, digits evoke vivid experiences of colours that are highly consistent over the lifespan. The conscious experience of synaesthesia is unidirectional: Digits evoke colours but not vice versa. Here, we show with our novel staircase method that synaesthetes have a benefit over non-synaesthetes when encoding specific colour sequences. These colour sequences contained numerical structure when translated back to digits. Our results demonstrate that synaesthetes can strategically activate digits when presented with colours in order to boost serial memory for colour sequences. Together, these results show that sequences stored in long-term memory can be encoded at a faster rate than novel sequences.

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