



PSYCHOLOGIE & GEHIRN
41. TAGUNG
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41. Tagung „Psychologie und Gehirn“

Frankfurt am Main, 04.-06. Juni 2015

Abstracts der Beiträge

Hauptvorträge

Donnerstag 14:00 h

See what you hear: Constructing a representation of the world across the senses

Uta Noppeney

(Department of Psychology and Computational Neuroscience and Cognitive Robotics Centre, University of Birmingham)

To form a coherent percept of the environment the brain needs to integrate sensory signals from a common source and segregate those from different sources. Human observers have been shown to integrate sensory signals in line with Bayesian Causal Inference by taking into account the uncertainty about the world's causal structure. Over the past decade, evidence has accumulated that multisensory integration is not deferred to later processing in association cortices but starts already in primary, putatively unisensory, areas. Given this multitude of multisensory integration sites, characterizing their functional similarities and differences is of critical importance.

Our research demonstrates that multisensory integration emerges in a functional hierarchy with temporal coincidence detection in primary sensory, informational integration in association and decisional interactions in prefrontal areas. Audiovisual interactions in low level sensory areas are mediated via multiple mechanisms including feedforward thalamocortical, direct connections between sensory areas and top down influences from higher order association areas.

Combining Bayesian modelling and multivariate decoding we demonstrate that the brain integrates sensory signals in line with Bayesian Causal Inference by simultaneously encoding multiple perceptual estimates along the cortical hierarchy. Critically, only at the top of the hierarchy, in anterior intraparietal sulcus, the uncertainty about the world's causal structure is taken into account and sensory signals are combined weighted by their sensory reliability and task-relevance as predicted by Bayesian Causal Inference.

Freitag 11:00 h

Hormone im sozialen Gehirn: Translationale Perspektiven für eine psychobiologische Therapie

Markus Heinrichs

(Institut für Psychologie, Albert-Ludwigs-Universität Freiburg)

Zwischenmenschliche Beziehungen spielen für den Menschen eine zentrale Rolle. Defizite in der Beziehungsfähigkeit gehen häufig mit tiefgreifenden Störungen einher, welche in der Regel schwierig behandelbar sind.

Tierexperimentelle Studien konnten zeigen, dass Neuropeptidhormone neben den bekannten physiologischen Funktionen ausgeprägte Verhaltenseffekte im Gehirn induzieren (Donaldson & Young, 2008). Das Neuropeptid Oxytocin ist bei Säugetieren über die etablierte Rolle für Geburt und Stillen hinaus entscheidend an der Steuerung sozialen Bindungsverhaltens (z.B. Mutter-Kind-Bindung, Paarbindung) beteiligt (Heinrichs et al., 2009). Wir konnten in einer Reihe von Studien erstmals zeigen, dass auch beim Menschen bindungs- und sozialrelevantes Verhalten wie Vertrauen, Blickkontakt und soziale Annäherung durch Oxytocin reguliert wird. Außerdem bewirkt Oxytocin eine Kontrolle angst- und stressreaktiver biologischer Systeme, welches wiederum die Annäherungsfähigkeit verbessert (Chen et al., 2011; Heinrichs et al., 2013a; Heinrichs et al., 2013b; Kanat et al., 2014; Kumsta & Heinrichs, 2013; Meyer-Lindenberg et al., 2011).

Der Vortrag bietet einen Überblick über den Stand unseres Wissens beim Menschen und beleuchtet die neurobiologischen Mechanismen menschlichen Sozialverhalten. Darüber hinaus widmet sich der Vortrag auch den translationalen Perspektiven für eine klinische Relevanz des Oxytocinsystems bei der Diagnostik und Therapie psychischer Störungen mit sozialen Defiziten („psychobiologische Therapie“) – insbesondere bei nur bedingt therapierbaren Störungen wie Autismus.

Samstag 11:00 h

Neuroscience and the Human Will

Marcel Brass

(Department of Experimental Psychology, Universiteit Ghent)

The problem of how we can voluntarily control our thoughts and actions has always fascinated philosophers and psychologists. At the heart of this problem lies the concept of human will or volition. However, volition as a scientific concept has lost its credibility with the onset of behaviourism and is only slowly starting to be rediscovered in psychology. Recent neuroscientific research on human volition has primarily tried to address two questions: First, what are the functional mechanisms and neural circuits underlying volition? Second, is a neuroscientific conception of volition compatible with the idea of free will? In the first part of my talk, I will summarize research revealing the central role of the medial prefrontal cortex in voluntary control of behaviour. In the second part, I will address the question of whether it matters that we believe in free will or not.

I will report a series of experiments in which we show that priming people with disbelief in free will affects intentional motor preparation, sense of agency and error processing. These findings suggest that high-level beliefs might have a much more profound influence on basic cognitive processes than previously thought.

Raum: Festsaal 1

Symposium 1.1: Überdauernde Effekte emotionaler Erfahrungen: (Neuro-) biologische Korrelate, Einflussfaktoren und Psychopathologie

Vorsitz: Andrea Hermann¹ & Daniela Mier²

¹Professur für Psychotherapie und Systemneurowissenschaften, Justus-Liebig-Universität Gießen, ²Zentralinstitut für Seelische Gesundheit, Universität Heidelberg/ Medizinische Fakultät Mannheim

In diesem Symposium werden Studien zu überdauernden Effekten emotionaler Reize und Erlebnisse vorgestellt. Der Fokus liegt neben der Charakterisierung zugrundeliegender (neuro-) biologischer Prozesse insbesondere auf der Bedeutsamkeit interindividueller Unterschiede. In den ersten beiden Studien wird mittels Furchtkonditionierung die Gehirn-Herz-Kopplung (Panitz et al.), sowie der Zusammenhang von oxytocinergen Genpolymorphismen und neuronalen Verarbeitungsprozessen (Müller et al.) während des Abrufs konditionierter und extingierter Furcht untersucht. Ein weiterer Beitrag (Zamoscic et al.) beschäftigt sich mit dem Zusammenhang von sensorischer Empfindsamkeit und der Konnektivität relevanter Gehirnareale beim Erinnern negativer Lebensereignisse bei depressiven Patienten. Im letzten Vortrag (Fenske et al.) werden die Effekte der Präsentation emotionaler Reize auf Hautleitfähigkeit und nachfolgende sozial-kognitive Verarbeitungsprozesse bei Patienten mit Schizophrenie untersucht.

Modulierte funktionelle Gehirn-Herz-Kopplung beim Abruf von konditionierter und extingierter Furcht

Panitz, Christian; Hermann, Christiane; Mueller, Erik M.
Abteilung Klinische Psychologie & Psychotherapie, Justus-Liebig-Universität Gießen

Die kardiale Furchtreaktion ist ein wichtiger Indikator für psychophysiologische Furchtverarbeitungsprozesse beim Menschen. Über zeitliche Aspekte der zugrundeliegenden Gehirnmechanismen ist bisher jedoch wenig bekannt. Zur Erfassung funktioneller Gehirn-Herz-Kopplung mit hoher zeitlicher Auflösung kann Cardio-EEG-Covariance-Tracing (CECT) verwendet werden, ein Verfahren bei dem die intraindividuelle Kovariation von evoziertem Einzeltrial-EEG und Herzperiode (HP) in verschiedenen Zeitfenstern erfasst wird. Zur Untersuchung des Einflusses

von Furcht auf kortiko-kardiale Kopplung nahmen N = 22 TeilnehmerInnen an einem zweitägigen Experiment mit differentieller Furchtkonditionierung und -extinktion teil. Bilder von Gesichtern wurden als konditionierte Stimuli (CS) verwendet, ein lautes Geräusch als aversiver unkontingierter Stimulus (US). Am ersten Tag wurden zunächst zwei Gesichtsstimuli durch gemeinsame Präsentation mit dem US furchtkonditioniert (CS+), zwei nicht (CS-). Anschließend wurden in einer Extinktionsphase jeweils ein CS+ und ein CS- ohne US präsentiert. In der Abrufphase an Tag 2 wurden wieder alle vier CS präsentiert. Die Gehirn-Herz-Kopplung in der Abrufphase zeigte sich sensitiv für Einflüsse der Furchtkonditionierung und -extinktion von Tag 1. In Folge des nicht-extingierten CS+ sagte die zentromedial evozierte EEG-Amplitude 250-500 ms post-CS intraindividuell die Stärke der HP-Veränderung 2-5 s später vorher. Diese kortiko-kardiale Kopplung zeigte sich nicht in Folge der CS- oder des vorher extingierten CS+. Neurale Mechanismen, die zu einer Modulation der kortiko-kardialen Transmission bei konsolidierter konditionierter Furcht beitragen könnten, werden diskutiert.

Oxytocinerge Genpolymorphismen und die neuronalen Grundlagen sozial-relevanter Konditionierungsprozesse

Müller, Eva A.¹; Munk, Aisha J.²; Hennig, Jürgen²; Stark, Rudolf¹; Hermann, Andrea¹

¹Professur für Psychotherapie und Systemneurowissenschaften, Justus-Liebig-Universität Gießen, ²Abteilung für Differentielle Psychologie und Persönlichkeitsforschung, Justus-Liebig-Universität Gießen

Das Neuropeptid Oxytocin spielt eine zentrale Rolle für die Verarbeitung sozial relevanter emotionaler Reize sowie für emotionale Lernprozesse, wobei oxytocinerge Genpolymorphismen substanziell zur Aufklärung individueller Unterschiede in diesen Lernprozessen beitragen können. Furchtkonditionierung stellt ein wichtiges Modell für die Entstehung sowie Aufrechterhaltung von Angststörungen dar. Diese Studie dient dazu, die Korrelate der Akquisition und Extinktion konditionierter Furcht unter Berücksichtigung der oxytocinergen Genpolymorphismen CD38 (rs3796863) und OXTR (rs53576) zu untersuchen. Eine Zufallsstichprobe von 57 gesunden Männern nahm an einem differentiellen sozial relevanten Konditionierungsparadigma teil. Neutrale Gesichtsausdrücke dienten als kon-

ditionierte Stimuli (CS) und negative Filmausschnitte mit beleidigenden Kommentaren als unconditionierte Stimuli (UCS). An einem ersten Tag fanden die Phasen Habituation, Akquisition und Extinktionslernen mit Erfassung der konditionierten elektrodermalen Aktivität sowie konditionierter evaluativer Maße statt. Der Furcht- sowie Extinktionsabruf wurde am nächsten Tag während einer funktionellen Magnetresonanztomographie-Untersuchung durchgeführt. In Abhängigkeit der oxytocinergen Genpolymorphismen zeigte sich eine veränderte elektrodermale Aktivität sowie neuronale Aktivierung in Gehirnregionen, die mit emotionalen Lernprozessen assoziiert sind. Die Ergebnisse dieser Studie liefern erste Hinweise darauf, dass Oxytocin-assoziierte interindividuelle Unterschiede mit Lernprozessen zusammenhängen, die möglicherweise für die Entstehung, Aufrechterhaltung und Veränderung psychischer Störungen eine große Rolle spielen.

Die Rolle der sensorischen Empfindsamkeit bei Depression: Hinweise aus dem Default Mode Netzwerk

Zamoscik, Vera; Huffziger, Silke; Kühner, Christine; Kirsch, Peter

Zentralinstitut für Seelische Gesundheit, Universität Heidelberg/ Medizinische Fakultät Mannheim

Stärkere Default Mode Netzwerk (DMN) Aktivität steht im Zusammenhang mit selbstreferentiellen Prozessen, Rumination und Depression. Auf neurobiologischer Ebene fanden wir, dass die Gyri parahippocampalis eine wichtige Rolle beim Umgang mit negativen Erinnerungen bei Depression spielen. Einige Ergebnisse deuten außerdem darauf hin, dass sensorische Prozesse einen Einfluss auf Rumination und den Umgang mit negativen Ereignissen haben könnten. Um dies weiter zu untersuchen wurde remittierten Personen mit rezidivierender Depression (rMDD, DSM IV, n=20) und gesunden Kontrollen (KG, n=18) im MRT traurige Stimmung induziert indem Stichworte negativer Lebensereignisse gezeigt wurden.

Höhere selbstberichtete sensorische Empfindsamkeit war mit Rumination und einem früheren Alter bei Beginn der Depression bei rMDD verbunden. Während trauriger Stimmung war eine höhere sensorische Empfindsamkeit mit einer höheren Konnektivität des PCC mit den Gyri parahippocampalis in rMDD und mit dem Sulcus calcarinus in der KG verbunden. Diese Ergebnisse unterstützen

die Annahme einer Verbindung von sensorischen Prozessen, trauriger Stimmung, Rumination und Depression. Die stärkere Vernetzung des DMN mit dem Sulcus calcarinus bei trauriger Stimmung in der KG mit höherer sensorischer Empfindsamkeit könnte auf einen positiveren Einfluss der Sensorik bei negativen Ereignissen bei Gesunden hinweisen. Im Gegensatz dazu integrierten Patienten mit höherer sensorischer Empfindsamkeit die Gyri parahippocampalis in das DMN, wobei wir früher zeigen konnten, dass dies die Verschlechterung von depressiven Symptomen vorhersagt. Weitere Erkenntnisse des Einflusses der Sensorik auf affektive Prozesse könnten zur Verbesserung von Interventionen beitragen.

Negativer Bias und reduzierte elektrodermale Reaktion in der Emotionserkennung neutraler Gesichter bei Schizophrenie

Fenske, Sabrina; Lis, Stefanie; Englisch, Susanne; Kirsch, Peter; Mier, Daniela

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Patienten mit Schizophrenie weisen deutliche sozial-kognitive Defizite auf. Insbesondere hinsichtlich der Emotionserkennung existieren zahlreiche Befunde, die auf einen negativen Bias in der Emotionserkennung hinweisen. Die emotionalen Kontextbedingungen, unter denen ein solcher negativer Bias auftritt und die damit assoziierten physiologischen Korrelate sind bislang jedoch wenig untersucht.

20 schizophrene Patienten und 30 hinsichtlich Alter und Bildung parallelisierte gesunde Probanden nahmen an einer Emotionserkennungsstudie teil. Es wurde ein Emotionserkennungsparadigma verwendet, in dem jedem zu klassifizierenden Gesichtsbild entweder ein positiv, neutral oder negativ valentes Szenenbild (IAPS) voraus ging. Während der Aufgabenbearbeitung wurde zudem die Hautleitfähigkeit der Teilnehmer aufgezeichnet.

Patienten zeigten im Vergleich zu Gesunden eine signifikant geringere Emotionserkennungsleistung für positive und neutrale Gesichtsausdrücke. Die stärksten Defizite wiesen Patienten bei der Klassifikation neutraler Gesichter auf, die auf emotionale Szenenbilder folgten. Diese Fehlklassifikationen gingen mit einem verstärkten negativen Bias einher. Im Gegensatz dazu zeigten die Patienten gegenüber den Gesunden, eine reduzierte elektrodermale

Reaktion auf neutrale Gesichter, die auf emotionale (v.a. negative) Szenenbilder folgten.

Die Ergebnisse stützen bisherige Befunde zu Defiziten in der Emotionserkennung und der Existenz eines negativen Bias bei Schizophrenie. Zudem sprechen die Ergebnisse für den Einfluss emotionaler kontextueller Faktoren auf die Wahrnehmung neutraler Gesichter, welche jedoch mit einer reduzierten elektrodermalen Reaktion assoziiert zu sein scheint.

Raum: 1.802

Symposium 1.2: Mehr Daten, mehr Wissen?: Aktuelle Machine Learning Ansätze in Grundlagenforschung und klinischer Anwendung

Vorsitz: Tim Hahn

Allgemeine Psychologie II, Institut für Psychologie, Goethe Universität Frankfurt am Main

In den letzten Jahrzehnten hat das „Machine Learning“ (ML) als Teilbereich der künstlichen Intelligenz große Erfolge erzielt. So nutzt jeder von uns ML-Algorithmen bei der Internetsuche, profitiert von ML-Anwendungen in der Medizintechnik oder bei der Erkennung von Spam E-Mails. In jüngster Zeit werden solche Verfahren auch in der Psychologie – besonders in den kognitiven Neurowissenschaften – immer häufiger eingesetzt. Das Symposium gibt einen Überblick über aktuelle Ansätze sowohl im klinischen Anwendungskontext (Vortrag 1 und 2 zur ML-basierten Unterstützung klinisch relevanter Entscheidungen) als auch im Bereich der Grundlagenforschung (Vortrag 3 und 4 zur Dekodierung mentaler Prozesse mittels ML). Abschließend werden praktische Fragen der Methodenauswahl und –anwendung beleuchtet, sowie neue Ansätze zur Integration multipler Datenquellen (fMRT, EEG, Genetik, Proteomik, Fragebogendaten) dargestellt (Vortrag 5).

Generierung (differential-)diagnostischer und prognostischer Marker bei Angststörungen mit Hilfe von Machine Learning Verfahren

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Auch wenn neurostrukturelle und -funktionelle Studien in den letzten Jahren unser Verständnis für die Pathophysiologie von Angststörungen enorm verbessert haben, ist die Anwendung dieser Erkenntnisse in der klinischen Praxis weitestgehend ausgeblieben. Ein Grund hierfür ist, dass den meisten Studien eine phänotypische Betrachtung auf Gruppenebene zugrunde liegt, die über den individuellen Patienten aber wenig aussagt. Ein „Biomarker“ sollte jedoch in der Lage sein, eine Vorhersage über den diagnostischen oder prognostischen Status eines Patien-

ten mit hoher Sensitivität und/oder Spezifität zu erlauben und damit klinische Expertenentscheidungen, z.B. zur Patientenstratifikation, zu unterstützen. Machine Learning Verfahren ermöglichen diese Herangehensweise und sind daher in besonderer Art dazu geeignet, für die Neuroimaging Forschung eine translationale Brücke zu praxisorientierten Fragestellungen zu schlagen. Ziel dieses Vortrags ist es, im Bereich der Angststörungen zu demonstrieren, wie klinische Fragestellungen zur (Differential-) Diagnose und Prognose des Therapieerfolgs anhand von strukturellen und funktionellen MRT-Daten exemplarisch beantwortet werden können.

Graph-regularisierte Machine Learning-Ansätze zur Klassifikation psychischer Störungen und Prädiktion des Behandlungseffekts anhand funktioneller Kernspintomographie

Gerchen, Martin F.; Becker, Alena; Hentze, Charlotte; Kirsch, Martina; Kiefer, Falk; Schnell, Knut; Kirsch, Peter
Zentralinstitut für Seelische Gesundheit, Universität Heidelberg/ Medizinische Fakultät Mannheim

Bei der Anwendung von Machine Learning (ML) sollen verteilte Muster in Daten entdeckt werden, die dann zur Vorhersage relevanter Variablen, zum Beispiel des Therapieerfolgs bei einer Interventionsstudie, genutzt werden. Optimaler Weise findet ein ML-Algorithmus in einem hochdimensionalen Datensatz diejenigen Datenpunkte die die größte Vorhersagekraft haben und ignoriert andere Datenpunkte die die Vorhersage stören. Kernspintomographiedaten stellen jedoch für das ML eine besondere Herausforderung dar, da in diesen das Gehirn in über 50 000 – 100 000 Voxeln repräsentiert wird deren Werte stark voneinander abhängig sind und die damit grundlegende Annahmen der Standard-ML-Algorithmen verletzen. Die direkte Anwendung dieser Algorithmen auf das ganze Gehirn umfassende Kernspintomographiedaten kann dann zu einem Modell relevanter Voxel führen das instabil und schwer zu interpretieren ist. Eine Möglichkeit mit dieser Situation umzugehen besteht darin, die Struktur des Gehirns als zusätzliche Randbedingung zu berücksichtigen und dadurch die Struktur des geschätzten Modells an die Besonderheiten der gegebenen Kernspindaten anzupassen, wie dies der GraphNet-Ansatz versucht (Grosenick et al., 2013). Wir präsentieren erste Ergebnisse von GraphNet basierten Gruppenvergleichen

zur Analyse aufgabenbezogener funktioneller Kernspintomographiedaten bei depressiven und alkoholabhängigen Patienten mit dem Ziel der Erstellung von Modellen zur Charakterisierung pathologischer Prozesse und zur Vorhersage von Therapieerfolg bei Interventionen.

Grosenick, L., Klingenberg, B., Katovich, K., Knutson, B., & Taylor, J.E. (2013) Interpretable whole-brain prediction analysis with GraphNet. *NeuroImage* (72), 304-321.

Multivariate Aktivität im visuellen und parietalen Kortex kodiert Aufmerksamkeitsausrichtung im Arbeitsgedächtnis

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Bei der Untersuchung räumlicher Aufmerksamkeitseffekte im visuellen und parietalen Kortex mittels fMRT wird von einem gemessenen BOLD Signal auf die Verteilung der räumlichen Aufmerksamkeit im visuellen Feld geschlossen. Üblicherweise werden dazu Voxelgruppen (sog. Regions of Interest, ROI) identifiziert, die maximal auf visuelle Stimulation bestimmter Bereiche des visuellen Feldes reagieren. Deren gemittelte Aktivität wird dann während des eigentlichen Experiments betrachtet. Überlappende rezeptive Felder und geringe kortikale Repräsentationsgrößen verhindern jedoch gerade in höheren visuellen Arealen (u.a. im posterior parietalen Kortex) oftmals deren eindeutige Definition. Klassifikationsverfahren ermöglichen es hingegen, die multivariaten Aktivitätsmuster eines gesamten visuellen Areals so in niedrigdimensionale Räume zu projizieren, dass deren Koordinatenachsen den relativen Aktivierungen unterschiedlicher Bereiche im visuellen Feld entsprechen.

Wir demonstrieren den Vorteil eines solchen multivariaten Vorgehens anhand von räumlichen, objektbasierten Aufmerksamkeitseffekten in retinotopen Arealen während der Behaltensphase eines Arbeitsgedächtnisexperimentes. Wir zeigen, dass das Ausrichten räumlicher Aufmerksamkeit auf eine im Gedächtnis gehaltene Position zur Koaktivierung einer weiteren nicht attendierten Position führt, die sich auf demselben Objekt befindet. Das vorgestellte Verfahren weist in frühen visuellen Arealen eine höhere statistische Power auf und erlaubt im Gegen-

satz zu klassischen ROI Analysen zudem den Nachweis desselben objektbasierten Aufmerksamkeitseffekts im posterior parietalen Kortex.

Dekodierungsgenauigkeit im superioren Sulcus intraparietalis prädiziert die Qualität und Stabilität von Arbeitsgedächtnisrepräsentationen

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Ressourcen-basierte Modelle des Arbeitsgedächtnis (AG) postulieren, dass sich unter erhöhter AG-Last (load) die Qualität/Präzision der mentalen AG-Repräsentation sowie die zeitliche Stabilität der mnemonischen Präzision verringert. Mittels fMRT (n=22) untersuchten wir, welche neuronalen Prozesse interindividuelle Unterschiede in der load-bedingten Veränderung der Präzision vermitteln. Wir verwendeten eine visuelle AG-Aufgabe mit 1, 3 oder 5 zu merkenden Farben sowie eine visuelle Farb-Detektionsaufgabe, auf deren Basis ein CART-Algorithmus trainiert wurde, die neuronalen Aktivierungsmuster für 3 unterschiedliche Farben zu differenzieren. Der trainierte Klassifikator wurde auf die AG-Aufgabe angewandt, um zu dekodieren, ob eine der drei Farben im jeweiligen Trial enkodiert bzw. gemerkt wurde. Die Ergebnisse zeigen, dass die Klassifikationsgenauigkeit in visuellen, parietalen sowie frontalen Arealen mit steigendem load abnahm ($F(df=2)=4.63, p=.01$). Basierend auf den Verhaltensdaten wurde die mnemonische Präzision und deren zeitabhängige Variabilität mittels variable precision Modell und bayesianischem Ansatz geschätzt. Der load-Anstieg führte zu einer Reduktion der Präzision der Gedächtnisrepräsentation sowie zu einem Anstieg der Variabilität, und diese Veränderungen in der AG-Leistung wurden durch eine abfallende Klassifikationsgenauigkeit bzgl. der neuronalen Muster im superioren Sulcus intraparietalis (sIPS) prädiziert. Zudem wiesen Personen mit stabileren Gedächtnisrepräsentationen stärkere sIPS Aktivität auf als Personen mit variablerer Präzision ($p<0.05$). Diese Ergebnisse legen nahe, dass sIPS-Aktivität einen stabilisierenden Effekt auf die Qualität von AG-Repräsentationen hat.

Mehr als fMRT: Machine Learning Ansätze zur Analyse und Integration multipler, hochdimensionaler Datenquellen

Hahn, Tim

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Sowohl in der Grundlagen- als auch in der klinischen Anwendungsforschung finden methodische Ansätze aus dem Bereich der multivariaten Mustererkennung und des Machine Learning mehr und mehr Eingang in die Auswertung funktioneller Magnetresonanztomographie (fMRT) Messungen. Vor dem Hintergrund der Erfolge solcher hochdimensionalen Vorhersageverfahren gibt der Vortrag einen Überblick über die häufig verwendeten Algorithmen und stellt anhand konkreter Beispiele dar, wie die optimalen Methoden für unterschiedliche Datenquellen gefunden werden können. Besonderes Augenmerk liegt dabei auf fMRT und EEG-Daten, sowie auf der Integration neuronaler Messungen mit anderen Informationsquellen wie genetischen, proteomischen oder fragebogenbasierten Daten.

Raum: 1.811

Symposium 1.3: Effekte von akutem Stress auf Empathie und Sozialverhalten

Vorsitz: Bernadette von Dawans

Albert-Ludwigs-Universität Freiburg

Das Symposium widmet sich den Effekten von akutem Stress auf verhaltensnahe, soziale Variablen. Bernadette von Dawans hat die Effekte von Stress auf Sozialverhalten für Männer untersucht und wird in ihrem Vortrag auch auf die hormonellen Einflüsse von oralen Kontrazeptiva bei Frauen eingehen. Livia Tomova wird sich den Effekten von Stress auf die „self-other-distinction“ widmen - einer wichtigen Komponente der Empathie - und auch hier Geschlechtseffekte berücksichtigen. Oliver Wolf wird Ergebnisse zweier Untersuchungen zu Empathie nach Stress (unter anderem für Schmerz) präsentieren. Abschließend wird Veronika Engert in ihrem Vortrag der Frage nachgehen, ob alleine das Beobachten einer gestressten Person bereits zu einer messbaren psychobiologischen Stressreaktion führt und ob dabei die Nähe zur gestressten Person aber auch das Geschlecht eine Rolle spielen.

Effekte von akutem Stress auf Sozialverhalten: Welche Rolle spielen das Geschlecht und hormonelle Kontrazeptiva?

von Dawans, Bernadette; Trüg, Amalie; Ditzen, Beate; Heinrichs, Markus

Albert-Ludwigs-Universität Freiburg

Stress hat bei Männern und Frauen unterschiedliche und vielfältige Konsequenzen. Während die „Fight-or-Flight“-Reaktion seit rund 100 Jahren vor allem für Männer postuliert wird, wird in der Psychologie derzeit das „Tend-and-Befriend“-Konzept (aktives Aufsuchen von Unterstützung durch andere Menschen unter Stress sowie Stärkung von sozialem Bindungsverhalten) als prototypisch weibliche Stressreaktion hypothesisiert (Taylor et al., 2000, Psychological Review). Die unmittelbaren geschlechtsspezifischen Verhaltenskonsequenzen von akutem Stress wurden jedoch bisher nicht experimentell untersucht. Auch die Auswirkungen hormoneller Kontrazeptiva auf den Effekt von Stress auf Sozialverhalten sind bisher noch ungeklärt.

In einer randomisierten Studie wurden im ersten Teil zu-

nächst 67 gesunde Männer der Stress- (n=34) bzw. Kontroll-Bedingung (n= 33) des neu entwickelten „Trier Social Stress Test for Groups“ ausgesetzt. Im zweiten Teil der Studie durchlaufen insgesamt 100 Frauen den TSST-G (Stress- oder Kontrollbedingung), wobei die Hälfte der Frauen orale Kontrazeptiva einnimmt. Um soziales Verhalten zu untersuchen wurde in beiden Teilen ein Paradigma aus der Verhaltensökonomie eingesetzt, welches Vertrauen, Vertrauenswürdigkeit, Teilen, Bestrafung und Risiko misst.

Männer zeigten unter Stress mehr Vertrauen, mehr Vertrauenswürdigkeit und teilten häufiger mit anderen Teilnehmern. Risiko und Bestrafung wurden hingegen nicht beeinflusst. Ob Frauen ein ähnliches prosoziales Verhalten unter Stress zeigen und ob diese Reaktionen durch hormonelle Kontrazeptiva verändert werden, wird im Rahmen der Tagung präsentiert.

Geschlechtereffekte in den Auswirkungen von Stress auf die Unterscheidung selbst- und fremdbezogener Emotionen und Kognitionen

Tomova, Livia; von Dawans, Bernadette; Heinrichs, Markus; Silani, Giorgia; Lamm, Claus

Albert-Ludwigs-Universität Freiburg

Die Auswirkungen von Stress auf soziale Interaktionsfähigkeiten sind bisher kaum untersucht worden. Ziel der Studie war es, die Effekte von Stress auf die Unterscheidung selbst- und fremdbezogener Emotionen und Kognitionen („self-other distinction“), einer wichtigen Komponente von Empathie und Perspektivenübernahme, zu untersuchen. Self-other distinction wurde auf drei verschiedenen Verarbeitungsebenen (perzeptuell-motorisch, affektiv und kognitiv) untersucht. Die Ergebnisse zeigten für Männer und Frauen ein konsistent gegensätzliches Muster: Frauen zeigten bessere self-other distinction unter Stress und waren somit besser in der Lage Egozentrität auf emotionaler und kognitiver Ebene zu überwinden. Männer hingegen, zeigten verminderte self-other distinction und höhere Egozentrität unter Stress. Die Implikationen für Stresseffekte auf Empathie und prosoziales Verhalten, sowie mögliche Erklärungen für die Geschlechterunterschiede, werden diskutiert

Gesteigerte emotionale Empathie nach Stressexposition

Wolf, Oliver; Brüne, Martin; Dziobek, Isabel

Ruhr-Universität Bochum

Wie beeinflusst Stress unsere Fähigkeit die Emotionen und Ziele anderer Menschen zu verstehen (kognitive Empathie) und mit ihnen mitzufühlen (emotionale Empathie)? Beeinträchtigt Stress unsere Empathie-Fähigkeit, wie aus der Idee der Kampf- und Fluchtreaktion ableitbar, oder werden wir pro-sozialer, wie durch die „tend and befriend“ Hypothese vorhergesagt?

Zur empirischen Beantwortung dieser Fragen wurden zwei experimentelle Studien durchgeführt. In der ersten Studie wurden männliche Probanden entweder einem psychosozialen Laborstressor (Trierer Sozialstress Test; TSST) oder einer Kontrollbedingung unterzogen. Nach der experimentellen Manipulation wurden die Probanden mittels des Multifaceted Empathy Test (MET) untersucht. Im Empathie-Test berichteten gestresste Probanden von signifikant mehr emotionaler Empathie, sowohl für Bilder mit negativer als auch für Bilder mit positiver Valenz. Hinsichtlich der kognitiven Empathie ergaben sich hingegen keine Unterschiede zwischen den Gruppen.

In der zweiten Studie wurden männliche und weibliche Probanden untersucht. Nach Stress- oder Kontrollexposition wurde die Empathie für Schmerzdarstellungen untersucht. Erneut zeigte sich gesteigerte emotionale Empathie in der Stressgruppe.

Die Experimente zeigen, dass Stress emotionale Empathie erhöht. Diese Ergebnisse passen zu Studien anderer Arbeitsgruppen, welche gesteigertes prosoziales Verhalten nach Stress beobachtet haben. Diese Befunde scheinen das Konzept eines erhöhten „tend and befriend“ Verhalten nach psychosozialen Stress zu unterstützen.

Empathischer Stress: Einflüsse von sozialer Nähe, Beobachtungsmodalität und Geschlecht

Engert, Veronika

Max-Planck-Institut für Kognitions- und Neurowissenschaften, Leipzig

Unabhängig davon, ob wir unmittelbar unter Stress leiden oder nicht, stellt sich die Frage, inwieweit der Stress, der uns tagtäglich umgibt, negative Auswirkungen haben kann. Wir haben untersucht, ob ein solcher „empathischer Stress“, definiert als eine Stressreaktion, die ledig-

lich durch die Beobachtung einer unmittelbar gestressten Zielperson ausgelöst wird, tatsächlich zur Aktivierung der Hypothalamus-Hypophysen-Nebennierenrinden-Achse (HHNA) führt. Zusätzlich haben wir untersucht, inwieweit die Familiarität zwischen Beobachter und Zielperson (Partner vs. Fremde), die Beobachtungsmodalität (direkt vs. virtuell) und das Geschlecht des Beobachters die empathische Stressreaktion moduliert. Probanden wurden in Dyaden getestet und entweder mit ihrem Partner oder einem gegengeschlechtlichem Fremden gepaart. Während die Zielperson einer Dyade (n=151) einen psychosozialen Laborstressor ausgesetzt wurde, sah der Beobachter (n=211) über einen Einwegspiegel oder via Videotransmission dem Geschehen zu. Insgesamt zeigten 26% der Beobachter physiologisch relevante Anstiege des Stresshormons Cortisol. Dieser empathische Stress war in den Partner Dyaden und bei direkter Beobachtung am stärksten ausgeprägt. Dennoch zeigten sich Cortisolanstiege auch in den Fremd Dyaden und bei virtueller Beobachtung. Frauen und Männern unterschieden sich in ihrer empathischen Cortisol-Stressreaktionen nicht. Im Hinblick auf das subjektive empathische Stressempfinden fand sich jedoch eine stärkere Reaktion bei den Frauen. Das Auftreten von physiologisch relevanten empathischen Stressreaktionen, sogar bei Fremden und virtueller Beobachtungsmodalität, kann bedeutsame Implikationen für die Entstehung Stress-assoziiierter Erkrankungen haben.

Raum: 1.812

Symposium 1.4: Prospektives Gedächtnis - neurokognitive Mechanismen und individuelle Unterschiede

Vorsitz: Christine Stelzel

Charité Berlin

Nicht immer sind wir erfolgreich darin, gebildete Intentionen in der Zukunft auch zu realisieren. Verschiedene Faktoren können den erfolgreichen Abruf von Intentionen modulieren. In diesem Symposium werden vier zentrale Faktoren diskutiert: Training (B. Meier), Motivation (C. Stelzel), Stress (K. Schnitzspahn) und die Anwendung zukunftsorientierter Strategien (M. Altgassen). Neben Leistungsmaßen werden verschiedene neurowissenschaftliche Ansätze präsentiert, um die neurokognitiven Grundlagen intra- und interindividueller Unterschiede prospektiver Gedächtnisleistung zu beleuchten, sowie differentielle Aspekte auch in der Entwicklungsperspektive zu betrachten. Im Vordergrund steht dabei auch die Frage, inwiefern die verschiedenen Interventionen zu einem Wechsel in der Verarbeitungsstrategie führen und wie dieser quantifiziert werden kann. Gemeinsam weisen diese Studien zur Modulierbarkeit von prospektiver Gedächtnisleistung auf das Potenzial möglicher therapeutischer Interventionen hin.

Physiologische Grundlagen von prospektivem Gedächtnis: Von elektrodermalen Aktivität zu elektroenzephalen Signaturen

Meier, Beat

Universität Bern

Prospektives Gedächtnis bezeichnet die Fähigkeit eine Absicht zu formulieren, diese zu behalten und sich wie geplant bei einer angemessenen Gelegenheit daran zu erinnern. Prospektive Gedächtnisaufgaben unterscheiden sich darin, ob sie nur einmal ausgeführt werden (z.B. einen Brief bei der Post einzuwerfen; episodische Aufgabe) oder ob sie immer wieder ausgeführt werden (jeweils nach dem Frühstück ein Medikament einnehmen; habituelle Aufgabe). Während im Alltag episodische Aufgaben häufig vorkommen, werden in Laborstudien oft mehrere Abrufhinweise verwendet (z.B. immer wenn ein bestimmtes Wort vorkommt, eine bestimmte Taste drücken). In diesem Beitrag thematisiere ich Messmethoden zur Erfassung von

episodischem und habituellem prospektivem Gedächtnis, präsentiere Ergebnisse aus der eigenen Forschung mit EDA („electrodermal activity“) und ERP („event-related potentials“) und diskutiere ihre Relevanz zum Verständnis der neurokognitiven Mechanismen und der Messung individueller Unterschiede.

Motivationale Effekte auf prospektive Gedächtnisprozesse im medialen vs. lateralen Präfrontalcortex

Stelzel, Christine¹; Brüning, Jovita²; Ludwig, Vera U.¹; Paschke, Lena M.¹; Walter, Henrik²

¹Charité Berlin & Berlin School of Mind and Brain, ²Charité Berlin

Verhaltensstudien konnten eine verbesserte Leistung im Abruf prospektiver Intentionen in Abhängigkeit von der motivationalen Bedeutsamkeit der Intentionen zeigen. Mittels funktioneller Magnetresonanztomographie (n = 22) und einem Design, welches erlaubt, verschiedene Verarbeitungsphasen (Enkodierung, Aufrechterhaltung, Abruf) bei der Verarbeitung prospektiver Intentionen zu trennen, wurden die neuronalen Grundlagen von Effekten monetärer Anreize auf die prospektive Gedächtnisleistung untersucht.

Neben Effekten in aufgabenrelevanten Regionen im lateralen Präfrontalcortex (PFC) erwarteten wir Effekte in motivations-relatierten Regionen im medialen PFC.

Die ereignisbasierte prospektive Aufgabe wurde eingebettet in eine 1-zurück Aufgabe mit Wörtern. In der Hälfte der Blöcke wurde jede erfolgreich abgerufene Intention mit 10 ct belohnt. Im Vergleich zu Sequenzen, in denen ausschließlich die 1-zurück Aufgabe durchgeführt wurde, konnten in Abhängigkeit von der Verarbeitungsphase typische Aktivierungsmuster repliziert werden, wie bspw. erhöhte anterior präfrontale Aktivierung während der Aufrechterhaltung der Intention. Während Regionen im lateralen PFC einen unspezifischen Motivationseffekt zeigten, der unabhängig von der Präsenz einer prospektiven Intention war, konnte in der prä-supplementären Motorregion eine Modulation gezeigt werden, die spezifisch für Phasen war, in denen tatsächlich auch eine prospektive Intention verarbeitet werden musste. Dieser Interaktionseffekt zeigte sich ausschließlich in der Enkodierungsphase. Die Ergebnisse zeigen die Bedeutung der Enkodierungsphase und spezifischer medial präfrontaler Saliensignale für Motivationseffekte im prospektivem Gedächtnis.

Acute psychosocial stress impairs prospective memory in young, but not in older adults.

Schnitzspahn, Katharina M.¹; Plessow, Frankziska²; Kirschbaum, Clemens²; Kliegel, Matthias¹

¹University of Geneva, ²Technische Universität Dresden

Acute stress activates the hypothalamus pituitary adrenal axis resulting in the increased release of cortisol. If cortisol reaches the central nervous system, it influences multiple brain structures known to be associated with cognitive performance. Accordingly, acute psychosocial stress has been shown to impair declarative memory retrieval (Kuhlmann, Piel, & Wolf, 2005), working memory (Schoofs, Preuss, & Wolf, 2008) and cognitive control (Plessow, Schade, Kirschbaum, & Fischer, 2012) in young adults. So far, only very little empirical research is available concerning possible adult age differences in acute stress effects on cognition in general and cognitive control in particular. Accordingly, the present study set out to test these effects in a controlled laboratory setting comparing performance in a prospective memory task in 66 young (19-34 years) and 57 older adults (60-82 years) exposed either to an established psychosocial stress procedure (Kirschbaum, Pirke, & Hellhammer, 1993) or an active control condition (Het, Rohleder, Schoofs, Kirschbaum, & Wolf, 2009). Stress responses were measured on a fine-grained level across the entire procedure using subjective and physiological stress markers (i.e., cortisol, alpha-amylase). Results suggest that the stress induction was equally successful in both age groups. Interestingly, while prospective memory was reduced under stress in the young adults, cognitive performance in the older adults was not influenced by acute stress. This missing stress effect in the older adults may be due to more effective and cognitive less effortful emotion regulation and age-related changes in the frontal lobes possibly reducing the responsiveness to acute cortisol elevations.

Future thinking increases prospective memory performance in older adults

Altgassen, Mareike¹; Rendell, Peter G.²; Bernhard, Anka³; Henry, Julie D.⁴; Bailey, Phoebe E.⁵; Phillips, Louise H.⁶; Kliegel, Matthias⁷

¹Radboud University Nijmegen, Donders Institute for Brain, Cognition and Behaviour, Nijmegen & Technische Universität Dresden, ²Australia Catholic University, Melbourne, ³Technische Universität Dresden, ⁴University of Queensland, Australia, ⁵University of Western Sydney, ⁶Aberdeen University, ⁷University of Geneva

Efficient intention formation may increase prospective memory by reducing the need for resource-demanding strategic processes during the delayed performance interval. The present study set out to test this assumption and provides the first empirical assessment of whether imagining a future action improves prospective memory performance equivalently at different stages of the adult lifespan. Thus, younger (n = 40) and older (n = 40) adults were asked to complete the Dresden Breakfast task, a task with a string planning component, which required them to prepare breakfast in accordance with a set of rules and time restrictions. All participants first generated a plan for later enactment. After making this plan, half of the participants were asked to imagine themselves completing the task in the future (future thinking condition), while the other half received standard instructions (control condition). As expected, overall younger adults outperformed older adults. Moreover, both older and younger adults benefited equally from future thinking instructions, as reflected in a higher proportion of prospective memory responses and more accurate plan execution. Thus, for both younger and older adults, imagining the specific visual-spatial context in which the intention will later be executed may serve as an easy-to-implement strategy that enhances prospective memory function in everyday life.

Raum: PEG 1.G147

Symposium 1.5: Memory Development Across the Lifespan: Cognitive and Neural Dynamics

Vorsitz: Markus Werkle-Bergner & Yee Lee Shing

Max Planck Institute for Human Development

Memory functions undergo profound and continuous changes across the lifespan. Theoretical considerations and accumulating evidence suggest two interacting neuro-cognitive compounds that drive lifespan changes in memory: A MTL based system for the formation and retrieval of integrated representations, and a PFC centered system for control and selection mechanisms. An exhaustive understanding of dynamic links between cognitive and neural ontogenetic changes remains challenging, but important.

In the present symposium, five contributions explore the dynamic interplay between representational and control mechanisms in memory on cognitive and neural levels. The studies cover life periods from infancy to late adulthood and utilize a broad range of experimental paradigms and neuroimaging techniques, underscoring the need for a multi-modal perspective. Together, the talks exemplify advantages and challenges of a lifespan developmental neuroscience approach.

Infants' maintenance and integration of movement information during occlusion events

Bache, Cathleen

Max Planck Institute for Human Development

Infants perceive occluded movements as ongoing and coherent, however, little is known about the neural mechanisms that enable infants' processing of moving targets. Movement information need to be maintained during disappearance as well as integrated following reappearance of an object in order to experience a unitary percept. This suggests the contribution of attention- and memory-related processes. In order to test this assumption, 10-month-old infants watched briefly occluded movements of an abstract object. Prior to occlusion, continuous or distorted versions of the movement were shown. After occlusion, the movement was identical in both conditions, ensuring that differences between conditions could be attributed to differences in visual input prior to occlusion. EEG re-

cordings were used to assess neural activity assumed to relate to processes of attention (occipital alpha) and memory (frontal theta) before, during, and after occlusion. Oscillatory activity was analyzed using an individualized data approach taking idiosyncrasies into account. Results for occipital alpha show that the attentional demands were higher during tracking of distorted movement relative to continuous movement prior to occlusion. Further, differences in frontal theta activity indicated that the mnemonic load was higher for distorted movement before and after occlusion. Hence, memory processes contributed considerably to maintaining and integrating information on occluded movement. In sum, observing occluded movements recruits processes of attention and memory, which are modulated by movement properties. In future studies, occlusion paradigms may be explored as a potential infant version of delayed memory tasks commonly used in adults.

Mapping hippocampal subfield contributions to episodic memory development

Keresztes, Attila

Max Planck Institute for Human Development

The CA3 and the dentate gyrus (DG) subfields of the hippocampus (Hc), a brain region essential for episodic memory (Tulving, 1983), have been implicated in the orthogonalization of overlapping memory representations by implementing pattern separation on neural input to the Hc (Yassa & Stark, 2011). Investigating how pattern separation maps onto human episodic memory processes has proven challenging, because of the difficulties in disentangling Hc-related episodic memory processes in typical young adult samples, and the insufficient spatial resolution of standard functional imaging techniques to detect Hc subfield activity. To meet these challenges, using high-resolution functional magnetic resonance imaging (hrfMRI), we directly compared children and adults to investigate the dynamic relationship between pattern separation and episodic memory processes during their buildup. A sample of young adults and children (6-14y) performed an incidental learning task designed to assess pattern separation (Bakker et al., 2008) during acquisition of hrfMRI data. After scanning, a surprise recognition task assessed the contribution of episodic memory processes to recognition performance. In this talk, we present

analyses that characterize the developmental trajectory of pattern separation using behavioral and neural measures as indicated by functional activity in the CA3/DG activity. Furthermore, we examine the extent to which functional activity in the CA3/DG subfields predicts age-differential contribution of recollection and familiarity to recognition memory performance in children and young adults.

Cognitive control contributions to memory development: Exploring the neural basis of retrieval monitoring across the lifespan

Fandakova, Yana

University of California, Davis & Berkeley

The ability to flexibly monitor memory outcomes continues to develop during childhood and undergoes age-related decline. Evidence from two neuroimaging studies will be presented that examined age differences in the neural underpinnings of retrieval monitoring in children (Study 1) and older adults (Study 2).

Study 1 examined uncertainty monitoring and its role in memory development. Younger children (8-10 years), older children (10-12 years), and younger adults retrieved object-scene pairs during fMRI. Participants could select a 'Don't Know' (DK) answer if they were uncertain about which scene had been studied with a target object. In all groups, DK responses were associated with increased activation in anterior insular and prefrontal (PFC) areas. The insula was recruited for both incorrect source and DK decisions, whereas the PFC was recruited specifically when participants withheld a source response. Stronger insular engagement for unsuccessful retrieval predicted memory improvement in children 9 to 24 months later, underscoring the role of uncertainty monitoring for memory development.

Study 2 examined individual differences in the modulation of mnemonic control by the quality of memory representations. Younger and older adults (65-75 years) performed an associative recognition test during fMRI. The intact and rearranged pairs were either correctly remembered or not remembered in an initial learning phase a day earlier. Modulatory effects of representation quality on frontal and occipital activations were more pronounced in younger than in older adults, indicating that the ability to adjust control mechanisms to differences in representation quality declines in later adulthood.

Alpha power modulations as a mechanism of memory formation in younger and older adults

Sander, Myriam C.

Max Planck Institute for Human Development

Current research highlights the role of synchronized rhythmic neural patterns in the alpha band for efficient memory functioning. However, not much is known about the degree to which differences in oscillatory mechanisms underlie episodic memory decline in older adults. We recorded EEG in 24 younger and 24 older adults who acquired scene-word pairs across several learning and recall cycles. By modifying the standard subsequent memory paradigm through repeated exposure and age-adapted learning set sizes, we were able to calibrate task difficulty across age groups, and closely monitor the learning history of each individual. In line with earlier results, we found that decreased alpha activity (8 - 12 Hz) supports successful encoding of episodes in young adults. In addition, alpha power differences during initial encoding were not only predictive of immediate subsequent memory performance, but even revealed more subtle differences in memory strength predicting the item's future successful learning. In older adults, we also observed reliable differences in alpha power between later remembered and later forgotten items. In addition to alpha power modulations within subjects being related to subsequent memory, inter-individual differences in overall alpha power during encoding were negatively related to performance in younger adults, revealing a stable learning advantage for individuals with low alpha power. However, in older adults, we observed the inverse pattern, suggesting that in the elderly lower overall alpha power rather indicates decline in cognitive performance. The present findings indicate that oscillatory neural mechanisms predicting successful memory formation operate similarly in younger and older adults.

Dynamics of schema effects on episodic memory during child development and intensive learning

Shing, Yee Lee

Max Planck Institute for Human Development

Recent neuroimaging studies suggest that the effects of schemas on memory reflect a relative shift from processing in the medial temporal lobes (MTL) towards proces-

sing in the medial prefrontal cortex (mPFC). The former involves arbitrary associations, while the latter involves operation of information in relation to a pre-existing schema represented in cortical areas. We test these hypotheses by examining the emerging effects of knowledge on memory through child development (Study 1) and intensive learning (Study 2) with fMRI.

In Study 1, we used a novel experimental paradigm in which task-relevant knowledge was experimentally induced to circumvent the collinearity between age and availability of knowledge. A hierarchy, which served as the schema, was established to the same level in children of age 8-11 and younger adults. Participants had to remember events that were either congruent or incongruent with the learned hierarchy. For successfully remembered schema-congruent events, we observed stronger mPFC activity in the young adults compared to the children, as well as a correlation between children's age and mPFC activity. These results suggest that the role of the mPFC for guiding schema-congruent memory retrieval is developing across middle childhood,

In Study 2, a sample of medical students who prepared for the state examination was scanned three months prior to (T1) and immediately after (T2) the examination. For successful encoding of face-diagnosis pairs, we found a decrease in hippocampal activation from T1 to T2. Our results suggest a relative decrease in the importance of hippocampus for memory formation with the increase of knowledge induced by intensive learning.

Raum: Festsaal 1

Symposium 2.1: Data Blitz Session

Vorsitz: Gordon Feldt, Andrea Hermann, Christian Merz, Sarah Weigelt

Talk 1: Neural correlates of building a spatial representation in a complex virtual environment

Brodts, Svenja

Eberhard Karls Universität Tübingen

Talk 2: Autonomic hyperarousal and enhanced reactivity during physical stress in children with social anxiety disorder: a home based ecological study

Asbrand, Julia

Albert-Ludwigs-Universität Freiburg

Talk 3: Olfaction and Social Interaction – Physiological Responses in a Virtual Environment

Flohr, Elena

Julius-Maximilians-Universität Würzburg

Talk 4: Intention to encode boosts memory-related pre-stimulus EEG beta power

Schneider, Signe Luisa

Universitätsklinikum Hamburg-Eppendorf

Talk 5: Down-regulation of the amygdala with real-time fMRI neurofeedback

Paret, Christian

Zentralinstitut für Seelische Gesundheit, Mannheim

Talk 6: Sleep integrates representations across multiple memory systems

Schönauer, Monika

Eberhard Karls Universität Tübingen

Talk 7: Singing in the brain: activation in right anterior insula modulates sensory feedback integration as a function of vocal expertise in trained and untrained singers

Kleber, Boris

Eberhard Karls Universität Tübingen

Talk 8: Necessity of group- and single-subject-level reliability in fMRI lateralization studies

Herholz, Peer

Philipps-Universität Marburg

Talk 9: Abnormally increased attentional allocation under uncertainty in obsessive-compulsive disorder (OCD) as revealed by temporospatial principal component analysis (PCA)

Dieterich, Raoul

Humboldt-Universität zu Berlin

Raum: 1.802

Symposium 2.2: Multisensory Plasticity and its Neurocognitive Basis

Vorsitz: Marcus J. Naumer¹ & Jason S. Chan²

¹Goethe-Universität, ²University College Cork

We experience the world around us using multiple senses in parallel. The effective integration of multisensory information is beneficial for our survival, health, and success. The neurocognitive mechanisms underlying such integrative processing are subject to plastic changes throughout our lives reflecting individual development, training, and experience. In our symposium, five speakers (from labs in Switzerland, The Netherlands, Germany, the U.S., and Ireland) will present their most recent MEG and MRI research on diverse aspects of this fascinating topic. The addressed issues range from training-induced changes in (emotional) perception and effects of handedness to the influence of second language ability and aging-related plastic changes in older adults.

The impact of valence on neural audiovisual object processing

Hein, Grit

Universität Zürich

The processing of audiovisual information is a critical aspect in common object recognition since many everyday life situations consist of object-related visual and auditory information. There is also evidence that emotional dimensions may play a role in audiovisual integration. However, this evidence mainly stems from research on social stimuli such as faces and voices. The aim of the present study was to investigate the influence of evaluative conditioning on the processing of non-social material such as artificial audiovisual objects. We used functional magnetic resonance imaging to analyze changes in cortical audiovisual processing of unfamiliar artificial objects and sounds in naive subjects (Pre fMRI) and after a behavioral evaluative conditioning session in which subjects acquired positive and negative emotional associations with the artificial stimuli (Post fMRI). Results from the Post fMRI showed that additional brain regions were recruited for the processing of positively and negatively conditioned stimuli compared to the Pre fMRI data. The processing of positive stimuli

li additionally involved the left caudate nucleus and the right medial prefrontal cortex whereas the processing of negative stimuli additionally recruited the left insula. In further analyses we tested how valence shapes the connectivity between multisensory integration regions and brain regions involved in emotion processing. In my talk I will discuss these findings and their implications for the neural plasticity of audiovisual object recognition.

Multisensory Perceptual Learning Enhances Top-Down Information Processing

Theves, Stephanie

Radboud Universiteit, Nijmegen

Multisensory integration strongly depends on the temporal proximity between two inputs. In the audio-visual domain, stimulus pairs with delays up to a few hundred milliseconds can still be perceived as simultaneous and integrated into a unified percept. The size of this temporal window of integration can be significantly narrowed by feedback-guided training on an audio-visual simultaneity judgment task (Powers et al., 2009, 2012). Yet it remained uncertain how the neural network that processes audiovisual asynchronies is affected by the training. In this study, participants were trained on a 2-IFC audiovisual simultaneity judgment task. Their neural activity was recorded in response to three different stimulus onset asynchronies (0 ms, individual window, 300 ms) before, and one-day following training, using MEG. There was an increase in beta (β)-band activity (12-30 Hz) in the post-training compared to pre-training session over the course of 80 to 410 ms post-stimulus onset. This increase appeared only in the asynchronous SOA-conditions where participants also improved their performance (300 ms, individual window). Considering the role of β -oscillations in carrying feedback from higher to lower cortical areas, this finding might suggest that enhanced top-down modulation of sensory processing is responsible for the improved temporal acuity after training. As β -oscillations can be assumed to preferentially support neural communication over longer conduction delays (Bibbig et al., 2002; Kopell et al., 1999), the widespread topography of our effect over central, parietal and temporal sensors suggests that training modulates not only processing within primary sensory areas, but communication within a large-scale network.

Enhanced visuo-haptic integration for the non-dominant hand

Yalachkov, Yavor

Goethe-Universität Frankfurt am Main

Visuo-haptic integration contributes essentially to object shape recognition. Although there has been a considerable advance in elucidating the neural underpinnings of multisensory perception, it is still unclear whether seeing an object and exploring it with the dominant hand elicits the same brain response as compared to the non-dominant hand. Using fMRI to measure brain activation in right-handed participants, we found that for both left- and right-hand stimulation the left lateral occipital complex (LOC) and anterior cerebellum (aCER) were involved in visuo-haptic integration of familiar objects. These two brain regions were then further investigated in another study, where unfamiliar, novel objects were presented to a different group of right-handers. Here the left LOC and aCER were more strongly activated by bimodal than unimodal stimuli only when the left but not the right hand was used. A direct comparison indicated that the multisensory gain of the fMRI activation was significantly higher for the left than the right hand. These findings are in line with the principle of “inverse effectiveness”, implying that processing of bimodally presented stimuli is particularly enhanced when the unimodal stimuli are weak. This applies also when right-handed subjects see and simultaneously touch unfamiliar objects with their non-dominant left hand. Thus, the fMRI signal in the left LOC and aCER induced by visuo-haptic stimulation depends on the hand employed for haptic exploration which demonstrates how sensorimotor experience and neuroplasticity might interact with multisensory integration.

Acquisition of active and passive second language ability is associated with structural changes of white matter: multi-modal pattern analysis

van den Bosch, Jasper J. F.

University of Washington

Real world language production and comprehension is inherently multisensory. It involves a number of different brain systems that interact, and therefore critically depends on connections. Acquiring a second language should therefore affect such connections. We sought to in-

investigate where in the brain such structural changes occur and what combination of measures best describes these changes. We collected diffusion weighted and structural MRI scans from 16 monolingual and 16 bilingual subjects. Their language abilities were registered using a range of questionnaires. The data was analysed such that we obtained the following modalities; Voxel-based morphometry (VBM), fractional anisotropy (FA), axial diffusivity (AD), radial diffusivity (RD), mean diffusivity (MD), and Mode (MO). We found that individual subject's exposure to the second language was associated with different measures. For instance, bilinguals have lower FA (FWE corrected, $p < .05$) than monolinguals in the arcuate fasciculus and inferior longitudinal fasciculus. Going beyond examining each of these modalities by itself, we constructed a multivariate pattern combining all of them for each voxel. This multi-modal pattern (MMPA) was then used to attempt classification and prediction of language skills. This analysis shows where individual differences in brain structure are most informative of language ability.

Increased β -activity in Older Adults Predicts a wider temporal binding window

Chan, Jason S.

University College Cork

Older adults are more likely to combine information from the different sensory modalities. However, it has been demonstrated that they combine this information in a less efficient manner. Older adults will integrate more sensory stimuli, over a longer period of time, compared to younger adults. To date, it is not yet understood the neural underpinning behind this wider temporal binding window. In this study, young and older adults experienced the sound-induced flash illusion (SiFi). The SiFi is a multisensory illusion where two auditory beeps are presented with a single visual flash. If the SOA between the beeps is short, participants tend to perceive two flashes. Replicating previous studies, older adults experienced more illusions at longer SOAs compared young adults. Using MEG we found that older adults have increased beta (β)-band activity compared to young adults. However, no difference in activity was found between illusion and non-illusion trials; suggesting the effect of age cannot be separated from the illusion percept. Using transfer entropy neural modelling, we were able to identify a complex network of brain

areas involved in the task; such as: the primary visual and auditory regions, bilateral fusiform, right middle frontal gyrus, and right middle temporal cortex. This network of brain areas was further refined and verified using dynamic causal modeling. Older and young adults use the same network to perform the task. However, the modulations of various links determine the amount of perceived illusions. In line with the theory of predictive coding, older adults enhance their 'template' of the world throughout their lives, which results in enhanced audiovisual binding of sensory events.

Raum: 1.811

Symposium 2.3: Die zeitliche Dynamik willentlicher Emotionsregulation – Eine Betrachtung kurz-, mittel- und langfristiger Nacheffekte

Vorsitz: Denise Dörfel

Technische Universität Dresden, Fachrichtung Psychologie, Arbeits- und Organisationspsychologie

Willentliche Emotionsregulation hängt mit einer Aktivierung präfrontal-parietaler Kontroll-Areale sowie einer Deaktivierung emotionsgenerierender Regionen, wie der Amygdala und der Insula zusammen. Ein tieferes Verständnis darüber, wie Emotionen kontrolliert werden, gewinnt man jedoch durch eine Betrachtung des zeitlichen Ablaufs neuronaler Prozesse. Dafür hat sich neben der Analyse des zeitlichen Verlaufs der BOLD-Response im fMRT, das Late Positive Potential (LPP) des EEGs bewährt, welches auf die Verarbeitung emotionaler Reize hinweist und durch Emotionsregulation verändert wird. In diesem Symposium werden neueste Studien über die zeitliche Dynamik der Emotionsregulation vorgestellt. Sie beschäftigen sich mit kurzfristigen (Dörfel et al., Diers et al.), mittelfristigen (Paul et al.), sowie langfristigen (Kress et al.) Nacheffekten der Emotionsregulation unter Nutzung der BOLD-Response und des LPP und behandeln und vergleichen dabei verschiedene Strategien der Emotionsregulation.

Zeitlich unterschiedliche Verläufe der BOLD-Response bei kognitiver Emotionsregulation

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Kognitive Emotionsregulation ist keine einheitliche Funktion, sondern setzt sich wahrscheinlich aus mehreren gleichzeitig und sequenziell ablaufenden Prozessen zusammen. Übereinstimmend mit dieser Annahme konnten in neueren Studien unterschiedliche regulationsbezogene Aktivierungsmuster in verschiedenen Regionen des Gehirns nachgewiesen werden. Daran anknüpfend sollten in dieser Studie die bisher in geringerem Ausmaß untersuchten Verläufe dieser Aktivierung über eine längere Zeitspanne untersucht werden. Im Rahmen einer fMRT-Mes-

sung setzten wir dazu ein langsames event-related Design ein. Die Probanden waren einerseits aufgefordert, eine Variante kognitiven Reappraisals zu realisieren, d.h. sich gedanklich von neutralen und negativen Bildern zu distanzieren („detach“-Bedingung); andererseits waren sie im Rahmen einer aktiven Kontrollbedingung gebeten, jegliche Gefühle zuzulassen („permit“-Bedingung), die durch diese Stimuli hervorgerufen wurden. Wir beobachteten eine allgemein erhöhte frontale und parietale Aktivierung während der Regulations-Bedingung im Vergleich zur Zulassen-Bedingung. Im Gegenzug lag nach negativen Stimuli eine verringerte Aktivierung der Amygdala unter der „detach“-Bedingung im Vergleich zur „permit“-Bedingung vor. Dieses Muster kehrte sich jedoch zu späteren Zeitpunkten um: Nach Ende der Stimuluspräsentations- und Regulationsphase war nach negativen Bildern eine erhöhte Aktivierung der Amygdala in Regulations-Trials im Vergleich zu Zulassen-Trials zu beobachten. Die Ergebnisse unterstreichen die Bedeutung des zeitlichen Aspekts für die Untersuchung der Emotionsregulation, deren zeitliche Dynamik bisher nur teilweise verstanden ist.

Zeitlicher Verlauf der Amygdala-Aktivierung während und nach willentlicher Emotionsregulation – Vergleich der Strategien Distanzieren, Uminterpretieren, Unterdrücken des Emotionsausdrucks und Ablenken

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Willentliche Emotionsregulation führt zur Verringerung der Aktivität in emotionsassoziierten Hirnregionen. Frühere Studien zeigten, dass nach Verringerung der Amygdala-Aktivität durch Reappraisal (Distanzieren), die Aktivität in dieser Hirnstruktur wieder anstieg (Rebound). Während erneuter Präsentation der Stimuli einige Minuten später, war der Emotionsregulationseffekt in der Amygdala jedoch noch sichtbar. Verschiedene Strategien sind unterschiedlich effektiv. Weisen verschiedene Strategien also auch einen unterschiedlichen Zeitverlauf in emotionsassoziierten Hirnarealen auf? Wir analysierten 4 Strategien der Emotionsregulation hinsichtlich des

zeitlichen Verlaufs der Amygdala -Aktivität. In einem between-subject design (Distanzieren N=17, Uminterpretieren N=19, Unterdrücken N=22, Ablenken N=16), sahen die Probanden während der fMRT-Messung negative und neutrale Bilder und sollten entweder ihre Emotionen zulassen oder, je nach instruierter Strategie, zu regulieren. Während Distanzieren, Unterdrücken und Ablenken die Amygdala-Aktivität verringerte, zeigte Uminterpretieren keine Unterdrückung der Amygdala-Aktivität. Einen Rebound in der Amygdala konnten wir signifikant für Distanzieren (auch in einer weiteren Studie mit 114 Probanden) und für Ablenken nachweisen, für Neubewerten und Unterdrücken wurde dieser Effekt nicht signifikant. Einen mittelfristigen Regulationseffekt nach erneuter Stimulus-Präsentation konnten wir nicht replizieren. Verschiedene Strategien zeigen also unterschiedliche zeitliche Dynamiken im Verlauf der Hirnaktivität, welche möglicherweise auch für die Unterschiede in der erlebten Effektivität verantwortlich sein könnten.

Zeitliche Dynamik und die Folgen von Ablenkung als Strategie der Emotionsregulation

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Das späte positive Potential (LPP) spiegelt die verstärkte Verarbeitung emotionaler Reize wider und ist durch die Anwendung von Emotionsregulationsstrategien modulierbar. Das Prozessmodell der Emotionsregulation (Gross, 1998) nimmt an, dass eine Ablenkung der Aufmerksamkeit die Emotionsentstehung zu einem frühen Zeitpunkt hemmt, wohingegen eine kognitive Umdeutung aufgrund vorangehender inhaltlicher Analyse später einsetzt. Entsprechend dieser Annahmen konnten wir zeigen, dass Ablenken bei der Betrachtung negativer Bilder zu einer früheren LPP-Amplitudenreduktion führte als Umdeuten (Paul et al., 2013). In einer aktuellen Studie untersuchten wir, welche Auswirkungen Ablenken hat, wenn man erneut mit demselben Reiz konfrontiert wird. Hierzu präsentierten wir 35 Probanden neutrale und negative Bilder. Bei der Hälfte der negativen Bilder wurden die Probanden instruiert, diese aufmerksam zu betrachten und aufkommende Gefühle zuzulassen. Bei der anderen Hälfte sollten sie sich kognitiv ablenken. Diese Stimulus-Instruktions-Paarung wurde in 3 Blöcken wiederholt.

Nach 10 Minuten wurden die Bilder in einem 4. Block nochmal präsentiert. Hierbei sollten nun alle Bilder aufmerksam betrachtet werden. Die Ergebnisse zeigen eine Abnahme der LPP-Amplituden über die ersten 3 Blöcke hinweg, wenn Probanden die Bilder betrachteten, nicht aber, wenn sie sich ablenkten. Im 4. Block zeigen sich größere LPP-Amplituden in Reaktion auf negative Bilder, von denen sich Probanden zuvor abgelenkt hatten im Vergleich zu Bildern, die aufmerksam betrachtet wurden. Dies deutet darauf hin, dass die Strategie der Ablenkung Habituationsprozesse hemmt und bei späterer, erneuter Reizkonfrontation mit einer verstärkten Aufmerksamkeitsallokation einhergeht.

Überdauernde Effekte von Emotionsregulation: eine fMRT-Studie

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Kognitive Strategien zur Emotionsregulation sind ein wichtiger Bestandteil der kognitiven Verhaltenstherapie. In zahlreichen Studien konnte gezeigt werden, dass kognitive Kontrolle in emotionalen Situationen kurzfristig zu verringertem negativen Affekt führt. Bislang ist allerdings kaum erforscht worden, wie sich die überdauernden Effekte von Emotionsregulation auf das emotionale Erleben und dessen neuronale Korrelate auswirken. Die vorliegende funktionelle Magnetresonanztomographie-Studie untersuchte an einer Stichprobe von 27 gesunden Frauen die kurz- sowie langfristigen Effekte von kognitiver Neubewertung und Distraction. Die Studienteilnehmerinnen wurden am ersten Tag der Untersuchung instruiert, ihre negativen Gefühle durch kognitive Neubewertung entweder zu verstärken oder zu verringern, sich abzulenken, oder aversive und neutrale Szenenbilder passiv zu betrachten. Um die überdauernden Effekte von Emotionsregulation zu untersuchen, erfolgte einen Tag später erneut eine Präsentation derselben Stimuli ohne Instruktion. Die Verringerung negativer Emotionen durch kognitive Neubewertung führte langfristig zu geringeren negativen Gefühlen im Vergleich zu Distraction und verstärkter Aktivierung des lateralen präfrontalen Kortex. Gleichzeitig ging der langfristige Regulationserfolg durch kognitive Neubewertung mit erhöhter Aktivierung des ventromedialen präfrontalen Kortex einher. Dieses Ergebnis deutet

darauf hin, dass Distraction langfristig möglicherweise nachteilige Effekte hat und kann somit wichtige Implikationen für Interventionen in der kognitiven Verhaltenstherapie aufzeigen. Stichworte: Emotionsregulation, Gedächtnis, kognitive Kontrolle, Lernen, fMRT

Raum: 1.812

Symposium 2.4: Neural Mechanisms of Social Understanding: From Gaze Following to Empathy and Theory of Mind

Vorsitz: Philipp Kanske & Anne Böckler

Max Planck Institute for Human Cognitive and Brain Sciences

Understanding others is an essential prerequisite for successful social interactions. This symposium will elucidate the neural mechanisms that contribute to the effective understanding of our conspecifics, ranging from basic (e.g., gaze processing) to higher-level social cognition (e.g., Theory of Mind (ToM)). The first two presentations study the processing of truly interactive (Schilbach) and observed gaze (Böckler) interactions in adults as well as in development and psychopathology. The next two presentations study the relation of ToM to perceptual and affective processes of social cognition, such as visual perspective taking (Schurz et al.) and empathy (Kanske et al.). Impairments of ToM, as an endophenotype for schizophrenia and bipolar disorder, are described in the final presentation (Mohnke & Walter).

Eyes only? Effects of observing shared attention on gaze following

Böckler, Anne

Max Planck Institute for Human Cognitive and Brain Sciences

Humans are highly sensitive to information provided by others' eyes. Indeed, attention is rapidly shifted according to others' gaze direction (i.e., 'gaze following') and information processing is boosted when provided by faces establishing eye contact (i.e., 'eye contact effect'). Linking these findings, previous research suggests that gaze following is enhanced after eye contact had been established.

The present set of studies investigated whether and how gaze following is modulated when eye contact is merely observed between others. Participants saw two faces that were either looking at each other or away from each other before jointly shifting gaze towards one of two target locations. Targets either appeared at the gazed at (congruent) or the non-gazed (incongruent) at location. This experiment was completed by neuro-typical adults, by adults diagnosed with high-functioning autism (HFA), and by 12 month old infants.

Results revealed that gaze following (faster responses to congruent versus incongruent trials) was enhanced after observing eye contact (as opposed to averted gaze) in healthy adults. While this effect was absent in participants with HFA, neuro-typical infants already showed sensitivity for observed eye contact. Results from an fMRI study employing the same paradigm revealed enhanced activation in fronto-parietal and temporal areas in congruent trials when faces had previously looked at each other (versus away from each other). Taken together, our results suggest that neuro-typical, but not HFA participants may have processed observed eye-contact as a signal pointing towards the importance of subsequent (gaze) behavior, thereby enhancing the processing of the directional gaze cues.

It's in your eyes: Novel approaches to study the neural mechanisms of gaze-based social interactions

Schilbach, Leonhard
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The gaze of others fascinates us from birth onwards. Traditionally, experimental approaches to study the effects of gaze have focused on how human observers respond to gaze cues and how attention, perception and action control is influenced by them. In recent years, the investigation of gaze behavior has moved towards the inclusion of more ecologically valid conditions, in which gaze signals are exchanged as part of reciprocal social interactions. Such an ‚interactive turn‘ is beginning to yield new insights into the neural mechanisms of gaze behavior as they unfold in real life, which may also be informative for an understanding of the biobehavioral correlates of psychiatric disorders, which are often characterized by impairments of social interaction.

Discovering the neural link between theory of mind and visual perspective taking: Issues of spontaneity and domain-specificity

Schurz, Matthias; Kronbichler, Martin; Weissengruber, Sebastian; Surtees, Andrew; Samson, Dana; Perner, Josef
University of Salzburg

Being able to adopt another's visual perspective is a basic element of human social cognition. It reflects our com-

petence to ascribe a form of mental states - perceptions - to other people. In an imaging meta-analysis of Theory of Mind (ToM) studies, we showed that different forms of mental state reasoning (e.g., about beliefs, action goals or personality traits) activate a common set of core-areas (Schurz et al., 2014) including right TPJ and mPFC. When comparing that to a meta-analysis of Visual Perspective Taking (VPT) studies (Schurz et al., 2013), however, little overlap was found. Most intriguingly, no overlap was found in core areas for ToM. In two fMRI studies, we sought to close this gap between VPT and ToM research. In study 1 we found that the right TPJ and the mPFC are spontaneously processing the other's perspective during self-perspective judgments. We argue that this has usually been washed out in previous VPT studies which only contrasted other versus self-perspective judgments. Furthermore, we compared activations for an avatar to directional control objects (arrow, lamp) to show that right TPJ and mPFC activations are domain-specific. In study 2 (ongoing work), we compared spontaneous activations for level 1 versus level 2 VPT, in order to find the characteristics of the processing limit of spontaneous / implicit perspective taking.

Affective and cognitive mechanisms of understanding other: Independence and interactions of empathy, compassion and Theory of Mind

Kanske, Philipp; Böckler, Anne; Trautwein, Fynn-Mathis; Singer, Tania

Max Planck Institute for Human Cognitive and Brain Sciences

Social neuroscience has identified different neural networks, a more affective (empathy and compassion) and a more cognitive route (Theory of Mind (ToM)), to the understanding of others. While the anterior insula (AI) is critically involved when empathizing with the pain of another person, experiencing compassion for another's suffering activates a different network including the ventral striatum. ToM tasks, in contrast, engage the temporoparietal junction (TPJ), temporal poles (TP) and medial prefrontal cortex (MPFC). The separability and interrelations of these two capacities and their related neural networks is, however, little understood.

We, therefore, developed a novel task, the EmpaToM. Participants are presented with naturalistic video stimuli in which people recount autobiographical episodes that are

either emotional or neutral. Each video is followed by empathy and compassion ratings and questions about the content of the video that probe ToM.

Emotional vs. neutral videos increased activity in bilateral AI, which parametrically modulated with subjective empathy ratings. Compassion ratings, in contrast, covaried with activity in the ventral striatum. ToM activated bilateral TPJ, TP and MPFC. These two networks interact during the online understanding of others. However, inter-individual differences in the activity of these networks were uncorrelated, suggesting some independence, such that strong empathizers are not (necessarily) good mentalizers. Separate training of these capacities within the longitudinal ReSource study has differential enhancing effects on ToM performance and compassion, providing some first evidence that we can induce plasticity in socio-affective and socio-cognitive capacities.

Theory of Mind Alterations: An Intermediate Phenotype of Psychosis?

Mohnke, Sebastian; Walter, Henrik

Charité – Universitätsmedizin Berlin

Clinical studies concordantly demonstrate that Theory of Mind (ToM), the ability to understand mental states of others, is compromised in patients suffering from schizophrenia and bipolar disorders. In line with this, neuroimaging studies show aberrant activity of brain regions counting to the ToM network (the medial prefrontal cortex, temporoparietal junction and the posterior cingulate cortex / precuneus). Since deficits are observable also during remission, prodromal states, as well as in non-affected relatives, there is reason for the assumption that ToM abnormalities might represent an intermediate phenotype of psychosis, especially in light of high heritability estimates of schizophrenia and bipolar disorder. Imaging genetics studies support this hypothesis. In two independent samples of controls without familial liability for schizophrenia or bipolar disorder a genome-wide supported risk variant for both disorders in the gene ZNF804A affected activity and connectivity of core ToM areas. Comparable effects are also reported in studies investigating healthy first-degree relatives of patients. These results provide evidence for the notion that one mechanism by which the genetic architecture might increase risk for psychosis is by affecting Theory of Mind processing and its neural correlates.

Raum: PEG 1.G147

Symposium 2.5: The left ventral occipito-temporal cortex in reading: a focal point of the current debate

Vorsitz: Fabio Richlan

Universität Salzburg

The left ventral occipito-temporal cortex (vOT) hosts the putative Visual Word Form Area (VWFA) and undoubtedly plays an important role in skilled reading. Its exact function, however, is still the subject of considerable debate. In this symposium we provide novel perspectives on the role of the left vOT during reading.

These novel perspectives include (1) functional imaging studies using different modalities (visual/auditory) aiming at bottom-up vs. top-down recruitment of left vOT cortex, (2) modulation of left vOT activation by language and task demands and inter-subject variability in bilingual speakers, (3) learning-induced changes in left vOT response and development of word representations, (4) development of left vOT function and influence from other brain regions during reading acquisition in typically developing and dyslexic children, and (5) plasticity of functional reading networks in the rehabilitation of patients who suffer from pure alexia following left vOT lesions.

Top-down recruitment of orthographic whole-word codes in left posterior vOT

Ludersdorfer, Philipp; Kronbichler, Martin; Wimmer, Heinz

Universität Salzburg

In two fMRI studies we investigated the hypothesis that the left ventral occipito-temporal cortex (vOT) hosts neuronal representations tuned to whole written words. This assumption is based on cognitive dual-route theories of reading which postulate abstract representations of the visual word form of all known words (i.e., an orthographic word lexicon). Instead of reading or reading-based tasks we relied on orthographic tasks with spoken input in which participants had to access the visual word form of auditory words. In the first study we used a spelling task in which participants had to indicate if a visually presented letter was included in a spoken word. We found that left vOT was the only brain region activated for a word

spelling condition (in which correct decisions had to be based on orthographic whole-word codes) relative to a pseudoword spelling condition (in which correct decisions had to be based on sublexical processes since no whole-word codes exist for pseudowords). In the second study we investigated whether the word > pseudoword activation pattern in left vOT could indeed be related to the recruitment of orthographic whole-word representations and not to the activation of lexical-semantic representations which also exist for words but not pseudowords. To this end, we contrasted lexical orthographic processing with semantic processing of auditory words. The results showed higher activation in left posterior vOT for the orthographic compared to the semantic task. In addition, semantic activation did not differ from an auditory baseline. Taken together, our results strongly support the position that the left posterior vOT is involved in orthographic whole-word coding.

Neural modulation of the left vOT in bilingual reading

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Neuroimaging evidence has underscored the key role of the left ventral occipitotemporal cortex (vOT) in reading. However, important debates exist about its involvement in orthographic and non-orthographic processes and the impact of the inter-subject variability in its location may had in prior findings. Theoretical accounts suggest that vOT is mostly involved in prelexical computation of visual word forms, while others consider that its activation depends on the integration of bottom-up sensory inputs with top-down connections. Here, we will present data from two fMRI studies examining the vOT activation profile and its connectivity with other regions along the ventral and dorsal reading networks, as a function of reading in L1 (first language) or L2 (second language), task demands (perceptual, semantic), and language orthography of the L2 (opaque, transparent). A total of 54 native Spanish-speaking early and late bilinguals (Study 1), and late bilinguals who either have an opaque (English) or a transparent (Basque) L2 (Study 2) participated. Our results showed, across different localization strategies, that vOT activation was modulated by language and task effects. This region was more strongly engaged for words in L2 vs L1, and for

the semantic than the perceptual task. Moreover, connectivity analysis revealed stronger vOT coactivation with regions within the ventral network during the semantic task. Finally, regions along the dorsal network showed a more phonological pattern, being more strongly engaged by late than early bilinguals and by participants with a transparent vs opaque L2. These findings constitute the strongest evidence so far of the modulation of vOT by language and task demands in bilingual reading.

How auditory experience shapes visual word recognition in left ventral occipito-temporal cortex

Gagl, Benjamin; Fiebach, Christian; Hutzler, Florian; Richlan, Fabio

Goethe-Universität Frankfurt am Main

In the present Study, we used a pseudoword-learning paradigm to investigate the influence of auditory familiarity on the processes in the left ventral occipito-temporal cortex (lvOT) during visual word recognition. The lvOT is a candidate region for orthographic processing and the integration of visual and auditory word information. In the pseudoword learning tasks one group of pseudowords was familiarized by auditory presentation and a second group by visual presentation before a brain response was recorded. These learned pseudowords were contrasted to unfamiliar novel pseudowords. Auditory learned words are familiar but the visual information of these pseudowords was not familiarized. Visually learned words were familiar and the integration of visual and auditory information was also trained. fMRI data showed a reduced brain activation in lvOT of both groups of learned pseudowords in contrast to novel pseudowords suggesting that only the familiarity of the pseudowords was reflected in lvOT processing. In contrast EEG data over left posterior electrodes indicated an early reduction of activation for the visually learned pseudowords and a later reduction of activation for the auditory learned pseudowords, which was also present in left frontal sites. Therefore the EEG data suggests that the training of the integration of visual and auditory information leads to early and focal processing at left posterior sites. In contrast, when the visual information for a familiar pseudoword is recognized the first time the distributed activations might reflect the first integration of the new visual information with the familiar auditory information.

Beyond the ventral visual stream: a dorsal visual stream deficit in dyslexic children

Boros, Marianna; Anton, Jean-Luc; Pech, Catherine; Grainger, Jonathan; Ziegler, Johannes C.; Szwed, Marcin
Jagiellonian University, Krakow

Several imaging studies on reading impairment in dyslexia have revealed an underactivation of the ventral occipito-temporal cortex in dyslexic participants. This part of the ventral visual stream hosts the Visual Word Form Area (VWFA), a region associated with fast, effortless reading. However, most previous studies of dyslexia were either carried out on adult dyslexics or used reading tasks. Given that fluent reading is severely impaired in dyslexia, the underactivation in the VWFA might simply reflect the well-established reading deficit in impaired readers and could be the consequence rather than the cause of dyslexia. To overcome the shortcomings of previous studies, we designed a task that doesn't rely on reading per se. In our fMRI study we asked children with dyslexia between the age of 8 and 12 to search for letters, digits, and symbols in 5-element strings of each type, a task highly relevant for reading. We found that in addition to significant group differences in the VWFA, dyslexic children showed a serious underactivation of the middle occipital gyrus (MOG) relative to control group. The MOG lays in the dorsal visual stream, known for its engagement in spatial processing, and the MOG was also proposed to be necessary for ordering the symbols in unfamiliar strings. Our results suggest that the VWFA deficit might be secondary to an impairment of visuospatial processing in the MOG. Thus we argue that MOG activity at the reading acquisition stage is critical for the development of effortless fast visual word recognition in the VWFA.

Reading front to back: Investigating the effects of reading rehabilitation on the reading network in pure alexia

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Pure alexia is an acquired word reading deficit in the absence of other language impairments, which is largely resistant to rehabilitation. Pure alexia is typically caused by left posterior cerebral artery stroke and is particularly as-

sociated with damage to the left ventral occipitotemporal cortex (the putative 'Visual Word Form Area').

This study looked at the role of the ventral occipitotemporal (vOT) cortex within the context of the reading network in 8 patients with pure alexia. Specifically, we investigated how intensive word reading training affected the connectivity of the intact (perilesional) vOT cortex. Patients received magnetoencephalography (MEG) scans immediately after a 6-week period of reading training. The MEG data were analysed using Dynamic Causal Modelling for Evoked Responses. This approach investigated the effective connectivity within the reading network within the first few hundred milliseconds of word processing, a critical time window for efficient orthographic processing in healthy controls, as indexed by the M170.

The DCM analysis revealed significant differences in network connectivity for trained relative to untrained words. Both forward and backward connections between the left occipital (visual) cortex and left vOT were stronger for trained and untrained words, consistent with stronger interactive processing of trained words along the left ventral visual stream. Additionally, the results demonstrated a stronger influence of the left inferior frontal gyrus after training, which may be responsible for passing feedback predictions to visual cortex about incoming word stimuli.

Raum: Festsaal 1

Symposium 3.1: Non-invasive modulation of brain oscillations

Vorsitz: Christoph Herrmann & Daniel Strüber

Carl von Ossietzky Universität Oldenburg

Non-invasive brain stimulation has become a powerful tool in neuroscience and a number of different methods have been developed that are able to modulate brain oscillations. Particularly, transcranial alternating current stimulation (tACS) offers the unique opportunity to demonstrate causal links between brain oscillations and cognitive processes. However, the neuronal mechanisms that underlie the effectiveness of tACS are still not well understood. In this symposium, recent developments in studying the neural basis of tACS will be highlighted. The contributions cover the role of phase delays in explaining tACS effects on the perception of near-threshold auditory stimuli (Riecke), the novel combination of magnetoencephalography and tACS for artifact elimination online to stimulation (Neuling), the origin of tACS-aftereffects that outlast stimulation offset (Vossen, Thut), and the location of tACS effects in the cortex by concurrent tACS-fMRI measurements (Voskuhl; Cabral-Calderin).

Combining Magnetoencephalography and transcranial alternating current stimulation

Neuling, Toralf; Ruhnau, Philipp; Hyvarinen, Petteri; Fusca, Marco; Demarchi, Gianpaolo; Herrmann, Christoph; Weisz, Nathan

University of Trento

Transcranial alternating current stimulation (tACS) has received an increased level of interest since brain oscillations are putatively crucial for normal cognitive functioning and alterations are associated with cognitive dysfunctions. Normally, studies using electroencephalography (EEG) compare pre-tACS recordings with post-tACS recordings. However, the period during tACS has remained a black box until now. Here, we present the novel combination of tACS and magnetoencephalography (MEG). First, a proof of concept will be presented showing that meaningful modulations of brain oscillations even at the stimulation frequency can be recovered. Using paradigms that lead to well-established and robust modulations of alpha power

(eyes open vs. closed and stimulus induced alpha power decrease), we demonstrate for the first time that MEG in combination with a spatial filtering technique can be utilized to disentangle oscillatory brain activity from the highly correlated oscillatory artifact. Our approach enables the study of brain activity even at the stimulation frequency during the ongoing tACS-stimulation. Secondly, we demonstrate data from different experiments on oscillatory brain activity that has been recorded during tACS and how the combination of MEG and tACS effectively opens up the black box of brain activity during tACS. This work enables a more detailed understanding of this brain stimulation method with broad implications for its application in cognitive and clinical neuroscience.

Studying the effects of transcranial alternating current stimulation on hearing and auditory scene analysis

Riecke, Lars

Maastricht University

Recent auditory studies have shown that perceptual detection of near-threshold auditory signals may depend on the timing of the signal relative to the phase of delta/theta ongoing brain oscillations (i.e., periodic fluctuations in the membrane potential of cortical neurons) (Ng et al., *J Neurosci*, 2012; Henry & Obleser, *PNAS*, 2012; Henry et al., *PNAS*, 2014). It has been further shown that transcranial alternating current stimulation (tACS), a non-invasive and silent brain stimulation technique, can entrain cortical alpha oscillations and thereby offer some experimental control over the phase of these oscillations (Helfrich et al., *Curr Biol*, 2014).

Based on these and related 10-Hz tACS findings on tone-in-noise detection (Neuling et al., *Neuroimage*, 2013), the present work investigates the potential of delta/theta tACS to modulate hearing in normally-hearing listeners. Detection performance was measured for near-threshold auditory stimuli (4-Hz click trains) that were presented at various moments (phase delays) during ongoing oscillatory electric stimulation (two synchronous 4-Hz alternating currents applied transcranially to the two cerebral hemispheres). Results show that detection performance fluctuates as a function of the phase delay, and these fluctuations can be explained best by a sinusoid whose frequency matches that of the tACS (Riecke et al, under review). The-

se findings suggest that delta/theta tACS can amplify (or attenuate) sounds and thereby enhance (or reduce) their detectability, provided that they are temporally coherent (anticoherent) with tACS. Ongoing research is exploring this hypothesized capability of tACS in auditory scenes using an informational masking paradigm.

tACS-induced plasticity in oscillatory networks

Vossen, Alexandra; Thut, Gregor

University of Glasgow

tACS is increasingly used in studies of cognition and perception with the intent to selectively modulate intrinsic oscillatory brain activity. It is widely believed that in these studies tACS shapes neural activity, and consequently higher order processing, as a function of the phase and amplitude of the alternating electric field (entrainment). While these entrainment effects typically do not outlast active stimulation, several groups (including ours) have observed enhanced alpha activity beyond stimulation. These aftereffects appear to be the result of plastic changes. While the frequency-specificity of these aftereffects still needs to be established, the possibility of inducing changes in local oscillatory neural networks using targeted periodic stimulation at/around these frequencies bears exciting prospects for clinical applications in the treatment of brain disorders associated with abnormal synchrony. In this talk I will present experiments that try to elucidate the nature and conditions for tACS-induced plastic changes, as well as some of the challenges in the assessment of such effects, such as intra- and interindividual variability.

BOLD signal effects of alpha tACS: a concurrent tACS-fMRI study

Voskuhl, Johannes; Huster, René; Herrmann, Christoph

Carl von Ossietzky-Universität Oldenburg

It has been shown that transcranial alternating current stimulation (tACS) in the alpha range can enhance the amplitude of the individual alpha frequency for up to 30 minutes after stimulation offset. It is not well understood though, where in the brain these electrophysiological changes occur and whether they also affect brain metabolism. We therefore tested whether alpha-tACS results in a decreased BOLD signal as would be expected from combined EEG-fMRI studies that report a negative correlation

between alpha amplitude and BOLD signal in the occipital cortex (e.g. Scheeringa, et al., 2012, *Brain Connectivity*, 2(5), 254–264). Three groups of subjects were measured in an MRI scanner receiving tACS at either their individual alpha frequency (IAF; N=11), one Hz (control; N=12) or sham (i.e. no stimulation at all - a second control; N=11) while responding to a visual vigilance task. TACS was administered in three intensities (0.2, 0.6, 1.0 mA, randomized within subject) in a total of 108 stimulation periods of 10 seconds. Stimulation periods alternated with stimulation-pauses of 10-30 seconds. The BOLD signal was analyzed in response to tACS onset during resting state and in response to the vigilance targets. We show that tACS at 1.0 mA at IAF reduced task-related activation in the occipital cortex compared to intermittent pauses without tACS. The deactivation occurs in an area which overlaps with the region of negative alpha-BOLD correlation as reported by Scheeringa et al., 2012. In conclusion our findings do not show a direct effect of tACS of resting state BOLD signal levels. Yet our results fit well with findings from tDCS/fMRI studies that report changes in BOLD activity only as a modulation of an existing BOLD signal.

Effect of rhythmic electrical stimulation on the BOLD signal and functional connectivity

Cabral-Calderin, Yuranny; Schmidt-Samoa, Carsten; Williams, Kathleen; Wilke, Melanie

Georg-August-Universität Göttingen

While transcranial alternating current stimulation (tACS) has been shown to modulate a variety of brain functions in a frequency-specific manner, its neuronal effects remain poorly understood. We recently found that gamma tACS (60 Hz) applied over occipital cortex increased the number of spontaneous perceptual reversals of an ambiguous structure-from-motion (SfM) stimulus (Cabral-Calderin et al., *J Cogn Neurosci.*, 2015). Based on current density modeling (Neuling et al., *Front Psychiatry*, 2012) and EEG studies (Helfrich et al., *Curr Biol*, 2014), we hypothesized that this effect was due to a tACS-induced activity increase in occipito-parietal areas. To test this hypothesis we combined tACS with fMRI and evaluated neural network changes induced by tACS at different frequencies during rest- and SfM task conditions. Overall, tACS effects were frequency- and task-specific, and mainly observed in fronto-parietal regions and at lower frequencies (10-20

Hz). In the SfM task, tACS effects were more pronounced in voxels that were not optimally driven. Although 60 Hz tACS did modulate BOLD activity in perceptual reversal-related regions such as the intraparietal sulcus, modulation in occipital cortices was almost absent. Also, functional connectivity changes were mainly observed between regions belonging to different resting state networks, but not between reversal-related areas. We conclude that tACS-fMRI might be a promising tool to evaluate tACS-induced effects on neural networks. However, since tACS-evoked BOLD activity changes were poorly predicted by current density modeling and EEG studies, systematic comparisons between the different methods will be necessary to use tACS-fMRI to rationalize the design of tACS experiments.

Raum: 1.802

Symposium 3.2: Contemporary P3 theories: unifying frameworks for the late positivities (P600, Pe ...)?

Vorsitz: Jona Sassenhagen

Institut für Psychologie, Goethe-Universität Frankfurt am Main

The P3 component of the EEG has been proposed to indicate the linking between stimuli/information uptake and decisions/responses (Verleger et al., 2006). For example, the LC/NE-P3 theory (Nieuwenhuis et al., 2005; Warren, 2011) postulates that the Noradrenaline/NE system responds to salient stimuli, and phasic NE release, supporting reorientation decisions, is reflected electrophysiologically in a P3. O'Connell et al. (2012) propose the P3 corresponds to gradual evidence-accumulation peaking in perceptual decisions.

Such contemporary P3 theories provide precise and falsifiable, but also broad and explanatorily powerful models. We discuss these theories, their commonalities and differences, methodological developments and challenges, and how they relate to similar late positive components, such as the Pe (Murphy et al., 2012) or the P600 (under the Monitoring Theory, van de Meerendonk, Chwilla & Kolk, 2011; or the LC/NE-P3 theory, Sassenhagen, Schlesewsky & Bornkessel-Schlesewsky.

Bridging events and actions: P3b reflects activation of stimulus-response links

Verleger, Rolf

Universität zu Lübeck

Ever since the first reports about the P3 component, its meaning has been debated. The majority view has taken for granted that P3b depends on processing („evaluation“) of stimuli only rather than on selecting responses. To further explore this matter, we used the oddball-effect on P3b in choice-response tasks where rare or frequent stimuli (S1) were followed by ancillary stimuli (S2). Rare S1s evoked large P3b components. In a series of experiments we show that this P3b became abolished when S1, though still relevant, did not define the response. It is proposed that P3b reflects the reactivation of established, but presently inactive stimulus-response links (e.g., „when X press left“) and that such links can and must be reactivated

with rare stimuli in the usual oddball task but cannot be reactivated when the response is still unknown.

Noradrenergic Modulation and the P3

Warren, Christopher

Leiden University

The P3 is elicited and/or modulated by a variety of experimental conditions, including task relevance, surprising or attention-capturing stimuli, stimulus frequency, stimulus discrimination difficulty, stimulus intensity, and many others. One common property of all these antecedent events is that they all have motivational salience, or potential importance. Nieuwenhuis, Aston-Jones, and Cohen (2005) proposed that the P3 is a manifestation of phasic norepinephrine (NE) release, which produces a timely, cortex-wide boost in neural processing in response to motivationally salient events. I will review evidence in favour of this position, with focus on recent findings that support the NE-P3 theory, as well as attention to recent alternative accounts of the P3. Furthermore, I will present data from a promising methodology for examining the effect of noradrenergic modulation in healthy human subjects. Specifically, transcutaneous vagus nerve stimulation putatively increases norepinephrine release because ascending fibers of the vagus nerve indirectly stimulate the primary NE-releasing brainstem nucleus. Previous studies of subcutaneous vagus nerve stimulation have shown that the P3 is increased in the treatment condition relative to the control. We are currently testing the efficacy of using the less-invasive transcutaneous vagal nerve stimulation as a means of manipulating NE levels, using the P3 as a marker for success.

Centro-parietal positivities as accumulation-to-bound decision variables: a simple, computationally explicit account of P3-like signals across a range of decision-making contexts

Murphy, Peter

Leiden University

Although the P3 has been intensively studied across a five-decade period, a consensus regarding its functional significance has not been reached. I will outline recent research that has attempted to build a unifying explanatory account of the P3 and related centro-parietal positivities (CPPs)

by drawing on a guiding principle from the decision sciences: that decisions can be optimized through repeated sampling and integration of evidence until a threshold for commitment is reached. Within this sequential sampling framework, a 'decision variable' representing the accumulation of evidence determines final choice. I will describe investigations across several decision-making contexts which support the proposal that CPPs encode an evolving decision variable. During both simple 'oddball' target detection and more protracted two-alternative perceptual decisions, CPPs are shown to dynamically build at a rate that reflects the strength of the available sensory evidence. Moreover, these signals reach a stereotyped amplitude immediately prior to commitment, consistent with an action-triggering decision threshold. I further highlight that the error positivity („Pe“), a post-response CPP that precedes the detection of errors, displays these same critical criteria of a decision variable, but this time one that reflects the accumulation of evidence for an error. Finally, I describe how computational modelling of the perceptual and error detection decision processes has been used to further identify these CPP signals with the process of evidence accumulation. Collectively, these findings offer a computationally tractable perspective on P3-like potentials as neural signatures of decision formation.

Monitoring theory: the P300 and the P600

Kolk, Herman

Donders Institute for Cognition, Brain and Behavior, Radboud University Nijmegen

Our monitoring theory of language perception maintains that a syntactic violation elicits a P600 effect, not because it is syntactic, but because such errors are rare. Therefore a conflict arises between the linguistic element that is expected and the one that is perceived. This conflict signals the possibility of a processing error. It is this conflict that triggers the P600. We assume that, in order to check whether such an error has actually occurred, the linguistic structure is reprocessed. In this way, we monitor the quality of our perception. In support of this theory we have conducted a number of studies, demonstrating P600 effects after semantic violations of various kinds and spelling errors. We have also used fMRI and have found that not only syntactic, but also semantic and spelling errors lead to an activation increase in the left inferior frontal

gyrus. A further result was that this same area was also activated in the Stroop task, lending support for our assumption that these errors induce a conflict. Finally, we employed sentences, in which one of the words was degraded, and therefore hard to read. These degraded words elicited P600 effects and led to increased activation in the IIFG. As degraded words presumably require extra attention, we have argued that it is this extra attention that leads to the resolution of the conflict. Having presented a summary of this evidence, I will address the question whether this theory has relevance for the P300, in particular in view of the recent findings presented by the other speakers.

P600, syntax or salience? Applying modern neurophysiological theories and analysis methods to linguistic paradigms

Sassenhagen, Jona¹; Rabs, Elisabeth²; Schlesewsky, Matthias³; Bornkessel-Schlesewsky, Ina⁴

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According to salience/decision-oriented theories of the P3, it follows potentially important stimuli and is temporally aligned with the decision. This entails a strict, falsifiable prediction for any proposal that a specific component, such as the P600 (commonly observed to follow structural deviations, especially in language) is a P3: it should show response time („RT“) alignment. The association of P600 and P3 has a two-decade-long controversial history; establishing their identity is desirable on grounds of parsimony, but its theoretical backing and experimental testability is, so we argue, contingent on contemporary P3 theories. We therefore test the RT alignment of the P600. We observe the predicted RT alignment, and in exploratory analyses, also observe that the P600 seems to resemble the P3 in further aspects: it correlates with heart period variability and skin conductance, as predicted by neuromodulatory accounts of the P3. We discuss our methods for the exploration of latency-variable EEG phenomena and their importance for studies of complex cognitive capacities, such as language.

Raum: PEG 1.G147

Symposium 3.3: Die Antizipation aversiver Reize

Vorsitz: Martin J. Herrmann & Thomas Straube

Universitätsklinikum Würzburg

Die Antizipation aversiver Stimuli führt sowohl während der antizipatorischen Phase als auch während der nachfolgenden Bedrohungsperzeption zu behaviouralen, neuronalen und autonomen Antworten, die u.a. durch die zeitliche Vorhersehbarkeit des aversiven Stimulus und die Antizipationsdauer moduliert werden. Dieses Symposium bündelt neuere Befunde zu diesem Themenfeld. Böhme et al. zeigen mittels fMRT die zeitliche neuronale Dynamik während antizipatorischer Angst. Brinkmann und Straube stellen eine fMRT Studie zu neuronalen Korrelaten antizipatorischer Angst bei Blut-Spritzen-Verletzungssphobie vor. Klingenberg et al., Reichert et al., und Schmitz et al. untersuchten Effekte der Bedrohungsvorhersehbarkeit bei Gesunden - z.T. in Abhängigkeit von Trait-anxiety - und bei Probanden mit Spinnenphobie mittels verschiedener psychophysiologischer Methoden (MEG, EEG, Startle). Die Diskussion der Befunde zielt vor allem auf die Weiterentwicklung integrativer Modelle der Bedrohungsantizipation ab

Neuronale Korrelate phasischer und anhaltender Angst

Böhme, Stephanie

Universitätsklinikum Würzburg

Im Verlauf pathologischer, aber auch ‚normaler‘ Angstreaktionen werden mindestens zwei unterschiedliche Phasen diskutiert (phasic vs. sustained fear). Eine Reihe von Befunden spricht für die Existenz von mehreren, z. T. sequentiell ablaufenden, Prozessen bei der Konfrontation mit einem bedrohlichen Stimulus bzw. beim Durchleben einer angstbesetzten Situation. Diese unterschiedlichen Prozesse können mit Aktivierungsunterschieden in verschiedenen Hirnarealen assoziiert werden, wobei der zeitliche Verlauf der Aktivierung eine Rolle zu spielen scheint. Die vorliegende Studie untersucht den Zeitverlauf der Aktivierung in unterschiedlichen Hirnarealen mittels funktioneller Magnetresonanztomographie bei 39 gesunden Probanden, während diese aversive oder neutrale Sounds antizipierten. Es zeigte sich, dass die Aktivierung

der Amygdala direkt nach der Ankündigung eines aversiven Stimulus ansteigt, sich jedoch im weiteren Verlauf der Antizipationsphase wieder zurückbildet. Im späteren Zeitverlauf der Antizipation aversiver Reize zeigte sich eine Hyperaktivierung des bed nucleus der Stria Terminalis (BNST) sowie anderen Hirnarealen. Funktionelle Konnektivitätsanalysen zwischen der Amygdala bzw. dem BNST und anderen Hirnarealen weisen neben einzelnen Übereinstimmungen, charakteristische Unterschiede auf. Die Ergebnisse der vorliegenden Studie sprechen für die Existenz zweier sequentiell aktivierter neuronaler Netzwerke, innerhalb derer die Amygdala bzw. der BNST eine wichtige Rolle zu spielen scheinen.

Gehirnaktivierungsmuster während antizipatorischer Angst bei Blut-Spritzen Verletzungsphobie

Brinkmann, Leonie

Westfälische Wilhelms-Universität Münster

Personen mit einer Blut-Spritzen Verletzungsphobie zeigen eine starke Ekelreaktivität während der Verarbeitung bedrohlicher Reize, die teilweise auch das spezifische autonome Antwortmuster in dieser Patientengruppe erklären könnte. Inwiefern diese Auffälligkeit auch während der Antizipation störungsrelevanter Stimuli auftritt ist unbekannt. In der vorliegenden Studie wurden behaviorale und, mittels funktioneller Magnetresonanztomographie, neuronale Korrelate der Antizipation störungsassoziierter versus neutraler Bilder bei Patienten mit BSV und gesunden Kontrollprobanden untersucht. Störungsrelevante vs. -irrelevante Antizipation führte zu erhöhten Angst- nicht jedoch Ekelratings bei den Patienten, wohingegen während der Bildpräsentation sowohl Ekel- als auch Angstratings erhöht waren. Die störungsrelevante Antizipationsphase war mit erhöhter Aktivierung u.a. im anterioren, zingulären Kortex und der Insel bei Patienten im Vergleich zu Kontrollpersonen assoziiert, wobei die Aktivierungen einer zeitlichen Dynamik unterlagen. Die Befunde werden anhand aktueller pathophysiologischer Modellvorstellungen bei BSV diskutiert.

Die Vorhersehbarkeit aversiver Reize beeinflusst die neuronale Verarbeitung visueller Stimuli

Klinkenberg, Isabelle

Westfälische Wilhelms-Universität Münster

Die Ankündigung eines aversiven Reizes mit klar definierten Onset erzeugt sogenannte phasische Angst (phasic fear) während die Ankündigung eines unvorhersehbaren aversiven Reizes mit Erwartungsangst (sustained fear) einhergeht. Basierend auf Grillon und Kollegen (2004) können diese Arten der Angstinduktion als Modell für Phobien (phasic fear) und Panikstörungen (sustained fear) dienen.

Zunächst wurden bei 32 gesunden Probanden die magnetischen Felder aufgezeichnet, die durch ängstliche und neutrale Gesichter unter sustained fear, phasic fear und no fear (kein aversiver Reiz) im Magnetoenzephalogramm evoziert wurden.

Die Schätzung neuronaler Quellen zeigt, dass die Gesichter in Abhängigkeit des Gesichts-ausdrucks eine höhere Aktivität im visuellen Verarbeitungspfad auslösen (ängstlich > neutral). Ferner finden wir eine zunehmende Aktivierung des dorsolateralen Prefrontalkortex (dlPFC) bei steigender Unvorhersehbarkeit (no fear < phasic fear < sustained fear).

Um die Effekte von Vorhersehbarkeit aversiver Reize in Angststörungen zu untersuchen, wurde die Studie mit 20 Spinnenphobikern und 20 Kontrollprobanden durchgeführt. Dabei zeigt sich eine differentielle Aktivierung der rechten occipito-parietalen Verbindung: Spinnenphobiker reagieren mit einer geringeren Aktivierung als Kontrollen, vor allem in der Verarbeitung der unter Unvorhersehbarkeit dargebotenen Gesichter. Dieser Befund kann in Überlegungen zur attentionalen Vermeidung emotionaler Reize eingeordnet werden.

Im dlPFC hingegen finden wir in beiden Stichproben ebenfalls eine verstärkte Aktivierung für diese Gesichter. Dies lässt darauf schließen, dass der dlPFC in der Salienz-Detektion von Stimuli und in der Top-Down-Kontrolle von Emotionen involviert ist.

Der Einfluss körperlicher Bedrohungsreize auf neurophysiologische Korrelate der Emotionsverarbeitung bei Hoch- und Niedrig-Angstsensitiven Probanden

Reicherts, Philipp

Julius-Maximilians-Universität Würzburg

Schmerz ist eine prototypische körperlicher Bedrohungsmodalität und kann durch Emotionen maßgeblich moduliert werden. Umgekehrt scheint die Wahrnehmung von Schmerz die Verarbeitung von Emotionen zu beeinflussen. Die reine Antizipation von Bedrohung hingegen induziert vermutlich einen Modus verstärkter (hypervigilanter) Verarbeitung. Dieser Effekt ist bei Personen mit ausgeprägter Wahrnehmung körperlicher Angst bzw. Paniksymptomen (Angstsensitivität, AS) potentiell besonders ausgeprägt. Um den Einfluss von akuter und antizipatorischer Bedrohung auf die Verarbeitung emotionaler Bilder zu vergleichen, wurden 25 hoch AS und 25 niedrig AS Probanden Blöcke von neutralen, positiven oder negative Bildern (IAPS) präsentiert, während ihnen keine Schmerzreize (Baseline), tonische Schmerzreize (Schmerz) oder phasische, unvorhersehbare Schmerzreize (Antizipation) verabreicht wurden. Neben EEG wurden blockweise Valenz- und Arousal- sowie Schmerzratings erhoben. Die Auswertung früher Komponenten (P100) der EKPs ergab sowohl eine Modulation durch den emotionalen Inhalt (Negativ > Positiv; Neutral) als auch durch die Bedrohungsmanipulation (Baseline > Antizipation; Schmerz). Zudem war die P100 bei Hoch-AS im Vergleich zu Niedrig-AS generell reduziert. Spätere Komponenten (LPP) zeigen ebenfalls eine Modulation durch die Bedrohungsmanipulation (Baseline > Schmerz) als auch durch den Bildinhalt (Emotional > Neutral). In der vorliegenden Arbeit führte die bloße Antizipation von körperlicher Bedrohung zu einer ähnlich starken Ablenkung von Aufmerksamkeit wie eine tatsächliche Schmerzstimulation, was die besondere Salienz von Schmerzreizen im Emotionsverarbeitungsprozess suggeriert, die bei hoch AS Probanden besonders ausgeprägt zu sein scheint.

Schreckreflex Potenzierung während der Antizipation unvorhersehbarer Bedrohung – Marker für das Vorliegen einer Angststörung, oder einer unterliegenden Vulnerabilität?

Schmitz, Anja; Mühlberger, Andreas

Universität Regensburg

Eine Potenzierung des Schreckreflexes während der Antizipation unvorhersehbarer Bedrohung (anxiety-potentiated startle) wurde in rezenten Studien mit dem Vorliegen einer Angststörung in Zusammenhang gebracht. Es ist jedoch nicht geklärt, ob diese Befunde stabil sind, und ob die hierdurch gemessene Reaktivität defensiver Systeme schon vor Auftreten einer Angststörung erhöht ist, oder sich erst mit der Manifestation dieser verändern.

Ziel der vorgestellten Studien war es, die bisher gefundenen Assoziationen zu replizieren (NIMH Family Study, N= 63 Angstpatienten N = 33 Kontrollen), und diese Maße in einer Stichprobe gesunder Probanden mit Vulnerabilitätsfaktoren für die Entwicklung einer Angststörung in Zusammenhang zu stellen (Universität Regensburg, N = 100). Hierzu wurde jeweils der NPU-Threat Test durchgeführt, in der NIMH Family Study diagnostische Daten über ein diagnostisches Interview erhoben, und in der Regensburger Vulnerabilitätsstudie die Ausprägung verschiedener Risikofaktoren für die Entwicklung einer Angststörung (Persönlichkeit, kritischen Lebensereignisse, Bindungsstile, familiäre Vorbelastung) durch Selbstberichte erfasst.

Assoziationen zu Angststörungen konnten hierbei besonders für das Auftreten von Panikanfällen und einer Panikstörung bestätigt werden. Risikofaktoren für die Entwicklung einer Angststörung stehen in der bisher erhobenen Teilstichprobe (N = 68) jedoch nicht in Zusammenhang mit einem erhöhten anxiety-potentiated startle. Aktuelle Ergebnisse aus dieser Studie werden vorgestellt und mögliche Implikationen diskutiert.

Raum: PEG 2.G047

Symposium 3.4: Frauen, Männer, Emotionen: Der Einfluss von Geschlecht und Geschlechtshormonen auf emotionale Prozesse

Vorsitz: Christian Merz¹ & Katrin Lübke²

¹Universität Trier, ²Heinrich-Heine-Universität Düsseldorf

Frauen und Männer reagieren unterschiedlich auf emotionale Reize, was u.a. im Kontext unterschiedlicher Prävalenzen für psychische Erkrankungen bei Frauen und Männern diskutiert wird. Die neurobiologischen Grundlagen der geschlechtsspezifischen Emotionsverarbeitung werden in diesem Symposium unter verschiedenen Gesichtspunkten und Methoden erläutert. Zunächst wird ein Überblick über den Einfluss von Geschlecht und Geschlechtshormonen auf die Sensitivität für soziale, emotional bedeutsame Chemosignale gegeben (Lübke). Anschließend wird die Verarbeitung negativer wie auch positiver Bilder bei Frauen mit unterschiedlichem Sexualhormonstatus präsentiert (Armbruster). Danach werden Geschlechtsdifferenzen und der Effekt der Geschlechtshormone auf Furchtkonditionierungsprozesse näher erläutert (Lonsdorf) und inwiefern Stress diese Prozesse beeinflusst (Antov). Abschließend werden Befunde zur geschlechtsspezifischen Belohnungsverarbeitung bei erhöhtem Cortisolspiegel dargestellt (Kinner).

Effekte von Geschlecht und Geschlechtshormonen auf die sozio-emotionale Chemokommunikation

Lübke, Katrin; Pause, Bettina

Heinrich-Heine-Universität Düsseldorf

Die Fähigkeit zur chemosensorischen Kommunikation geht einher mit einer Vergrößerung des Gehirns (Säugetier) und des Neokortex (*Homo sapiens*) und erlaubt eine komplexe implizite Analyse sozialer Reize und Strukturen. Sie ist daher insbesondere bei in Gruppen lebenden Spezies zentral für das Überleben eines Individuums und der Spezies selbst von Bedeutung. Bei Menschen hat die chemosensorische Kommunikation einen Einfluss auf Reproduktion, Partnerwahl und Bindung, sowie auf die Wahrnehmung von Emotionen. Innerhalb dieses Überblicks sollen die Rolle von Geschlecht und sexueller Orientierung, sowie Zusammenhänge zwischen chemosensorischer Kommunikation und Sexualhormonen beleuchtet werden.

Es werden Befunde vorgestellt, die eine verstärkte Verarbeitung chemosensorischer Stresssignale bei Frauen im Vergleich zu Männern zeigen, konform mit einer erhöhten Sensitivität für schwach saliente sozio-emotionale Signale. Veränderungen der Verarbeitung dieser Stresssignale im Verlauf einer Schwangerschaft bei Frauen, sowie Korrelationen zwischen der Sensitivität für chemosensorische Aggressionssignale und Testosteron bei Männern zeigen einen Zusammenhang von sozialer Chemorezeption und Sexualhormonen auf. Darüber hinaus wird dargestellt, welche Effekte die sexuelle Orientierung auf die Chemokommunikation hat, wobei diese Ergebnisse auch im Hinblick auf sozio-emotionale Sensitivität diskutiert werden. Abschließend werden die Befunde im Hinblick auf ihre mögliche evolutionäre Bedeutung integriert, und ein Ausblick auf weiterführende Forschungsfragen zum Einfluss chemosensorischer Kommunikation auf das inner- sowie zwischengeschlechtliche Sozialverhalten gegeben.

Einfluss von Menstruationszyklus und oralen Kontrazeptiva auf physiologische Korrelate emotionaler Reaktivität

Armbruster, Diana; Kirschbaum, Clemens; Strobel, Alexander

TU Dresden

Sexualhormone (SH) erfüllen eine Vielzahl von Funktionen und beeinflussen in Interaktion mit weiteren Neuromodulatoren auch emotionales Erleben und Verhalten. Studien zu den Einflüssen von Menstruationszyklus bzw. Einnahme oraler Kontrazeptiva (OC) zeigen systematische Zusammenhänge mit Emotionalität, weisen aber oft auch auf eine ausgeprägte Varianz innerhalb der Population in Bezug auf die emotionalen Effekte von SH-Veränderungen hin.

In einer aktuellen Studie untersuchten wir physiologische und subjektive Indikatoren emotionaler Reaktivität bei (a) Frauen, die OC einnehmen (n=50) und (b) Frauen mit freiem Zyklus (n=40), wobei letztere in der Follikular- und der späten Lutealphase untersucht wurden. Den Probandinnen wurden 60 emotionale Bilder (neutral, positiv oder negativ) sowie 48 akustische Startle-Stimuli (95 db, 50 ms, weißes Rauschen) präsentiert, während EKG, Hautleitfähigkeit und faziales EMG (*orbicularis oculi*, *corrugator supercilii*, *zygomaticus major*) abgeleitet wurden. Die Teilnehmerinnen bewerteten Bilder und Töne

hinsichtlich Valenz und Arousal und füllten Fragebögen zu Indikatoren verschiedener biologischer Rhythmen (Tages-, Monats-, Jahresrhythmus) aus. Zur Bestimmung der Östrogen-, Progesteron- und Testosteronlevel wurden Speichelproben erhoben. Ziel der Studie ist die Untersuchung des Ausmaßes (a) der intraindividuellen Variabilität in physiologischen Korrelaten emotionaler Reaktivität in Abhängigkeit von Zyklusphase und (b) der interindividuellen Unterschiede in diesen Parametern zwischen Frauen mit freiem Zyklus und Frauen, die OC einnehmen. Die Befunde werden auch im Zusammenhang mit den Ergebnissen zu circadianer und jahreszeitlicher Rhythmen diskutiert.

Geschlechtsunterschiede während des kontextabhängigen Furchtlernens und des Wiederabrufs – die Rolle des biologischen Geschlechts, hormoneller Kontrazeptiva und der Zyklusphase

Lonsdorf, Tina; Haaker, Jan; Schümann, Dirk; Sommer, Tobias; Bayer, Janine; Brassens, Stefanie; Bunzeck, Nico; Gamer, Matthias; Kalisch, Raffael

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Angststörungen treten bei Frauen doppelt so häufig auf wie bei Männern. Trotz dieses deutlichen Unterschiedes in den Prävalenzraten basiert der Großteil der experimentellen Studien auf männlichen Probanden und Studien, die explizit Geschlechtsunterschiede untersuchen, sind selten. Ebenso ist der Einfluss von hormonellen Kontrazeptiva und der Zyklusphase während der Furchtkonditionierung und der Extinktion bisher kaum untersucht worden.

Geschlechtsunterschiede während der kontextabhängigen Furchtkonditionierung und Extinktion (Tag 1) sowie deren Wiederabruf (Tag 2) wurden in einer Stichprobe von 377 Versuchspersonen (261 Frauen) untersucht. Dazu wurden Hautleitfähigkeit (SCR) sowie Furcht- und US-Erwartung erfasst.

Robuste Geschlechtsdifferenzen zeigten sich in allen abhängigen Variablen (AV). Frauen gaben generell höhere Furcht- und US-Erwartungswerte an, zeigten jedoch geringere SCRs als Männer. Außerdem wurde bei Frauen eine reduzierte CS+/CS- Diskrimination in allen AV gefunden. Frauen, die hormonelle Kontrazeptiva verwenden, zeigten außerdem eine reduzierte CS-Diskriminierung an Tag 2 im Vergleich zu Männern sowie Frauen, die keine hormonellen Kontrazeptiva anwenden.

Das in dieser Studie bei Frauen beobachtete Diskriminierungsmuster ähnelt sehr dem beobachtbaren Muster bei Angstpatienten. Diese Ergebnisse legen nahe, dass tiefgreifende Defizite in assoziativen Lernprozessen und des subjektiven Ausdrucks von Sicherheitsinformationen (auf den CS-) den höheren Prävalenzraten bei Angststörungen und der ausgeprägteren Symptomatik bei Frauen zu Grunde liegen könnten. Vermutlich führt eine individualisierte Therapie mit Fokus auf inhibitorischem Lernen zu verbesserten Therapieerfolgen.

Niedrige Östradiolspiegel machen Frauen anfälliger für negative Effekte von Stress auf deklaratives Gedächtnis und Furchtextinktion

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Frauen leiden häufiger an Angst- und Stressbezogenen Erkrankungen. Ein Grund könnten die unterschiedlichen Spiegel zirkulierender Geschlechtshormone sein. Niedrige Spiegel von 17 β -Östradiol (E2) sind assoziiert mit Defiziten in der Furchtextinktion und mit der Häufigkeit sog. Flashbacks. Studien zeigen Interaktionen zwischen experimentell-induziertem Stress und Hormonstatus in der Gedächtnisleistung für emotionales Material.

Wir präsentieren bisher unpublizierte Ergebnisse zum deklarativen Gedächtnis aus einer Studie zur Furchtkonditionierung und -Extinktion [1]. Wir haben 3 Hormonstatusgruppen (je n=24) untersucht: Frauen in der frühen folliculären (FF, Zyklustage 1-5, E2 niedrig) und in der mittzyklischen Phase (MZ, Zyklustage 11-16, E2 hoch) sowie Männer. Jeweils die Hälfte jeder Gruppe wurde einer Stressvorbehandlung (Rede vor Kamera) oder einer Kontrollaufgabe (stilles Lesen) ausgesetzt (3x2 Plan). Sieben Minuten nach dem Ende der Behandlung wurde eine neutrale Geschichte dargeboten. Geprüft wurde der freie Abruf unmittelbar, 35 Minuten und 24 Stunden nach Enkodierung.

Wir fanden, dass sich die 3 Hormonstatusgruppen nur nach der Stressbehandlung unterschieden: hier zeigten FF-Frauen eine geringere Gedächtnisleistung als MC-Frauen und Männer, die sich ihrerseits nicht unterschieden. Wir fanden ein ähnliches Muster für die Furchtextinktion: gestresste FF-Frauen zeigten Defizite im Extinktionsabruf. Die Ergebnisse weisen darauf hin, dass Frauen in der Zyklusphase mit niedrigem E2 anfälliger sind für negative Ef-

fekte von Stress auf (emotionsneutrale) deklarative Inhalte und auf das Extinktionsgedächtnis.

[1] Antov, M. I. & Stockhorst, U. (2014). Psychoneuroendocrinology, 49, 106-118.

Geschlechtsspezifischer Cortisoleffekt auf die neuronalen Korrelate der Belohnungsantizipation

Kinner, Valerie; Wolf, Oliver; Merz, Christian

Ruhr-Universität Bochum

Dysfunktionen in der Belohnungsverarbeitung spielen eine zentrale Rolle in der Entstehung affektiver Störungen. Aktuelle Studien zeigen, dass akuter Stress die Sensitivität für belohnende Reize herabsetzt und somit möglicherweise den Beginn pathologischer Prozesse begünstigt. Die neurobiologischen Mechanismen, die den stressinduzierten Effekten auf das Belohnungssystem zugrunde liegen sowie potentielle Geschlechtsdifferenzen sind jedoch noch weitestgehend unerforscht.

In dieser fMRT-Studie wurde daher untersucht, wie sich das Stresshormon Cortisol auf die neuronalen Korrelate der Belohnungsantizipation auswirkt. Dazu wurden insgesamt 60 Probanden (30 Männer und 30 hormonell verhaltende Frauen) unter Placebo-kontrollierter Gabe von Cortisol mit der Monetary Incentive Delay Task getestet. Während dieser Aufgabe wurden den Versuchsteilnehmern drei verschiedene visuelle Reize mit unterschiedlicher Belohnungsassoziation präsentiert. Abhängig von der Reaktionszeit erhielten die Probanden entweder eine monetäre Belohnung oder ein verbales Feedback. In der Kontrollbedingung war keine Reaktion erforderlich.

Cortisol führte bei Männern zu einer abgeschwächten neuronalen Antwort sowohl auf verbale als auch auf monetäre Belohnungsreize im Belohnungsnetzwerk. Bei Frauen zeigte sich ein umgekehrtes Ergebnismuster mit einer erhöhten Aktivierung belohnungsassoziierter Hirnareale nach Cortisol-Gabe.

Diese Ergebnisse deuten darauf hin, dass sich erhöhte Cortisolkonzentrationen das Belohnungslernen im menschlichen Gehirn bei Männern beeinträchtigen, bei Frauen jedoch fördern. Die aktuellen Befunde liefern somit erste Hinweise dafür, dass Cortisoleffekte auf das neuronale Belohnungssystem durch das Geschlecht moduliert werden.

Raum: Festsaal 1

Symposium 4.1: Neuronale Korrelate appetitiver

Hinweisreize

Vorsitz: Rudolf Stark

Justus-Liebig-Universität Gießen

Annäherungsverhalten wird häufig durch appetitive Hinweisreize ausgelöst. Die Untersuchung von Hinweisreizen spielt besonders in der Suchtforschung eine große Rolle, da konditionierten Reizen eine zentrale Bedeutung für die Initiierung des Konsumverhaltens zugeschrieben wird. Die vier Beiträge des Symposiums untersuchen die Wirkung von appetitiven Hinweisreizen im Kontext natürlicher Verstärker (bevorzugte Nahrungsmittel: Andreatta & Pauli), substanzbezogener Süchte (Alkoholsucht: Vollstädt-Klein et al.) und Verhaltenssüchte (Sexuelle Reize: Snagowski et al. und Wehrum-Osinsky et al.). Die Ähnlichkeiten und Unterschiede in den Ergebnissen der verschiedenen Untersuchungsansätze können wichtige Hinweise auf die veränderten neuronalen Prozesse geben, die Suchterkrankungen zugrunde liegen.

Appetitive und aversive Konditionierung am Menschen

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Während eines klassischen Konditionierungsparadigmas wird ein Stimulus (konditionierter Stimulus, CS) mit einem biologisch relevanten Ereignis (unkonditionierter Stimulus, US) assoziiert. Bei Furchtkonditionierung ist der US aversiv (Schmerz) und der CS löst Vermeidungsreaktionen aus. Bei appetitiver Konditionierung ist der US angenehm (Essen) und der CS löst Annäherungsreaktionen aus. Im Gegensatz zur Furchtkonditionierung ist die appetitive Konditionierung v.a. am Menschen selten untersucht worden, trotz ihrer Relevanz für pathologisches Verhalten wie beispielsweise Adipositas. Ziel dieser Studie war es Tierbefunde über appetitive Konditionierung auf den Menschen zu übertragen und dabei eine primäre Belohnung in der Form von Lebensmittel als US zu nutzen. Dreiunddreißig Probanden nahmen zwischen 8 Uhr und 10 Uhr nüchtern am Versuch teil. Während der Akquisitionphase wurde je eine geometrische Figur (avCS+) mit einem aversiven US (schmerzhafter elektrischer

Reiz) assoziiert, eine Figur (appCS+) mit einem appetitiven US (entweder Salzbretzel oder Schokolade, je nach Probandenpräferenz) und eine dritte Figur (CS-) sagte keinen US vorher. In der Testphase wurden die drei Figuren nochmals präsentiert und zusätzlich eine vierte Kontrollfigur (NEU), aber kein US wurde dargeboten. Sowohl Valenz- und Erregungsrating als auch Schreckreflex und Skin-Conductance Reaktion (SCR) wurden als Lernindex erhoben. Wir haben erfolgreiche aversive und appetitive Konditionierungen gefunden. Einerseits wurde der avCS+ negativer und erregender als der CS- bewertet und löste eine Potenzierung des Schreckreflexes und höhere SCR aus. Andererseits wurde der appCS+ positiver als CS- bewertet und löste eine Verminderung des Schreckreflexes und höhere SCR aus. Zusammengefasst konnten wir Tierbefunde erfolgreich auf den Menschen übertragen. Letzten Endes ist ein hungriger Zustand die Voraussetzung für eine appetitive Konditionierung mit primären Belohnungen und er hat keinen Einfluss auf die Furchtkonditionierung.

Validierung des „incentive-habit“-Modells für die Alkoholabhängigkeit mittels fMRT

Vollstädt-Klein, Sabine; Nakovics, Helmut; Kirsch, Martina; Sommer, Wolfgang; Mann, Karl; Kiefer, Falk
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Nach dem „incentive-habit“-Modell der Tabakabhängigkeit (Di Chiara 2000) stehen hedonische Effekte zu Beginn einer Abhängigkeit des Rauchens im Vordergrund („incentive smoking“), während später das „habit smoking“, das eher gewohnheitsmäßige Rauchen, dominiert. Neuere Studien geben Hinweise auf eine Gültigkeit des Modells auch für andere Substanzen (Sjoerds et al. 2014). Zur Validierung des „incentive-habit“-Modells für Alkoholabhängigkeit entwickelten wir einen Fragebogen (Craving Automated Scale – Alcohol, CAS-A, (Nakovics et al. 2012; Vollstädt-Klein et al. in press), der retrospektiv „automatischen Alkoholkonsum“ erfasst. In einem zweiten Schritt untersuchten wir bei 22 männlichen alkoholabhängigen Patienten nach Alkoholzug mittels fMRT die Assoziation zwischen reizinduzierter Hirnaktivierung auf visuelle Alkohol-Reize und den 5 Subskalen des CAS-A-Fragebogens, die verschiedene Aspekte des Konsums und der Volition messen. Patienten mit hohem automatischen Alkoholkonsum zeigten eine verminderte Reaktivität auf

alkoholassoziierte Reize in Insula, mittlerem okzipitalen Kortex, medialem Frontalkortex, Parahippokampus und fusiformem Gyrus (i.e. in für Interozeption, Aufmerksamkeit und hedonische Bewertung relevanten Hirnregionen) sowie erhöhte Reaktivität in Thalamus, Putamen sowie Nucleus Ruber (i.e. in für motorische Kontrolle, motorische Vorbereitung sowie Bildung von Gewohnheiten bedeutsamen Arealen). Zusammengefasst sprechen unsere Ergebnisse für eine Gültigkeit des „incentive-habit“-Modells auch für die Alkoholabhängigkeit.

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Neurale Korrelate von Cue-Reactivity und Craving im Kontext pathologischer Internetsexnutzung

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In Anlehnung an Substanzabhängigkeiten wird diskutiert, Internetsexsucht als spezifische Form der Internetsucht innerhalb der Verhaltenssuchte zu klassifizieren, da vorgegangene Studien u.a. Cue-Reactivity und Craving bei pathologischen Internetsexnutzern auf Verhaltensebene zeigen konnten (z.B. Laier et al., 2014). Neurophysiologische Studien mit pathologischen Computerspielern fanden bei der Präsentation suchtrelevanter Stimuli Aktivierungen im ventralen Striatum, die mit Cue-Reactivity und

Craving in Verbindung gesetzt werden. In der vorliegenden Studie wurden neurale Korrelate von Cue-Reactivity und Craving als Reaktion auf die Präsentation pornographischer Stimuli untersucht.

Insgesamt 20 männliche, heterosexuelle Probanden absolvierten ein Reiz-Reaktions-Paradigma, bei dem präferierte und nicht-präferierte pornographische Bilder im fMRT präsentiert und hinsichtlich sexueller Erregung und Präferenz bewertet wurden. Symptome pathologischer Internetsexnutzung wurden über die Kurzversion des Internet Addiction Test (Pawlikowski et al., 2013) erfasst, die für Internetsex modifiziert wurde (Laier et al., 2014).

Auf Verhaltensebene konnte die Präferenz pornographischer Bilder über die subjektive sexuelle Erregung der gezeigten Bilder vorhergesagt werden. Auf neuraler Ebene war die Aktivität im ventralen Striatum bei präferierten Bildern höher als bei nicht-präferierten. Zusätzlich konnte ein positiver Zusammenhang zwischen der Aktivität im ventralen Striatum und Symptomen der pathologischen Internetsexnutzung gefunden werden.

Die Ergebnisse legen nahe, dass die Präsentation von präferierten im Vergleich zu nicht-präferierten pornographischen Bildern unterschiedliche neurale Aktivierungen hervorruft. Die Verbindung zwischen belohnungsassoziierten Hirnarealen (ventrales Striatum) sowie subjektiver Komponenten (sexuelle Erregung und Präferenz) und Symptomen pathologischer Internetsexnutzung deuten auf den suchtspezifischen Charakter des Phänomens hin. Aufgrund der Analogie auf neuraler und subjektiver Ebene zu stoffgebundenen- und Verhaltenssuchten kann somit für eine Klassifikation der pathologischen Internetsexnutzung als Verhaltenssucht argumentiert werden.

Gleich gibt's was zu sehen! Neuronale Korrelate der Antizipation und Verarbeitung visueller sexueller Reize und Assoziationen zum Pornographiekonsum

Wehrum-Osinsky, Sina; Schweckendiek, Jan; Voelske, Anna; Stark, Rudolf

Professur für Psychotherapie und Systemneurowissenschaften, Justus-Liebig-Universität Gießen

Die neuronale Verarbeitung sexueller Reize hat in den letzten Jahrzehnten verstärktes Interesse erfahren. Über die neuronalen Korrelate der Antizipation sexueller Reize ist bislang jedoch noch wenig bekannt. Diese könnten

u.a. im Hinblick auf das umstrittene Konzept der Sexsucht interessant sein: Hier könnten sich Gemeinsamkeiten mit anderen Süchten ergeben, bei denen die Verarbeitung von Hinweisreizen gut belegt ist.

In einer Untersuchung mittels funktioneller Magnetresonanztomographie (n=70; 35 Frauen) wurden sexuelle und neutrale Reize (Fotos und Filmsequenzen) präsentiert und durch Hinweisreize angekündigt (schwarzer Bildschirm, Aufschrift „erotisches/neutrales Bild/Video“). Unmittelbar nach der Reizdarbietung wurde die erlebte sexuelle Erregung sowie der aktuelle Wunsch nach sexueller Aktivität der Probanden erfasst. Zusätzlich wurde das Alter des ersten regelmäßigen Pornographiekonsums (PK) und das aktuelle Ausmaß des Konsums pornographischer Materials erfragt.

Aktivierungen in Strukturen der sexuellen Reizverarbeitung zeigten sich sowohl für sexuelle Reize als auch für sexuelle Ankündigungsreize. Während die Verarbeitung sexueller Reize mit dem Ausmaß des PK assoziiert war (anteriores Cingulum, orbitofrontaler Kortex), konnten sexuelle Ankündigungsreize mit dem Beginn des regelmäßigen PK in Zusammenhang gebracht werden: Im Vergleich zu Probanden mit späterem PK Beginn zeigten Probanden mit frühem Beginn stärkere Aktivierungen in Regionen, die mit der Verarbeitung belohnender/ sexueller Reize assoziiert sind (z.B. Nucleus accumbens).

Die Ergebnisse implizieren, dass sowohl das aktuelle Ausmaß des PK als auch der Beginn des regelmäßigen Konsums die neuronale Responsivität auf sexuelle Reize beeinflusst.

Raum: 1.802

Symposium 4.2: Altruism Neuroscience

Vorsitz: Sabine Windmann

Johann Wolfgang Goethe Universität

Altruism can take rewarding (helping, sharing) and punishing forms (costly acts opposing norm violations and moral transgressions). Both reflect costly behaviors that will benefit others more than oneself. The behavior is puzzling from both economic and evolutionary perspectives proposing the maximization of personal profit and welfare as the ultimate driving force in life and development. With methods from the Neurosciences, psychologists can help to elucidate the proximate mechanisms underlying altruistic motivations and decisions, in the attempt to resolve some of the mysteries surrounding the phenomenon. In this symposium, we will examine the neurobiological mechanisms underlying and predicting altruism.

Variation in ADHD-associated dopamine genes and altruistic punishment in the ultimatum game

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Altruistic punishment – the costly punishment of norm violations without any overt benefit for the punisher, but potentially for other individuals – is a crucial factor for the maintenance of cooperation in larger groups. It has been assumed that altruistic punishment is a deliberate, controlled behavior, as, e.g., virtual lesions of the prefrontal cortex diminish altruistic punishment behavior. On the other hand, it has been argued that altruistic punishment is an impulsive behavior, as, e.g., impulsive choice in a delay-discounting paradigm correlated with altruistic punishment. In the present study, we used an indirect approach to address this controversy by examining two genetic variants that have been identified as risk alleles of attention deficit/hyperactivity disorder (ADHD): the 7-repeat allele in exon III of the dopamine D4 receptor gene (DRD4) and the 10-repeat the 3' UTR of the dopamine transporter gene (DAT1). At three occasions, 98 healthy young participants played an Ultimatum Game, with the minimum acceptable offer serving as a measure of altruistic punishment. Indeed, the self-reported fairness norm

was positively related to minimum acceptable offers. With regard to the genetic effects, we observed a significant effect of the presence of the DRD4 7-repeat allele and an even stronger significant effect of the DAT1 10/10 genotype: Both genotype groups displayed higher minimum acceptable offers. As these alleles have been associated with a rather impulsive psychological condition such as ADHD, our data provide at least indirect evidence in favor of an interpretation of altruistic punishment as an impulsive behavior.

The neural substrate of stable cooperation: evidence from fMRI and EEG recording at rest

Hahn, Tim; Notebaert, Karolien; Anderl, Christine; Reicherts, Philipp; Wieser, Matthias; Kopf, Juliane; Reif, Andreas; Teckentrup, Vanessa; Kaßecker, Anja; Windmann, Sabine

Wolfgang Goethe University Frankfurt

Humans display individual variability in cooperative behavior. While an ever-growing body of research has investigated the neural correlates of task-specific cooperation, the mechanisms by which situation-independent, stable differences in cooperation render behavior consistent across a wide range of situations remain elusive. Addressing this issue, we show in two independent samples that the individual tendency to behave in a prosocial or individualistic manner can be predicted from electroencephalographic (EEG) as well as from functional Magnetic Resonance Imaging (fMRI) connectivities at rest. More specifically, functional connections of the cinguloopercular network and brain-electrical connectivity in the alpha band (7-14 Hz) encode cooperative tendency. Effects of virtual lesions to the cinguloopercular network on the efficacy of information exchange throughout the brain corroborate our findings. These results shed light on the neural mechanisms underlying individualists' and prosocials' habitual social decisions by showing that reliance on the cinguloopercular task-control network predicts stable cooperative behavior. Based on this evidence, we provide a unifying framework for the interpretation of functional imaging and behavioral studies of cooperative behavior.

Single trial theta activity predicts fair dictator offers in altruists

Hewig, Johannes; Rodrigues, Johannes; Ulrich, Natalie
Julius-Maximilians-Universität Würzburg

The present study aimed to examine neurofunctional mechanisms in altruism. In the past decade, midfrontal theta activity has been linked to decision-making and reinforcement learning. Interestingly, recent findings indicated the involvement of frontal midline activity in fair offers in the dictator game. Thus, we used the dictator game, which has been used an indicator of altruistic behavior in the past and where a proposer can share a certain amount of money between himself or herself and a receiver.

Based on a preselection with a questionnaire measure 20 high-level and 20 low level altruists participated in the study. To study situational aspects we manipulated the anonymity of the decision and the income of the receiver on the offer made by the participants as dictators. Additionally, we analyzed single trial midfrontal theta activity prior to the offer.

We found the following effects on the offer made by the dictator: High altruism of the dictator led to higher offers as well as lower income of the receiver. Moreover, the anonymity of the decision further increased offers in high altruists, when they were not observed, and decreased offers in low altruism in this condition. Finally, midfrontal theta activity predicted upcoming fair offers in high altruism, maybe indicating altruistic motivation or empathy on a physiological basis.

A friend in need: time-dependent effects of stress on social discounting

Hangebrauk, Zsofia; Strombach, Tina; van Wingerden, Marijn; Joels, M; Schwabe, Lars; Kalenscher, Tobias
Heinrich Heine Universität Düsseldorf

Acute stress is associated with a tend-and-befriend response, a putative coping mechanism where people behave generously towards others to seek and provide mutual protection. We hypothesized that it would be maladaptive to befriend everyone alike during stressful times. Instead, it would be more advantageous to build and conserve social relationships with only a delimited number of socially close, but not distant individuals. We set out to investigate how stress affects social discounting, i.e., generosity as a

function of social distance between interaction partners, both using a behavioral stress induction procedure (Trier Social Stress Test) and a pharmacological manipulation using Hydrocortisone and Yohimbin. We predicted that the neuroendocrinological changes associated with acute stress would alter the social discount function, particularly affecting generosity towards socially close individuals. Behavioral results show that individuals under acute stress show increased generosity towards socially close individuals compared to a non-stressed control group. Preliminary data from a pharmacological study also confirms the effect of stress hormones on generosity.

Learning empathy towards outgroups

Hein, Grit; Engelmann, Jan; Vollberg, Marius; Tobler, Philippe

Universität Zürich

Deficits in empathy towards individuals who are perceived as outgroup are well documented, and have negative effects in our globalized world. However, so far there are no efficient interventions to counteract this phenomenon. Here, we tested whether participants can learn empathy towards outgroups based on positive experiences with an outgroup individual. The participants inside the fMRI scanner were randomly assigned to an experimental and a control group. During the learning-intervention of the experimental group, the participant received help from an outgroup member, in the control group from an ingroup member. In both groups, we measured the neural response to the pain of the ingroup and the outgroup member before and after the intervention. After the intervention, the ingroup versus outgroup difference in empathy-related brain response in anterior insular cortex significantly decreased in the experimental group, but not in the control group. These changes in empathy were driven by the learning signal which was elicited when receiving help during the intervention. Importantly, learning from one outgroup individual generalized such that it resulted in an increase of empathy towards another representative of the outgroup. Finally, we can show that surprisingly few positive experiences with the outgroup member are sufficient to initiate learning-related changes in neural outgroup empathy. In sum, our results show that learning based on positive experiences is a very efficient way to counteract deficits in empathy towards outgroups, and provide a

novel link between classical learning mechanism and the plasticity of the empathic brain.

Raum: PEG 1.G147

Symposium 4.3: Stress effects on memory: targeting the mechanisms

Vorsitz: Lars Schwabe

Universität Hamburg

Stress is ubiquitous in our daily life and may have a critical impact on our health and well-being. This impact is at least partly due to stress-induced changes in cognition. In particular, stress effects on memory processes are well-known. Whether stress enhances or impairs memory depends critically on the stage of memory that is affected: stress strengthens memory consolidation but appears to impair memory retrieval. Recent research aims to elucidate the mechanisms involved in these effects of stress. The present symposium covers different approaches directed at unravelling the mechanisms underlying the impact of stress on memory, including sophisticated behavioral experiments, EEG, fMRI, and pharmacological manipulations. Together, the presented findings suggest a critical role of the concerted action of glucocorticoids and sympathetic arousal in stress effects on memory and its underlying neural architecture, thus pointing to potential avenues for the modulation of these effects.

Temporal dynamics of stress effects on memory retrieval

Schwabe, Lars

Universität Hamburg

Stress is thought to impair memory retrieval. This stress-induced retrieval impairment has been attributed to the action of the stress hormone cortisol, which increases with a delay of several minutes after a stressful encounter and then exerts both rapid, non-genomic and delayed, genomic effects. To date, most research focused on the impact of rapid cortisol effects on retrieval, yet whether stress-induced cortisol may have longer lasting effects via its genomic actions was unknown. Likewise, it remained unclear whether stress affects retrieval also when memory testing takes place before cortisol is elevated. To address these questions, two experiments varied the interval between stress exposure and retrieval testing. Results of the first experiment showed that stress did not affect memory when retention testing took place immediately after the

stressor, before cortisol levels were elevated. However, memory was impaired both 25 minutes and 90 minutes after stressor exposure. Similarly, the second experiment indicated that stress-induced cortisol correlated with impaired memory performance 25 minutes post-stress. Interestingly, however, when memory was tested under stress and was an integral part of the stressful episode, the autonomic stress response was even associated with enhanced retrieval. In sum, these findings show that (i) the same stressor may have opposite effects on memory retrieval, depending on the presence of autonomic arousal and cortisol and (ii) once cortisol levels are elevated, the associated retrieval impairment may last longer than commonly assumed.

Memory under stress: targeting the temporal dynamics of information processing during encoding and memory retrieval at a 24h delay

Quaedflieg, Conny

Maastricht University

Stress can exert profound effects on memory encoding and glucocorticoids (mainly cortisol in humans) have been shown to play a crucial role in this. Importantly, glucocorticoids are known to exert a time specific dual mode of action. We examined the rapid versus delayed effects of stress and stress-induced elevations in cortisol on information processing during encoding and memory retrieval at a 24h delayed test and its neural basis by combining behavioural measures with electroencephalography (EEG) measurements. Sixty-four participants engaged in the Maastricht Acute Stress Test (MAST) or a no-stress control condition either immediately before (i.e., proximate condition) or 30 min before (i.e., distant condition) a picture encoding task. In general, stress decreased the number of freely recalled and recognized pictures and increased the number of false alarms. However, timing of stress exposure did not differentially affect picture recall, recognition or selective attention processes (i.e., LPP). Nevertheless, stress-induced cortisol responses and correctly recognized neutral pictures were positively associated within the proximate stress condition but negatively associated within the distant stress condition. These findings suggest that the time at which a stressor is applied might differentially impact the association between stress-induced cortisol elevations and memory formation and indicate the need for a finer delineation of the time

window during which glucocorticoids affect memory formation processes.

Acute stress facilitates attention and recollection: emotion and brain potentials

Weymar, Mathias; Schwabe, Lars; Wirkner, Janine; Löw, Andreas; Hamm, Alfons

University of Greifswald

Stressful experiences during learning have been found to promote memory for emotionally arousing events. To investigate the neural mechanisms associated with the role of emotional arousal on stress-mediated memory formation we investigated, in two separate studies, the impact of imminent brief pre-encoding stress (Socially Evaluated Cold Pressure Test; SECPT) on brain dynamics (ERPs) associated with (1) encoding and (2) long-term recognition memory of emotional and neutral pictures. Participants exposed to the SECPT, relative to a warm water procedure, showed enhanced late positive potentials (LPPs; 400-800 ms post-picture onset) during encoding of emotional scenes indicating enhanced attention allocation toward these cues. In addition, enhanced LPP amplitudes for emotional pictures after stress predicted subsequent memory performance (free recall) 24 hours later. In the second ERP study, we found that brief exposure to the SECPT not only affected encoding but also influenced ERPs associated with correct recognition memory measured 2 weeks after encoding. Specifically, imminent stress enhanced the centro-parietal ERP old/new effect (enhanced ERP positivity for old compared to new stimuli), an electrophysiological signature of recollection based remembering, but only for unpleasant stimuli. This old/new difference for emotional pictures was most pronounced in participants reporting high subjective stress experience during exposure to the SECPT. Taken together we found electrophysiological evidence that acute stress around the time of encoding facilitates recollection based emotional episodic long-term memories likely mediated by heightened selective attention and arousal induced by the unpleasant stressor during encoding.

A stress-induced shift between memory systems in humans depends on the mineralocorticoid receptor

Vogel, Susanne

Universität Hamburg

Encountering stressful events triggers a cascade of neural changes which also affect memory. Recent studies showed that stress can change memory quality by shifting the balance of systems underlying learning and retrieval. Under stress, memory is supposedly dominated by ‚habitual‘ forms of learning depending on the striatum and the amygdala. In contrast, stress reduces more ‚cognitive‘ memories centered at the hippocampus. This shift towards habit memory is assumed to be adaptive by enabling rapid learning and recall of simple stimulus-response associations in the face of high external demands. However, it may prove relevant for stress-related mental disorders involving well-learned maladaptive responses to salient cues. While the neural basis of this shift is still quite unclear in humans, some evidence points at cortisol interacting with the mineralocorticoid receptor (MR) to affect functioning of the amygdala, hippocampus, and striatum. We set out to reveal the neural mechanisms underlying a stress-induced shift on memory in humans. Using pharmacological fMRI and a randomized, placebo-controlled, full-factorial between-subjects design, we tested the effects of stress and MR-blockade on spatial and fear memory formation. I will provide evidence for a role of the MR in mediating a stress-induced shift towards brain regions supporting habit-like memories. The stress-induced shift appears to be orchestrated by the amygdala, altering striatal and hippocampal functioning. Together, this leads to a dominance of habit memories in behavior. Importantly, the shift can be prevented by MR-antagonist administration, potentially offering new research avenues into the treatment or prevention of stress-related mental disorders.

Raum: PEG 2.G047

Symposium 4.4: Attentional selection of signals in noise

Vorsitz: Malte Wöstmann

MPI for Human Cognitive and Brain Sciences

How does the brain process relevant signals despite distraction and uncertainty (i.e., noise)? This symposium will take a look at recent magneto- and electroencephalography (M/EEG) findings to reveal the brain dynamics of “attention to” and “prediction of” signals in noise. M. Reiche will show how predictions influence brain mechanisms that guide attention in complex auditory scenes. A. Marzecová will present independent and interactive effects of attention and prediction on the selection of visual targets in noise. S. Passow will relate interindividual differences in attentional control to the concentration of biochemical markers in the brain. M. Wöstmann will show that neural oscillations signify attentional demands of speech comprehension in noise. This symposium combines diverse experimental approaches from young national and international scientists to aid an understanding of the brain mechanisms that enable the attentional selection of relevant signals in complex environments.

The impact of uncertainty on predictive auditory processing

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Predictive processing has been shown to play a crucial role in auditory perception and attention. Predictable parts of a sound mixture can be pre-processed and attenuated, which facilitates the processing of less predictable (hence more informative) parts of the mixture. However, prediction and predictive coding are only necessary if aspects of the sensory input entail a certain degree of uncertainty. In fact, predictability in natural signals is an inverse function of uncertainty. Hence the proposed predictive mechanism is only plausible if it can be shown to dynamically adapt to the certainty provided by the sensory context. We investigated this issue by experimental manipulations of certain-

ty in an event-related potential (ERP) paradigm in which predictability is implemented via frequency repetition in a passive listening situation. In contrast to earlier studies, we systematically manipulated the certainty of predictive relations between tones across conditions using different parameters of (un)certainty, e.g. the overall proportion of possible predictions and the accuracy with which predictions can be made. Results of two independent EEG experiments demonstrate that ERP correlates of predictive processing show graded effects depending on predictive certainty in the sequence. This suggests that the proposed predictive mechanism flexibly adapts to the degree of certainty in the auditory sensory context. The results support a possible role of prediction in guiding auditory attention when a target signal is embedded in a complex auditory scene. However, the exploitation of predictions under ecologically valid conditions is limited by the certainty and accuracy provided by the sensory context.

Interactive effects of attention and prediction on selection of signals

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Attention and prediction are mechanisms that enable selective processing of sensory information. Top-down attention prioritises selection of those information that are relevant for current goals. Prediction facilitates interpretation of sensory data based on information about prior probability. Although attentional selection often relies on prediction, these two sources of top-down influence seem to operate in a distinct fashion and leave dissociable signatures on neural responses. It remains a challenge to characterise how attention and prediction synergistically influence sensory processing. I will present two event-related potentials (ERPs) experiments that analyse the time-course of attention and prediction effects on processing of visual stimuli, ie. sinusoidal gratings embedded in noise. The first study showed both independent and interactive effects of attention, manipulated by trial-by-trial task-relevance cues, and prediction, manipulated by probabilistic

cues. An enhanced amplitude of posterior N1 potential (150–190 ms) was observed for attended gratings, while the main effect of prediction was characterised by a broad fronto-central negativity in the later time window (175–220 ms). Unpredictable gratings elicited larger negativity than predicted ones. As revealed by the interaction between attention and prediction, this effect was magnified in the unattended condition. These results will be contrasted with the second study that looks at the interaction between attention manipulated in the block-wise filtering fashion and prediction of a specific feature (orientation of the grating). The findings will be discussed within the predictive coding framework.

Neural Correlates of Interindividual Differences in Attentional Control of Auditory Perception: Findings from a combined EEG-1H-MRS study

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Mastering challenging listening situations with competing auditory inputs demands cognitive control to focus on relevant information while rejecting irrelevant information. This ability varies considerably, not only across different age groups but also within an age-homogeneous group of young adults. A previous EEG study using dichotic listening (DL) revealed a fronto-central negativity, approximately 450ms after stimulus onset, that is more negative in high demand tasks than in low demand ones (N450 modulation effect). Furthermore, combined functional magnetic resonance imaging and proton magnetic resonance spectroscopy (1H-MRS) studies using the same DL task have shown that the strength of blood oxygen level-dependent (BOLD) signal changes in response to cognitive control demands is predicted by glutamatergic neurotransmission in the anterior cingulate cortex (ACC). The underlying biochemical mechanisms of the N450 modulation effect are still under

investigation. Thus, this talk will present data from a combined EEG and 1H-MRS study examining the relationship between interindividual differences in the concentration of glutamatergic metabolites in the ACC and the N450 modulation effect. We collected data from healthy young adults. In line with previous findings, the N450 amplitude was modulated by cognitive control demand. More crucially, we found a significant positive correlation between glutamate+glutamine (Glx) concentration in the ACC and the magnitude of the N450 modulation effect. This result provides further evidence of a critical role of glutamatergic neurotransmission in attentional control of auditory perception and sheds new light on the underlying neural mechanisms of interindividual differences therein.

Neural oscillations indicate the attentional selection of speech in noise

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Speech in everyday listening situations is often masked by various types of noise, such as competing talkers or environmental noise. Thus, successful speech comprehension critically depends on the attentional selection of relevant speech from the mixture of sounds. I will present data from magneto- and electroencephalography (M/EEG) studies that signify alpha oscillations (~10 Hz) as a neural signature of attentional demand during effortful listening. In a two-talker paradigm, we varied the orthogonal factors acoustic detail and predictability of speech content. We found lower alpha power when the attentional demand decreased with more acoustic detail. Higher predictability of speech content also induced a decrease in alpha power, suggesting that attentional challenges as well as the use of predictive cues to overcome these challenges are reflected in neural alpha oscillations. When we tested healthy older listeners (60–70 years) using the same paradigm, we found that their alpha power was modulated more strongly by varying acoustic detail compared to younger listeners. Altered alpha dynamics thus indicate reduced attentional control in the elderly. To further elucidate the functional significance of alpha oscillations for selective attention, we recorded alpha power using MEG

in a dichotic listening task. Results show that the lateralization of alpha power over the left and right cerebral hemispheres predicts how successfully participants attended to the cued speech stream. In line with current theories on alpha oscillations in the visual modality, I will argue that alpha oscillations reflect auditory selective attention by facilitating and suppressing the neural processing of signal and noise, respectively.

Raum: Festsaal 1

Symposium 5.1: Current Perspectives on Predictive Coding during Perception and Language Processing: From Mice to Men

Vorsitz: Peter Uhlhaas

Perception can be described as an inferential process that combines sensory signals fed forward along the cortical hierarchy with endogenous predictions fed back from higher hierarchical levels. These predictions derive from an internal model that represents the knowledge and beliefs about the outer world, and enable a stable and unitary perceptual experience despite noisy and ambiguous sensory information.

In the current symposium, we will review the relevance of predictive coding for perception and language processing as well as dysfunctions in predictive mechanisms for the explanation of sensory disturbances in schizophrenia. The presentations will cover auditory processing in mouse auditory cortex (Sigurdsson), fMRI during visual perception in humans (Muckli), language processing (Fiebach) and MEG-data in ScZ-patients (Uhlhaas).

Language Processing by Overlapping Predictions: A Predictive Coding Account of Language Processing

Fiebach, Christian

Goethe-Universität Frankfurt am Main

Language is among the highest evolutionary achievements of humans, and poses great demands on the efficiency of perceptual and cognitive systems. Within just a few milliseconds of time, our brain can decode from the auditory signal a multitude of information – phonological, lexical, conceptual-semantic, syntactic – and integrates this information into a mental representation of the communicative context. Neurocognitive models of language have so far conceptualized language processing as a sequence of information processing stages in the brain that proceeds in a strictly bottom-up fashion from sensory to phonological to lexical to conceptual-semantic processing. On the other hand, we know from psycholinguistics that context can override local processing difficulties, calling into question the strict bottom-up view of language processing in the brain. Also, evidence exists that sentences are processed

incrementally, implying that our language system can predict plausible upcoming input based on, e.g., partially processed sentences. In this theoretical talk, I will apply the predictive coding framework to language processing. I propose that at any given time, the brain maintains a constantly updated internal model of the current communicative context that results in multiple parallel predictions from different linguistic levels of representations – phonetic, lexical, semantic, syntactic. This model, termed Language Processing by Overlapping Predictions, can integrate neurocognitive findings (e.g., abundant ERP data obtained from violation paradigms) with psycholinguistic models of incremental parsing, and at the same time makes novel predictions beyond the classical bottom-up conception of how the brain processes language.

Processing of self-generated sounds in the mouse auditory cortex

Sigurdsson, Torfi

Goethe Universität Frankfurt

Many of the sounds that activate our auditory system are caused by our own actions, for example the sound of our footsteps when we walk or our voice when we speak. In order to accurately perceive the outside world, such self-generated sounds must be distinguished from those caused by external sources. Experiments in humans suggest that this is achieved by attenuating responses to self-generated sounds, an example of predictive coding in the brain. Interestingly, this attenuation is impaired in schizophrenia patients and could underlie the hallucinations and delusions observed in the disease. Understanding the neural mechanisms by which self-generated sounds are processed may therefore have implications for understanding the pathophysiology of schizophrenia. Animal models of the disease are likely to prove valuable in this endeavor. To this end, we have developed paradigms to study the processing of self-generated sounds in mice. Our results suggest that, similar to humans, responses to self-generated sounds are attenuated in the mouse auditory cortex. I will also describe experiments aimed at uncovering the mechanisms underlying this attenuation and discuss the application of this experimental paradigm to mouse models of schizophrenia.

Predictive coding of auditory and contextual information in early visual cortex – evidence from layer specific fMRI brain reading

Muckli, Lars

University of Glasgow

David Mumford (1991) proposed a role for reciprocal topographic cortical pathways in which higher areas send abstract predictions of the world to lower cortical areas. At lower cortical areas, top-down predictions are then compared to the incoming sensory stimulation. One question that arises within this framework is the following: Do descending predictions remain abstract, or do they translate into concrete level predictions, the ‘language’ of lower visual areas? We have exploited a strategy in which feedforward information is blocked or absent in parts of visual cortex: i.e. along the non-stimulated apparent motion path, behind a white square that we used to occlude natural visual scenes, or by blindfolding our subjects (Muckli & Petro 2013). By presenting visual illusions, contextual scene information, or by playing sounds, we were able to capture feedback signals to non-feedforwardly-stimulated areas of visual cortex. MVPA analysis of the feedback signals reveals that they are more abstract than the feedforward signal. Furthermore, using high resolution MRI, we found that feedback is sent to the outer cortical layers of V1. We also show that feedback to V1 is induced even by auditory information processing (Vetter, Smith & Muckli 2014). Auditory-induced feedback is especially strong in the periphery of V1, and contains abstract categorical information. I argue that these feedback signals function to provide abstract predictions, i.e. priors in a Bayesian framework, biasing future processing already at an early processing stage of V1.

Local and global predictive processes during mismatch negativity (MMN) in patients with schizophrenia

Uhlhaas, Peter

University of Glasgow

According to hierarchical predictive coding models, the cortex constantly generates predictions of incoming stimuli at multiple levels of processing. Responses to auditory mismatches and omissions are interpreted as reflecting the prediction error when

these predictions are violated. An alternative interpretation, however, is that neurons passively adapt to repeated stimuli.

To test this hypothesis, we carried out an experiment to test prediction mechanisms in ScZ. Participants performed an auditory two-level oddball task (Local-Global paradigm; Wacongne et al., 2011) which is based on local (within trials) and global (across trials) violations of temporal regularities. The brain’s response to such a violation is reflected in the mismatch negativity (MMN), which provides an electrophysiological index of sensory learning and requires intact prediction mechanisms. Analysis of event-related fields revealed that ScZ-patients (N = 18) showed a decreased response to local deviants, which replicates the prominent finding of reduced MMN in ScZ. Importantly, however, the data also clearly indicate that ScZ is characterized by reduced responses to global deviants and omitted sounds, which implicates an impaired prediction mechanism in ScZ.

Raum: 1.802

Symposium 5.2: The neurophysiology of threat processing – From experimental fear to clinical anxiety

Vorsitz: Matthias J. Wieser

Department of Psychology, University of Würzburg

In this symposium, we aim to shed light on the dynamic modulations of sensory processing by threat using different measures of neurophysiology. Schneider presents MEG data which show that gamma band activity in fusiform gyrus and amygdala is related to state anxiety and predictive of anticipated threat. Müller demonstrates that fear-conditioned stimuli show rapid activation of the fusiform gyrus even one year after extinction. Wieser presents ssVEP data in a NPU paradigm on differential processing of unpredictable and predictable contexts. Schulz presents data from a face learning paradigm in patients with social anxiety disorder who show enhanced ERPs in response to emotional faces during initial encoding, but not during subsequent recall. Wessing reports enhanced MEG responses in children with anxiety disorders to threatening faces in early visual processing. Together these studies support the notion of fast, persistent, and clinically relevant threat-biases in sensory processing.

Oscillatory neuronal activity and its role in fear and anxiety

Schneider, Till R.

Universitätsklinikum Hamburg-Eppendorf

Neurocognitive models of anxiety predict enhanced processing of threat-related stimuli especially in anxious individuals. A widely distributed neuronal network including cortical and subcortical regions is suggested to mediate this preferential processing of threat-related stimuli. In behavioral experiments attention was found to be biased towards emotional stimuli in healthy individuals with elevated levels of anxiety. The neuronal mechanisms underlying prioritization of threat-related stimuli are, however, not yet fully understood. In general, high-frequency neuronal activity in the gamma-band is enhanced during processing of emotional and threat-related stimuli. In two MEG studies we investigated the role of gamma-band activity for processing of fear-related stimuli. In the first ex-

periment individual anxiety levels were assessed with the state-trait-anxiety inventory. During presentation of faces with fearful expression high gamma-band activity was found to be enhanced. Interestingly, this enhancement was correlated with the individual level of anxiety in the fusiform gyrus and the amygdala. In the second experiment participants were classically conditioned with aversive stimuli in a partial reinforcement scheme. Power in the high gamma-band gradually increased following the conditioned stimulus in anticipation of the unconditioned stimulus. Thus gamma-band responses were predictive of the anticipated aversive stimuli. The findings suggest an important role of oscillatory neuronal activity for emotional processing and the attentional bias to threat. The results provide novel evidence for the neurocognitive model of anxiety by characterizing oscillatory neuronal activity associated with individual levels of anxiety.

One-year-old fear memories rapidly activate human fusiform gyrus

Mueller, Erik M.; Pizzagalli, Diego A.

Justus-Liebig-Universität Gießen, Germany

Threat-signaling fear-conditioned visual stimuli have been found to rapidly (< 80 ms) activate visual brain regions including the fusiform gyrus (FG) on the conditioning day. Whether remotely fear conditioned stimuli (CS) evoke similar early processing enhancements is unknown. In the current study, 16 participants who underwent a differential fear-conditioning and extinction procedure on day 1 were presented the initial CS 24h after conditioning (recent recall test) and 9-17 months later (remote recall test) while EEG was recorded. Using a data-driven segmentation procedure of CS evoked event-related potentials, five distinct microstates were identified for both the recent and the remote memory test. To probe intracranial activity, EEG activity within each microstate was localized using low resolution electromagnetic tomography analysis (LORETA). In both the recent (41-55 ms and 150-191 ms) and remote (45-90 ms) recall tests, fear conditioned faces potentiated rapid activation in proximity of FG, even in participants unaware of the contingencies. When previously extinguished fear stimuli were presented, this early FG enhancement was attenuated in the recent, but not remote, memory test. These findings suggest that rapid processing enhancements of conditioned threat signals (a)

persist over time and (b) can be (temporarily) reduced by extinction.

Disentangling attentional mechanisms during predictable and unpredictable threat: A frequency-tagging ssVEP approach

Wieser, Matthias J.; Reicherts, Philipp; Juravle, Georgiana; von Leupoldt, Andreas

Universität Würzburg

Fear and anxiety are functionally different defense states mediated by distinct brain structures. Whereas fear is elicited by imminent threat and leads to a phasic fear reaction, anxiety is characterized by a sustained state of heightened vigilance due to temporally uncertain danger. In the present study we sought to investigate whether fear and anxiety are associated with different states of attentional vigilance as measured by visuocortical facilitation. To this end, we employed a NPU-paradigm together with ssVEPs and frequency-tagging methodology. We investigated ssVEPs across three context conditions (30 sec): no aversive events (N), predictable aversive events (P), and unpredictable aversive events (U) signaled by a grid of four peripheral objects. Short-duration cues (Gabor patches) were presented for 3 seconds several times in each condition. Aversive events were signaled by the cues in the P condition but were presented randomly in the U condition. Importantly, cues and context events were flickered at different frequencies (15 Hz vs. 20 Hz) in order to disentangle electrocortical responses to contexts and cues. As expected, the onset of the context elicited larger electrocortical responses for the U compared to the P context in the first 1000 ms. Conversely, P cues elicited larger electrocortical responses compared to the N and U cues. Interestingly, during the presence of the P cue, visuocortical processing of the concurrent context was also enhanced. The results support the notion of enhanced hypervigilance to unpredictable threat, while predictable cues show electrocortical enhancement of the cues themselves but additionally a boost of context processing.

Emotional face learning in social anxiety disorder tracked by event-related potentials

Schulz, Claudia; Hagemann, Julian; Straube, Thomas

Westfälische Wilhelms-Universität Münster

Face perception and face recognition are crucial abilities for everyday interactions. Interindividual differences in face learning can be observed in several event-related potential (ERP) correlates of face perception. For people suffering from social anxiety disorder (SAD), with about 12% a highly prevalent disorder, faces constitute an important, disorder-related category of stimuli. Patients show attentional and interpretational biases; however, it is not yet clear whether they also display changes in face memory due to potential changes in initial perception. Such a memory bias could be affected by the emotional expression of the face, if it is threatening. Therefore, patients with SAD and healthy controls (HC) participated in a learning study, in which they had to learn a larger number of individuals from emotional faces (happy, angry, neutral) and later recognize them from a neutral image. EEG was recorded throughout learning and test. Behaviorally, we observed a main effect of emotion on accuracies and response times, but irrespective of participant group. During the learning phase, we observed effects of face emotion on P1, N170, P2, N250 and LPC, predominantly in SAD. However, in the test phase, an N250 familiarity effect proceeded to LPC, while a difference by group was no longer present. These data reveal enhanced processing of emotional faces in SAD during several stages of initial encoding. Interestingly, and in contrast to previous learning studies, these differences do not influence face memory, as they neither affect recognition performance, nor show up in ERPs associated with face recognition.

Threat-processing in Children with Anxiety Disorders: Vigilance-Avoidance indicated by MEG-based source localization

Wessing, Ida; Romer, Georg; Junghöfer, Markus

Universitätsklinikum Münster

An altered pattern of threat-processing is assumed to play a role in the development of anxiety disorders (AD). According to a vigilance-avoidance hypothesis, AD patients show heightened vigilance to threat cues at early, but avoidance at later stages of processing. EEG studies

indeed show enhanced threat-processing in early and reduced threat-processing in late time intervals in adults with AD. The present study investigated if this can already be observed in children. Children with AD and healthy control (HC) children saw faces with angry and neutral expressions while whole-head magnetoencephalography was recorded. Distributed neural sources were estimated based on L2-Minimum-Norm inverse source modelling. ANOVAs with the factors expression (angry vs neutral) x group (AD vs HC) were calculated for each time point and neural source and spatio-temporal cluster of significant effects after correction for multiple comparisons were determined. Cluster showing significant expression x group interactions occurring in early (50-150 ms) and late time intervals (300-700ms) were then submitted to an ANOVA with the additional factor time (early vs late). Clusters showing expression x group x time interactions were localized in the occipital cortex (OCC) and in the right dorsolateral PFC. In the OCC, AD children showed the expected enhanced threat-processing in the early but not late time interval, while HC children showed enhanced threat-processing only in the late time interval. In the right dlPFC, a reverse pattern of threat-processing was observed. These results support the vigilance-avoidance hypothesis of threat-processing in children with AD and suggest that this effect may be based on an interaction of right dlPFC and OCC.

Raum: PEG 1.G147

Symposium 5.3: Lernen und Entscheiden unter Stress: Eine psychoneuroendokrinologische Perspektive

Vorsitz: Oliver T. Wolf

Ruhr-Universität Bochum

Im Alltag müssen wir regelmäßig unter Stress lernen und entscheiden. Doch wie wird unser Lernen und Entscheiden durch Stress beeinflusst?

Das vorliegende Symposium präsentiert hierzu Befunde aus laborexperimentellen Studien, in welchen die Auswirkungen von Stress und Stresshormonen auf Lern-, Gedächtnis-, und Entscheidungsprozesse untersucht werden. Im Fokus stehen die Rollen der Hormone des sympathischen Nervensystems (SNS) und der Hypothalamus-Hypophysen-Nebennierenrindendachse (HHNA). Insgesamt werden fünf Präsentationen die Themen Stress und Lernen (Glienke), Stress und Extinktion (Hamacher-Dang), Stress(hormone) und Gedächtnis (Kühl), Stress und Entscheidungsfindung (Starcke) und Stresshormone und Verlustaversion (Hangebrauk) behandeln.

Die Präsentationen dokumentieren den Fortschritt in diesem sich rasch entwickelnden Feld und tragen zu einem besseren Verständnis der komplexen Effekte von akutem Stress auf menschliches Handeln und Entscheiden bei.

Psychosozialer Stress und sein Einfluss auf die elektrophysiologischen Korrelate der Verhaltensanpassung

Glienke, Katharina; Bellebaum, Christian; Wolf, Oliver T.

Universität Witten/Herdecke

Stress gilt als Einflussfaktor bei verschiedenen Formen des Lernens, allerdings berichtet der gegenwärtige Stand der Forschung vor allem über den Einfluss auf deklarative Lernformen. In der aktuellen Studie wird der Einfluss von psychosozialem Stress auf feedback- basiertes Lernen und dessen elektrophysiologische Korrelate untersucht. Getestet wurden insgesamt 40 gesunde Männer, welche in 2 Gruppen mit je 20 Probanden unterteilt wurden. In einer der Gruppen wurde Stress mittels des sozial evaluierten Kaltwassertests induziert, während die andere Gruppe eine Kontrollbedingung durchlief. Beide Gruppen absolvierten im Anschluss ein feedback-basiertes Lernpara-

digma, welches sowohl kontingente Lernbedingungen, als auch eine nicht-kontingente Bedingung umfasste. Während der Lernaufgabe wurde die neuronale Aktivität mittels Elektroenzephalographie abgeleitet. Im Hinblick auf das Lernparadigma konnte sowohl die feedback-related negativity (FRN) als auch die error-related negativity (ERN) parallel erfasst werden. Im Lernverhalten zeigten sich keine Unterschiede zwischen Stress- und Kontrollgruppe. Allerdings zeigten die gestressten Probanden im Vergleich zu den nicht gestressten Probanden signifikant erhöhte FRN Amplituden nach negativem Feedback. Des Weiteren spiegelte der Amplitudenunterschied bei gestressten Probanden die Feedback-Kontingenz stärker wider als bei den Kontrollprobanden.. Für die ERN konnte kein statistisch signifikanter Unterschied zwischen Stress- und Kontrollgruppe festgestellt werden. Stress scheint somit die neuronale Sensitivität gegenüber negativem Feedback im Rahmen der Verhaltensanpassung zu erhöhen.

Modulation von Extinktionsgedächtnisprozessen durch Stress

Hamacher-Dang, Tanja; Wolf, Oliver T.

Ruhr-Universität Bochum

Die Extinktion von erworbenen Assoziationen zwischen Reizen und bestimmten Konsequenzen erfolgt durch die wiederholte Präsentation eines Reizes bei Wegfall der damit verbundenen Konsequenz und führt zum Abbau konditionierter Reaktionen auf diesen Reiz. Wenn jedoch eine Veränderung des Kontextes nach der Extinktion eintritt, kann dies zu einem Wiederauftreten der konditionierten Reaktion führen (Renewal-Effekt). Dieser und andere Wiederauftretens-Effekte deuten darauf hin, dass das Extinktionslernen nicht zur vollständigen Löschung der konditionierten Reaktion, sondern zur Bildung einer zweiten Gedächtnisspur führt, die beim Abruf mit der ursprünglichen Assoziation konkurriert. Aus Studien zum deklarativen Gedächtnis ist bekannt, dass Stress i.d.R. den Gedächtnisabruf beeinträchtigt, während er förderliche Effekte auf die Konsolidierung ausübt. Dies wurde bisher noch nicht systematisch für Extinktionsgedächtnisprozesse erforscht. In drei Studien wurde daher an gesunden Studierenden im Rahmen einer prädiktiven Lernaufgabe mit wechselnden kontextuellen Hinweisreizen untersucht (Lernphase an Tag 1, Extinktion an Tag 2, Abruf/Renewal-Test an Tag 3), wie eine kurze Stressinduktion

das Extinktionsgedächtnis beeinflusst. Der Zeitpunkt der Stressinduktion wurde gezielt variiert (vor dem Abruf in Studie 1, nach dem Extinktionslernen in Studie 2 und vor dem Extinktionslernen in Studie 3); Speichelcortisol- und Blutdruckwerte wurden erfasst. Die Ergebnisse zeigen, dass Stress Extinktionsgedächtnisprozesse phasen- und kontextabhängig moduliert und leisten einen Beitrag zum besseren Verständnis der Einflussfaktoren, die auf das Extinktionsgedächtnis einwirken – ein Befund, der ebenso für die klinische Anwendung von Relevanz ist.

Einfluss von Mineralocorticoidrezeptor-Stimulation auf kognitive Prozesse

Kühl, Linn; Hinkelmann, Kim; Wingefeld, Katja; Otte, Christian

Charité – Universitätsmedizin Berlin

Ein Einfluss des Stresshormons Cortisol auf kognitive Funktionen konnte in vielen Studien gezeigt werden. Cortisol bindet auf zentraler Ebene sowohl an Glucocorticoid- als auch an Mineralocorticoid-rezeptoren. Neben der Rolle des Glucocorticoidrezeptors für kognitive Prozesse wird zunehmend auch die Rolle des Mineralocorticoidrezeptors (MR) untersucht. In einer vorherigen Studie konnte unsere Arbeitsgruppe zeigen, dass eine MR-Blockade zu einer Verschlechterung von nonverbalen und Arbeitsgedächtnisprozessen führte. In der aktuellen Studie wurde nun der Einfluss einer MR-Stimulation durch Gabe des MR-Agonisten Fludrocortison bei gesunden jungen und älteren Probanden untersucht. 31 junge und 22 ältere Probanden erhielten entweder Fludrocortison oder ein Placebo und wurden in einem randomisierten, doppel-blinden, messwiederholten Design untersucht. Getestet wurden Arbeits-, verbales und nonverbales Gedächtnis. Wie zu erwarten, zeigten die jungen Probanden signifikant bessere Ergebnisse als die älteren. Außerdem zeigte sich über die Gruppen hinweg ein signifikanter Manipulationseffekt, der auf eine verbesserte Gedächtnisleistung nach Gabe von Fludrocortison hinweist. Unsere Ergebnisse unterstützen damit Vorbefunde, die für eine wichtige Rolle des MR für kognitive Prozesse sprechen. Dies passt auch zu weiteren Ergebnissen aus aktuellen Studien unserer Arbeitsgruppe, in denen wir die Rolle des MR hinsichtlich kognitiver Prozesse bei verschiedenen Patientengruppen untersucht haben.

Effekte von Stress auf die Entscheidung eine Sicherheitsvorschrift zu missachten

Starcke, Katrin; Brand, Matthias; Kluge, Annette

Universität Duisburg-Essen

Experimentelle Studien zeigen, dass Stress Entscheidungen beeinflussen kann. Zusätzlich zeigen Fragebogenstudien, dass Stress mit Regelverletzungen im Arbeitskontext zusammenhängt. In der aktuellen Studie wird der Einfluss von laborinduziertem Stress auf nachfolgendes Entscheidungsverhalten in einer komplexen arbeitspsychologischen Entscheidungsaufgabe untersucht.

In der Waste Water Treatment Simulation Task (WaTr Sim) lernen Probanden zunächst, wie Wasser und Giftstoffe in einer komplexen Simulationsumgebung voneinander getrennt werden. In den anschließenden Entscheidungsdurchgängen werden sie instruiert, dabei eine Sicherheitsvorschrift zu beachten. Verletzungen dieser Sicherheitsvorschrift sind mit potentiell hohen Gewinnen (schnellere Arbeit, höherer Umsatz) assoziiert, bergen aber auch das Risiko einer Katastrophe (Explosion im Wasseraufbereitungswerk). Das Risiko des Eintretens der Katastrophe beträgt 20%. In der Stressgruppe ($n = 24$) wurde mit dem Trier Social Stress Test (TSST) Stress induziert, die Kontrollgruppe wurde einer Ruhebedingung (Plazebo-TSST) ausgesetzt. Zur Messung der Stressreaktionen wurden Speichelcortisol und Fragebögen verwendet. Es zeigt sich, dass in der Stressgruppe mehr ProbandInnen die Sicherheitsvorschrift missachten als in der Kontrollgruppe $\chi^2(1, N = 53) = 3.98, p = .046, V = .27$. Allerdings wird dieser Effekt ausschließlich durch die weiblichen Probandinnen verursacht $\chi^2(1, N = 24) = 10.36, p < .001, V = .66$.

Wir schlussfolgern, dass Stress die Entscheidung gegen die Sicherheitsvorschrift verstärkt, weil gestresste Probandinnen auf die potentiell hohen Gewinne fokussieren und mögliche negative Konsequenzen vernachlässigen.

Der Effekt exogener Manipulation von Cortisol und Noradrenalin auf Verlustaversion

Hangebrauk, Zsofia; Kalenscher, Tobias

Heinrich Heine-Universität Düsseldorf

Akuter Stress führt zu erhöhter Aktivität in glukocorticoiden und noradrenergen Systemen. Die Rolle von Glucocorticoid-Aktivität auf Kognition ist in rezenten

Studien untersucht worden. Erhöhte Cortisol-Niveaus verändern via glucocorticoid-Rezeptoren in limbischen und präfrontalen Hirnregionen kognitive und emotionale Prozesse, darunter Risikoverhalten, Gedächtnisabruf und zielgerichtetes Verhalten. In finanziellen Entscheidungssituationen wurde gezeigt, dass akuter Stress die Sensibilität gegenüber prospektiven Verlusten reduziert und dass die Reduktion in Verlustaversion mit stress-relatierten endogenen Cortisolanstieg korreliert. Darüberhinaus wurde gefunden, dass die exogene Gabe von Cortisol die Risikoeinstellung bei finanziellen Entscheidungen erhöht. Nur wenige Studien haben jedoch den kombinierten Einfluss von Cortisol und Noradrenalin auf Entscheidungen unter Risiko untersucht. In der vorliegenden Studie wurden sowohl Cortisol als auch Noradrenalin pharmakologisch manipuliert, um die Haupt- und Interaktionseffekte der Hormonmanipulation auf Verlustaversion und Risikoeinstellung bei finanziellen Entscheidungen zu untersuchen. Im Einklang mit neurobiologischen Theorien zum kombinierten Einfluss dieser Stress-Hormone auf kognitive Fähigkeiten erwarten wir, dass Cortisol und Noradrenalin dissoziierbare Haupt- und Interaktionseffekte auf entscheidungsrelevante mentale Prozesse haben, die der Verlustaversion zu Grunde liegen.

Raum: PEG 2.G047

Symposium 5.4: Studying language-related processes with functional near-infrared spectroscopy (fNIRS)

Vorsitz: Thomas Dresler¹ & Hellmuth Obrig²

¹Universitätsklinikum Tübingen, ²MPI for Human Cognitive and Brain Sciences

The use of language – either in its spoken or written form – represents the most sophisticated form of human communication and its formal rule acquisition is complex and challenging. In this symposium, the speakers will present original research that investigated different language-related processes using the optical imaging technique of functional near-infrared spectroscopy (fNIRS), which is now increasingly used in neurocognitive research. The symposium aims at showing the manifold application in various settings and illustrating the advantages of fNIRS especially on this topic. The speakers will cover a broad spectrum from early-age developmental pathways, such as phonotactic competence, to reading processes to more complex rule-learning mechanisms in second language learning. In addition to normative language processes, the investigation of aberrant language processes in schizophrenia will be addressed.

Investigating language acquisition by non-invasive optical imaging (fNIRS) and EEG.

Obrig, Hellmuth; Richter, Maria; Rossi, Sonja

MPI for Human Cognitive and Brain Sciences, Leipzig

Infants acquire language with a surprising speed and efficiency. This requires the extraction of regularities and meaning from the auditory stream of the native language, supplied by their environment. Prior to the acquisition of words (lexico-semantics) and long before infants understand or even produce meaningful sentences (syntax), infants are masters in extracting more basic regularities from the input. Some of these regularities relate to the sound inventory of a given language. Apart from phoneme discrimination and the tuning into the native phonetic inventory, phonotactic regularities may be of relevance during the first steps into language competence. They may ease segmentation of the auditory stream and - in the com-

petent speaker - they ease lexical access. Governing the potential combinations of sounds at different word positions phonotactic rules help to find word boundaries (e.g. the phoneme cluster /MR/ cannot be the onset of a word in English, German, Dutch or French whereas /TR/ can). In a number of experiments we have investigated how infants of different ages process different phonotactic regularities (native versus non-native). I will present studies in which we used fNIRS and/or EEG to elucidate the developmental path of phonotactic competence. Additionally I will present studies using fNIRS looking at even more basic auditory feature processing and at some aspects of lexico-semantic learning, which are relevant much later in language development.

Occipital and orbitofrontal haemodynamics during naturally paced reading

Hofmann, Markus J.¹; Dambacher, Michael²; Jacobs, Arthur M.³; Kliegl, Reinhold²; Radach, Ralph¹; Kuchinke, Lars⁴; Plichta, Michael M.⁵; Fallgatter, Andreas J.⁶; Herrmann, Martin J.⁷

¹Bergische Universität Wuppertal, ²University of Potsdam, ³Free University Berlin, ⁴Ruhr-University Bochum, ⁵Medical Faculty Mannheim, ⁶University of Tuebingen, ⁷University of Wuerzburg

Because humans read at incredibly fast rates, the high temporal resolution of NIRS can help to disentangle haemodynamic responses of subsequent words even at a natural reading pace. By presenting words every 280 ms, we found a lower occipital deoxygenation to words unpredictable from sentence context in comparison to predictable words. Greater haemodynamic responses to unexpected words suggest that the visual features of expected words have been pre-activated previous to stimulus presentation, as suggested by a recent neurocognitive process model [1]. In addition, we tested opposing theoretical proposals about the role of the medial orbitofrontal cortex (OFC): Either the OFC may respond to the breach of expectation; or the OFC is activated when the present stimulus matches the top-down prediction. A significant interaction between word frequency and predictability indicated OFC responses to breaches of expectation for low-frequency words. When more bottom-up information is available in high-frequency words, in contrast, the OFC tends to engage greater neural activation to high- than to low-predictability words thus indexing a matching prediction [2].

1. Hofmann & Jacobs, *Neuroscience & Biobehavioral Reviews*, 2014
2. Hofmann et al., *NeuroImage*, 2014

The production of inflected verbs in native and non-native speakers – a NIRS study

Wartenburger, Isabell; Jacob, Gunnar; Mutyala, Rithwik; Clahsen, Harald
University of Potsdam

Behavioural studies investigating the processing of inflected verb forms in an L2, i.e. a late-learned non-native language, have come to different conclusions about whether L2 processing is qualitatively different from native (L1) processing. Some studies [1,2] suggest that the L1 processing of regular verbs is based on (de-)composition of stems and affixes, while irregular verbs have whole-word representations. L2 speakers, in contrast, are assumed to process both regular and irregular verbs via full-form access. Other studies [3,4], however, did not find differences between L1 and L2 processing. In a NIRS experiment, we investigated which brain regions are involved in the production of regular vs. irregular verb forms in English. In a blocked design, 15 L1 and 15 highly-proficient L2 speakers of English silently produced past-tense or – as controls – present-tense forms [5]. NIRS data were recorded with 16*16 optodes covering the left and right frontal and temporal brain regions (NIRScout™, NIRx). A mixed-effects ANOVA revealed a significant 3-way interaction between Group, Condition, and region of interest (ROI), which was due to more activation for irregular than regular past-tense production in the left temporal ROI for L1 speakers and the opposite effect for L2 speakers, i.e. more activation for regular past-tense forms. There were no effects for the present-tense control conditions showing that these L1/L2 differences are specific to past-tense formation. The results indicate (a) different brain-activation patterns for L1 and L2 speakers in producing past-tense forms and (b) more effort in applying the –ed past-tense formation rule for L2 than for L1 speakers.

1. Neubauer & Clahsen, *Studies in Second Language Acquisition*, 2009
2. Jacob, Fleischhauer & Clahsen, *Bilingualism: Language and Cognition*, 2013
3. Feldman et al., *Bilingualism: Language and Cognition*, 2010

4. Coughlin & Tremblay, *Bilingualism: Language and Cognition*, 2013
5. Budd et al., *Brain and Language*, 2013

Investigating aberrant language processing in schizophrenia using combined EEG-fNIRS measurements

Dresler, Thomas; Schneider, Sabrina; Ehlis, Ann-Christine; Fallgatter, Andreas J.
University of Tuebingen

A well-known type of language comprehension deficits in patients with schizophrenia refers to difficulties in correctly interpreting and understanding non-literal (i.e. figurative) speech. The simultaneous application of neuroimaging methods combining high temporal and spatial resolution can uniquely help to elucidate the neurobiological background of these impairments. In two subsequent studies, electroencephalography (EEG) and functional near-infrared spectroscopy (fNIRS) measurements were conducted simultaneously in order to jointly assess neural (event-related potentials/ERPs) and haemodynamic (cortical oxygenation changes) activity during figurative language processing in healthy subjects and schizophrenia patients. In the first study, 20 healthy subjects judged sentences that were literal, figurative, or meaningless, with respect to their meaningfulness. Here, we found figurativeness-specific variations in early ERPs (P200 and N400) as well as haemodynamic responses within the left inferior frontal cortex. In the second study, the same language paradigm and EEG-fNIRS measurements were used in a sample of schizophrenic patients and a healthy control group (each N=22). Schizophrenic patients showed deficient and delayed sentence comprehension. Moreover, both the N400 and left-hemispheric activation during sentence processing were altered in patients. Correlation analyses showed that ERPs and haemodynamic activity were strongly linked in healthy subjects, but not in patients. Our findings indicate that combined EEG-NIRS applications are useful to depict cortical neural and haemodynamic activation anomalies in schizophrenic patients that are related to language processing deficits.

Raum: Festsaal 1

Symposium 6.1: The oscillatory brain and its functions: news and views

Vorsitz: Christian Keitel & Anne Keitel

University of Glasgow

The human brain generates rhythms in characteristic frequency bands. Their explanatory use in the cognitive neurosciences has increased dramatically over the last decades. To date, a vast literature describes relationships between dynamics of brain rhythms and aspects of perception and cognition – including attention and consciousness – as well as behavioural performance. However, our knowledge about the characteristics, prevalence, and functional role of oscillatory activity is still limited.

Brain rhythms thus take centre stage in our symposium as we discuss the following issues: How has research into intrinsic as well as stimulus-driven neural rhythms shaped our current understanding of the human brain? Can we treat stimulus-driven and intrinsic rhythms as equivalent? How can we use oscillatory signatures of intrinsic rhythms to characterise brain regions and their functional connections and, finally, what role does neural plasticity play in altering functional connectivity?

Forgotten rhythms: a selective review of early EEG literature

Quigley, Clíodhna

German Primate Center Göttingen

It is textbook knowledge that alpha waves were the first observed phenomenon in Hans Berger's electroencephalogram recordings in the 1920s. These intrinsic brain rhythms were subsequently investigated in several labs around the world, with quite sophisticated custom-made analysis and stimulation devices. Widespread interest in their functional role eventually waned and oscillatory activity went out of fashion until the late 1980s, when parallel recordings with multiple electrodes revealed synchronous patterns in neuronal firing. Although the focus has since broadened from gamma to lower frequencies including alpha, the work published in the first half of the 20th century has been largely forgotten. In this talk, I will review findings from early EEG investigations into the character, origin, and meaning of brain rhythms. In or-

der to demonstrate the value of looking at this “outdated” literature, I will focus on results that are relevant to our current understanding of brain oscillations.

Flexible neural oscillators: EEG-stimulus locking to near-periodic visual flicker

Keitel, Christian; Thut, Gregor; Gross, Joachim

University of Glasgow

Current research frequently refers to visual stimulus-driven neural rhythms as phase-locked “entrainment” of intrinsic oscillators in the alpha frequency range (8-13 Hz) of the human EEG/MEG. This assumed identity suggests that visual perception can easily be hi-jacked by stimuli flickering with frequencies around 10 Hz when considering the functional role ascribed to the alpha rhythm. We critically review arguments for this view and present data of two experiments that aimed at a more comprehensive characterisation of stimulus-driven neural oscillators. Both EEG experiments measured brain responses to quasi-periodic visual stimulation whose frequency varied over time in a random (Experiment 1) or monotonous fashion (Experiment 2). We found that the visual system was able to follow the frequency changes of the stimulation, thus, demonstrating an unbeknown flexibility of cortical oscillators. Moreover, in Experiment 1, not only alpha band but theta- (4-7 Hz) and beta- (15-20 Hz) band restricted stimulation likewise elicited frequency-following responses. While contributing to a better understanding of the relationship between intrinsic and stimulus-driven brain rhythms our data can also serve practical purposes: Current developments in frequency-tagged multi-element brain-computer interfaces may benefit from implementing a more flexible and time-varying choice of stimulation frequencies even within specific frequency bands.

Characteristic spectral profiles of human brain areas

Keitel, Anne; Gross, Joachim

University of Glasgow

The human brain can be parcellated into diverse anatomical areas, each with its specific cytoarchitectonic structure and connectivity. This specialisation might also be expressed in different patterns of oscillatory activity. The aim of the present study was to comprehensively characterise

these ‘spectral profiles’ of anatomical areas. To this end, we analysed MEG data of 22 healthy adults that were recorded for approximately 7 minutes during rest. Complex sensor-level Fourier spectra for frequencies between 1 and 120 Hz were computed and projected into source space by using an LCMV beamformer. We used the AAL (Automated Anatomical Labeling) atlas to partition the brain into anatomical areas. Power spectra of 1-second long data segments for each of the 115 atlas-defined brain areas were then grouped into distinct clusters, using k-means and Gaussian mixture clustering algorithms. Within and between anatomical areas, clusters demonstrated diverse spectral profiles. The number of clusters and their peak frequencies differed considerably between areas. Our results suggest that, first, brain areas can be distinguished based on their resting state spectral profiles, and second, individual brain areas engage in different ‘functional modes of activity’ during rest.

The other side of power? How connectivity helps understanding the role of brain oscillations in consciousness.

Ruhnau, Philipp; Weisz, Nathan

Universita degli Studi di Trento

Brain oscillations are accepted as an index of cognitive processing. Experimental modulations of, for instance, alpha (~10Hz) oscillatory power have been found to be related to many cognitive functions such as working memory, attention, and also conscious perception. Most studies, however, have stressed a local role of oscillations, as an index of activity in task relevant areas. In this mindset alpha often is interpreted to reflect (active) cortical inhibition. This view is neat and offers clear predictions and interpretations; however, in a wide network such as the brain it has some shortcomings. I will try to emphasize the importance of investigating network connections in oscillatory bands. To illustrate this point, I will focus on data testing our framework ‘windows to consciousness’, which shows that network effects prior to a sensory stimulus can predict its perceptual fate.

Working memory training changes large-scale interactions in the brain - Insights from a visual deprivation model

Rimmele, Johanna; Gudi, Helene; Nolte, Guido; Röder, Brigitte; Engel, Andreas K.

Universitätsklinikum Hamburg-Eppendorf

We investigated whether changes in large-scale interactions are one mechanism of neuroplasticity. Congenitally blind (CB) and sighted control (SC) participants took part in a working memory (WM) training study. SC participants were matched in age, gender, education and handedness with the CB sample. Participants either underwent (1) a WM training with voices, (2) a WM training with tactile stimuli or (3) an active control task. Prior to (pre) and after the training (post), magnetoencephalography (MEG) and behavioral responses were recorded while participants performed an auditory WM task (2-back task).

In a comparison of pre-post training related connectivity (using imaginary coherency) changes between the CB and SC samples, we found a stronger increase in fronto-occipital beta-band connectivity in the CB compared to the SC sample. Connectivity increased in the auditory trained compared to the control group in the blind, whereas no significant changes were observed in the sighted sample.

Our findings suggest that in congenitally blind adults, brain areas of the deprived visual cortex are integrated into existing networks, and therefore are testimony to the crucial role of synchrony-mediated large-scale interactions as mechanism of neuroplasticity.

Raum: 1.802

Symposium 6.2: Molecules of change: Investigating endocrine influences on brain and behavior

Vorsitz: Christine Anderl & Sina Radke

RWTH Aachen University

Individuals constantly need to adjust to changing situational and personal demands. Hormones can be considered a likely candidate to support this flexible neurobehavioral adaptation, as recent biopsychological research suggests (1) that hormones influence a wide range of human behaviors through activation of hormone receptors in the brain and (2) that endogenous hormone levels themselves dynamically change depending on context.

Addressing this notion, the present symposium will bring together both results from administration studies and findings on endogenous changes in hormone levels with behavioral, psychophysiological and neuroimaging data. Insights into various functions, i.e., fear conditioning (M. Eckstein), emotion recognition (G. Domes), strategic gambling (C. Eisenegger), stress responses (B. Derntl) and cooperation (C. Anderl), will provide a framework for discussion about the context-dependency of endocrine modulations and potential clinical implications.

Oxytocin facilitates the extinction of conditioned fear in humans

Eckstein, Monika; Becker, Benjamin; Scheele, Dirk; Scholz, Claudia; Preckel, Katrin; Schlaepfer, Thomas E.; Grinevich, Valery; Kendrick, Keith M.; Maier, Wolfgang; Hurlemann, René

Universitätsklinikum Heidelberg

Emotional / fear learning is an adaptive process allowing the quick detection and prediction of threat. However, in an ever changing environment it is also essential to flexibly readjust learned fear behavior when circumstances change. Previously acquired fear responses gradually decline when the fear-associated stimuli is repeatedly presented in the absence of threat. This active learning process, termed extinction learning, crucially depends on the interaction between the amygdala and prefrontal cortex (PFC). Disrupted extinction learning may contribute to the development of anxiety disorders. Furthermore, ex-

tingtion learning is the main mechanism underlying exposure therapy.

Across species the mammalian neuropeptide oxytocin (OXT) modulates neural fear circuits, including the amygdala and the PFC. Translational research suggests that OXT might augment extinction learning. In the present randomized placebo-controlled trial we examined, whether OXT can modulate extinction learning in humans. After successful Pavlovian fear conditioning of social (faces) and non-social (houses) stimuli, 62 healthy subjects were randomized to the administration of either 24 UI of intranasal OXT or placebo before extinction training. OXT increased the decline of skin conductance responses from early to late extinction trials. During early extinction OXT increased PFC activity and functional coupling between the PFC and the precuneus / posterior cingulate. In line with OXTs proposed anxiolytic effects OXT generally dampened amygdala reactivity. Notably, these effects were not modulated by the social content of the stimuli.

The present findings provide the first direct evidence that OXT can facilitate extinction learning in humans and suggest that OXT might be a potential pharmacological augmenting agent for extinction-based therapies.

Effects of exogenous oxytocin on face and emotion processing in autism spectrum disorder

Domes, Gregor; Kanat, Manuela; Heinrichs, Markus

Albert-Ludwigs-Universität Freiburg

The neuropeptide oxytocin has recently been shown to enhance eye gaze and emotion recognition in healthy men. Regarding the role of oxytocin in autism spectrum disorders (ASD), some studies have shown that genetic variations of the oxytocin receptor might play a role in the pathogenesis. In addition, beneficial effects of exogenously administered oxytocin on ASD symptoms have been reported.

To investigate the neural underpinning of oxytocin-induced improvement in facial emotion recognition in ASD, we conducted a randomized double-blind, placebo-controlled trial that examined the neural and behavioral effects of a single dose of intranasal oxytocin on emotion recognition in individuals with Asperger syndrome (AS). Using fMRI, we investigated whether oxytocin would enhance emotion recognition from facial sections of the eye vs the

mouth region and modulate regional activity in brain areas associated with face perception in both adults with AS, and a neurotypical control group.

Oxytocin improved performance in a facial emotion recognition task in individuals with AS. This was linked to increased left amygdala reactivity in response to facial stimuli and increased activity in the neural network involved in social cognition. Our data suggest that the amygdala, together with functionally associated cortical areas mediate the positive effect of oxytocin on social cognitive functioning in AS.

Oxytocin-induced facilitation of social attention and emotion recognition suggests that the intranasal administration of oxytocin might be a promising approach in the treatment of cognitive deficits in the social domain in ASD. However, the experimental studies so far underline the need for controlled clinical trials.

Effects of testosterone on strategic gambling in poker play

van Honk, Jack; Will, Geert-Jan; Terburg, David; Raub, Werner; Eisenegger, Christoph; Buskens, Vincent

Universitaet Wien

In a variety of species, the hormone testosterone motivates animals to strive for social dominance. In humans, testosterone arguably optimizes behaviors that maximize personal financial profits, and hence has frequently been portrayed as the hormone of greed. However, financial resources generally enhance social dominance, which guarantees access to financial resources in turn. Therefore, it is unclear whether testosterone motivates for social dominance or the pursuit of financial profits at all costs.

To address this issue, we used a unique game of bluff poker, wherein concerns for economic resources and social dominance collide. The profit maximizing strategy in this game is to confuse and mislead the other players by random bluffing, also when holding poor cards (i.e. cold bluffing). Furthermore, one should refrain from calling the other players' bluffs when holding poor cards. For upright social dominance these strategies are disadvantageous; being caught cold bluffing damages one's social reputation by revealing deceptive intent, and not calling the other players' bluffs signals submission in blindly tolerating deception.

We show that testosterone administration, compared to

placebo, induces significantly less cold bluffing and significantly more calling with poor cards in hand. In sum, our data suggest that testosterone in humans promotes social dominance even when this comes at financial costs.

Significant association of testosterone and prefrontal stress response is specific for males

Derntl, Birgit

Uniklinik RWTH Aachen

Previous research revealed a significant impact of competitive situations on testosterone levels. However, it is unclear if these effects are specific to the competition context or whether stress in general influences testosterone levels. The aim of the present study was to investigate the impact of experimentally induced, acute stress on testosterone levels and to shed light on associated neural mechanisms.

Eighty students (40 females) were performing a stress task (mental arithmetic under time pressure) while undergoing functional magnetic resonance imaging. Before and after the stress task, participants provided subjective distress ratings and saliva samples for hormone measurement. Data analyses revealed significantly better performance and stronger neural activation in males compared to females. Moreover, a significant testosterone increase only occurred in males, but no change emerged in females. In males this stress-induced testosterone increase was further associated with neural stress responses in dorso-lateral prefrontal cortex (DLPFC).

Our results indicate an increase of testosterone following an experimental stress induction, which seems to be specific for males. Competition research has associated testosterone increase with active coping mechanisms. The significant correlation of testosterone increase with neural activation in DLPFC, a brain region associated with vigilance, attention and arousal, and the superior performance of males further bolsters the interpretation of an active, task-focused coping in male compared to female participants. Hence, our data indicate a specific role of testosterone in the male stress response but further research is mandatory to better understand its actions regarding stress resilience or social status.

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Prosociality fluctuates across the female menstrual cycle

Anderl, Christine; Hahn, Tim; Rutter, Barbara; Windmann, Sabine

Goethe-Universität Frankfurt am Main

People engage in a variety of cooperative and prosocial behaviors, ranging from helping family members and friends to donating money, goods, and even blood or bone marrow to unrelated strangers. Building on evidence from administration studies suggesting that hormones influence diverse facets of human social behavior, we asked whether a woman's inclination to cooperate with another individual varies across the natural female menstrual cycle.

Across three online studies with large samples of naturally ovulating women (N=97, N=209 and N=184), we show that women are significantly more prosocial in the early follicular phase (low levels of estradiol and progesterone) compared to the midluteal phase (high levels of estradiol and progesterone), as indicated by more prosocial choices in the Social Value Orientation task (SVO; Studies 1 through 3) and increased reciprocity in the trust game (Study 3). Furthermore, using day-specific cyclic hormonal variations estimated from norm data, we found estradiol, but not progesterone or testosterone variation across the entire cycle to correlate negatively with SVO of all N=480 participants combined.

In sum, our results suggest that women's prosocial preferences change as a result of cycle-dependent natural fluctuations of hormonal levels. Furthermore, they highlight the importance of investigating psychological effects of estradiol, a steroid hormone that has been largely neglected in administration studies, albeit its synthetic derivative ethinyl estradiol is taken daily by millions of women in the form of contraceptive pills.

Raum: 1.811

Symposium 6.3: Neurobiologische Grundlagen sozio-affektiver Prozesse

Vorsitz: Martin Melchers & Sabrina Strang

Universität Lübeck

Das vorliegende Symposium stellt eine Zusammenstellung von empirischen Forschungsarbeiten dar, die funktionelle Bildgebung und genetische Ansätze nutzen, um verschiedene sozio-affektive Endophänotypen zu untersuchen. Im Vordergrund stehen experimentelle Paradigmen der Emotionsverarbeitung, die Betrachtung reicht hierbei von Fairness- und Gerechtigkeitsprozessen über Fremdscham bis hin zu affektiven Stresserkrankungen. Trotz unterschiedlicher methodischer Zugänge und Unterschieden in den betrachteten sozio-affektiven Teilprozessen zeigen die Studien wichtige neue Erkenntnisse und teils konvergierende Evidenz bezüglich der neuronalen Grundlagen sozio-affektiver Verarbeitung.

When distance matters – the neural correlates of social discounting

Strombach, Tina

Universität Düsseldorf

Teilen ist belohnend und etwas mit unserer Familie zu teilen ist belohnender als etwas mit Fremden zu teilen. Vorherige Studien haben gezeigt, dass Freigiebigkeit mit sozialer Distanz hyperbolisch abnimmt, diesen Effekt nennt man ‚social discounting‘. In dieser Studie wurden folgende Hypothesen bezüglich des ‚social discounting‘ überprüft: Wir nehmen erstens an, dass die Gehirnaktivierung in Belohnungsarealen mit der ökonomisch konstruierten ‚other-regarding utility‘ (auf andere bezogener Nutzenwert) korreliert. Wir nehmen außerdem an, dass Gehirnaktivierung im TPJ, ein Areal welches häufig mit ‚Theory of Mind‘ Prozessen assoziiert wird, mit der Konfliktstärke zwischen großzügigen und egoistischen Motiven korreliert und somit die Überwindung des egoistischen Motive darstellt.

In der Studie kam fMRT zum Einsatz, um die neuronalen Korrelate von ‚social discounting‘ zu untersuchen. Soziale Distanz wurde in eine Skala aus 100 kleinen Figuren transformiert. Die Figuren repräsentieren das soziale Umfeld des Probanden. Die Probanden mussten sich für

verschiedene, gegebene soziale Distanzen, zwischen einer egoistischen und einer großzügigen Wahlalternative entscheiden. Das heißt sie hatten die Wahl zwischen einer großen Belohnung für sich selber oder einer kleineren Belohnung für sich selber und eine andere Person mit einer bestimmten sozialen Distanz. Die Indifferenzpunkte zwischen den egoistischen und einer großzügigen Optionen wurden verwendet, um die ‚other-regarding utility‘ zu konstruieren.

Unsere Resultate zeigen, dass einige Gehirngebiete während großzügiger Entscheidungen im Vergleich zu egoistischen Entscheidungen aktiver waren, unter anderem die TPJ. Eine parametrische Modulation zeigte außerdem, dass genau diese Region auch die Konfliktstärke zwischen den zwei Optionen kodiert. Je kleiner die Differenz zwischen dem Nutzenwert der egoistischen und dem der freigiebigen Option, desto höhere Aktivierung war im TPJ nachzuweisen. Eine Konnektivitätsanalyse zeigte, dass TPJ ‚social discounting‘ fördert, indem diese Region grundlegende neuronale Nutzensignale im vmPFC moduliert, um diese in die soziale Distanz Repräsentation zu integrieren. Es werden also soziale Präferenzen in eine normalerweise egoistische Nutzenrepräsentation integriert. Die Resultate zeigen außerdem, dass die (?) TPJ die Überwindung egoistischer Motive unterstützt.

Neural Correlates of Third-Party Help and Punishment: An fMRI Investigation

Strang, Sabrina

Universität Lübeck

Soziale Normen sind der Grundstein unserer Gesellschaft. Um das soziale Normsystem aufrecht zu erhalten, gibt es verschiedene Maßnahmen: man kann entweder dem Opfer helfen, oder den Normübertreter bestrafen. Eine aktuelle Verhaltensstudie zeigt, dass die Entscheidung als außenstehende Partei zu helfen oder zu bestrafen durch Empathie moduliert wird. Die neuronalen Prozesse, die dieser Entscheidung zu Grunde liegen, und inwieweit Empathie diese Prozesse beeinflusst sind jedoch noch unklar. In dieser Studie haben wir mit Hilfe von fMRT versucht, diese Frage zu beantworten.

Im Paradigma der Studie übernahmen 48 Probanden die Rolle der ersten oder zweiten Partei in einem Diktatorspiel. Weitere 36 Probanden bekamen im Scanner die Rolle der dritten/außenstehenden Partei zugewiesen.

Während die Probanden im Scanner lagen, wurden ihnen Normüberschreitungen der ersten Partei (unfaire Angebote im Diktatorspiel) gezeigt und sie mussten sich entscheiden, ob sie den Normübertreter (erste Partei) bestrafen oder dem Opfer (zweite Partei) helfen wollten. In einer Kontrollbedingung wurden diese Entscheidungen von einem Computer übernommen. Empathie wurde mit Hilfe des Interpersonal Reactivity Index (IRI) Fragebogen nach der fMRT Messung erhoben.

Dem Opfer zu helfen wie auch den Normübertreter zu bestrafen löste vergleichbare Aktivierung in Belohnungsarealen (bilaterales ventrales Striatum) aus. Der Kontrast Helfen versus Bestrafen ergab keine signifikante Aktivierung. Die IRI Messungen korrelierten positiv mit der Gehirnaktivierung im lateralen präfrontalen Kortex und im anterioren cingulaten Kortex für den Kontrast Helfen versus Bestrafen. Eine Konnektivitätsanalyse ergab zudem, dass die Empathiemessungen positiv mit der funktionellen Konnektivität zwischen dem bilateralen Striatum und dem rechten lateralen präfrontalen Kortex korrelieren wenn sich die Probanden dazu entschlossen haben zu helfen.

Diese Resultate weisen darauf hin, dass die Prozesse, welche Helfen und Bestrafen durch eine außenstehende Partei zu Grunde liegen, sehr ähnlich sind. Beide wiesen Aktivierung in Belohnungsarealen auf. Des Weiteren zeigen die Daten, dass hoch empathische Menschen andere Gehirnareal für diese Art Entscheidungen verwenden als weniger empathische Menschen.

Embarrassment with, for, and anyhow

Krach, Sören

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In meinem Vortrag werde ich zwei Wege vorstellen, soziale Emotionen im Kontext funktionell-bildgebender Verfahren zu untersuchen. Zunächst werde ich in einem klassischen Ansatz Studien präsentieren, die mithilfe funktioneller Kernspintomographie (fMRT) die neuronalen Korrelate des empathischen Empfindens und Miterlebens sozialer Emotionen Anderer beleuchten. In mehreren Studien haben wir untersucht, welche Faktoren einer sozialen Integritätsverletzung einer beobachteten Person dazu beitragen, dass BeobachterInnen stellvertretend für und/oder empathisch mit der beobachteten Person soziale Emotionen wie u.a. Peinlichkeit empfinden. Wir konn-

ten zeigen, dass ein kortikales Netzwerk, die sogenannte Schmerzmatrix (anteriore Insula, anteriorer zingulärer Kortex), die affektive Qualität dieses Empfinden kodiert und mit selbsteingeschätzter Empathiefähigkeit korrelierte. Das Empfinden stellvertretender sozialer Emotionen war dabei unabhängig davon, ob die beobachtete Person, der/die ProtagonistIn, selbst eine Emotion erlebte (i.e. embarrassment with vs. embarrassment for).

Abschließend werde ich ein Paradigma vorstellen, das es erlaubt, genuines Peinlichkeitserleben im Kernspintomographen zu induzieren (i.e. embarrassment anyhow). In einem sozial-immersiven Ansatz ließen wir dabei Versuchspersonen kognitive Schätzaufgaben bearbeiten und manipulierten die An- bzw. Abwesenheit von ZuschauerInnen während des Feedbacks. Es zeigte sich, dass speziell „öffentliches Scheitern“ bei der Aufgabenbearbeitung Peinlichkeitserleben auslöste. Auf neuraler Ebene war Peinlichkeitserleben mit Aktivierungen in „Mentalizing“-Arealen, der anterioren Insula und erhöhter Konnektivität in paralimbische Regionen sowie auf peripherphysiologischer Ebene mit erhöhter Pupillendilatation, als Marker für erhöhtes Arousal assoziiert.

Zusammenfassend möchte ich in meinem Vortrag darlegen, dass die Untersuchung sozialer Emotionen und deren neurobiologischer Korrelate ein klinisch als auch grundlagenwissenschaftlich sehr relevantes Themenfeld ist und im Kontext neuerer „second-person“-Ansätze in Zukunft an Bedeutung gewinnen wird.

Reality TV and vicarious embarrassment: an fMRI study

Melchers, Martin

Universität Bonn

Fremdscham wird durch die Beobachtung von Missgeschicken oder sozialen Normverletzungen anderer ausgelöst. In der Literatur versuchen verschiedene Theorien, die Entstehung dieser Emotion unter anderem durch Perspektivübernahme oder durch Identifikation mit der gleichen sozialen Gruppe zu erklären. Über die biologischen Grundlagen von Fremdscham ist bisher wenig bekannt. Um ein besseres Verständnis für die zugrunde liegenden neuronalen Prozesse zu gewinnen, untersucht diese Studie die Aktivierungsmuster, die als Reaktion auf die Betrachtung von Ausschnitten von Reality-TV-Shows entstehen. Reality-TV ist bekannt für die Darstellung von

sozialen Normverletzungen, Makeln und Missgeschicken der Protagonisten und damit als ökologisch valider Auslöser von Fremdscham geeignet. In dieser Studie wurden 60 TeilnehmerInnen während einer fMRT-Messung Bilder von zuvor betrachteten Ausschnitten verschiedener deutscher Reality-TV Formate gezeigt. Diese Ausschnitte wurden in einer Vorstudie nach starkem versus schwachem Fremdschaminhalt vorselektiert. Neben der Betrachtung dieses Hauptkontrastes wurden auch Analysen der funktionellen Konnektivität (Psychophysiologische Interaktionen) vorgenommen. Es zeigte sich in der „starker Fremdscham“ Bedingung deutlich erhöhte Aktivität in Arealen des Theory of Mind Netzwerkes (mittlerer temporaler Gyrus, supramarginaler Gyrus, rechter inferiorer frontaler Gyrus und Gyrus rectus), was nahelegt, dass die Fähigkeit, sich in andere hineinzusetzen, eine zentrale Voraussetzung für die Empfindung von Fremdscham ist. Dieser Befund wird dadurch unterstützt, dass auch auf Individualebene die Bewertung des Fremdschämcharakters der Filme mit der Stärke der neuronalen Aktivierung korrelierte. Die funktionellen Konnektivitätsanalysen erbrachten vor allem eine Verbindung des beschriebenen Netzwerkes zum Anterioren Cingulären Kortex, einem Kerngebiet der Schmerzmatrix, das auch bei „sozialen Schmerzen“ wie Fremdscham aktiviert wird.

Identification of first genetic risk factors for the burnout-syndrome

Reuter, Martin

Universität Bonn

Obwohl das Burnout-Syndrom in den Massenmedien in aller Munde ist, ist es bislang keine anerkannte medizinische Diagnose. Viele Experten sind der Auffassung, dass es an empirischer Evidenz mangelt, um Burnout von anderen affektiven Erkrankungen, insbesondere der Depression differentialdiagnostisch abgrenzen zu können. Ein weiteres Defizit der Burnout-Forschung ist ihr bis dato fast ausschließlich a-biologischer Charakter. Die Frage ist, ob trotz substantieller Korrelation zwischen Burnout und Depression distinkte genetische Faktoren identifiziert werden können, die diese beiden affektiven Syndrome voneinander abgrenzen können. In Bezug auf die Depression ist eine starke Heritabilität, sowie Kandidatengene bereits nachgewiesen worden. Im Fokus der Studie lag das CHRNA4-Gen, das für die α -4 Untereinheit des ni-

kotinerger Acetylcholinrezeptors kodiert und bereits mit Depression in Zusammenhang gebracht werden konnte. In einer Stichprobe von $n = 400$ Patienten aus psychosomatischen Kliniken und $n = 878$ Arbeitnehmer(n)/innen aus unterschiedlichen Berufsgruppen wurden acht SNPs auf dem CHRNA4 Gen bestimmt und univariat als auch mittels multivariater Haplotypanalysen in Bezug auf Burnout (MBI) und Depression (BDI-2) analysiert. Die Ergebnisse zeigen, dass sowohl auf Einzel-SNP-, als auch auf Haplotyp-Ebene CHRNA4 signifikant mit der Stärke der Burnoutbelastung aber nicht mit Depression assoziiert ist. Ferner kann der CHRNA4-Haplotyp signifikant die Gruppenzugehörigkeit (Burnout ja/nein) vorher sagen ($\text{Chi}^2 = 16.551$, $\text{df} = 1$, $p = 0.000041$; Odds ratio: 1.824). Die Ergebnisse bekräftigen die Rolle des cholinergen Systems für affektive Störungen und erbringen erste molekulargenetische Evidenz dafür, dass Burnout nicht mit Depression gleichzusetzen ist.

Raum: 1.812

Symposium 6.4: Kognitive Kontrolle. Von genetischen und neuronalen Grundlagen zu sozioaffektiven Konsequenzen

Vorsitz: Sören Enge & Sebastian Markett

Kognitive Kontrolle umfasst eine Reihe von Prozessen zur Herstellung und Aufrechterhaltung zielgerichteten Verhaltens. Das Spektrum kognitiver Kontrollprozesse reicht von basalen Aspekten der Aufmerksamkeitssteuerung, einschließlich der Abschirmung und Kontrolle von interferierenden Reizen und Reaktionstendenzen, über die Handlungsüberwachung und Konflikthanpassung bis hin zu hochkomplexen Adaptations- und Regulationsprozessen in affektiven und sozialen Entscheidungskontexten. Aufgrund der Bedeutungsbreite kognitiver Kontrollfähigkeit ist nicht nur die Untersuchung seiner verschiedenen Wirkungsbereiche von Interesse, es ist weiterhin erforderlich, sich dem Konstrukt mittels diverser methodischer Ansätze zu nähern. In unserem Symposium bringen wir Arbeitsgruppen aus vier Universitäten zusammen, die mittels neuro- und peripherphysiologischer, bildgebender, molekulargenetischer wie pharmakologischer Methodik verschiedene Aspekte kognitiver Kontrollprozesse im Menschen beleuchten.

Dopamin D2 Rezeptor-Genotyp und die Architektur des strukturellen Konnektoms – Implikationen für exekutive Kontrolle und das Arbeitsgedächtnis

Markett, Sebastian; de Reus, Marcel A.; Reuter, Martin; Montag, Christian; Weber, Bernd; Schöne-Bake, Jan-Christoph; van den Heuvel, Martijn P.

Universität Bonn

Funktionale Variation auf dem Dopamin Rezeptorgen (DRD2 rs6277) steht mit interindividuellen Unterschieden in kognitiven Kontrollprozessen in Verbindung. Erste genetische Bildgebungsstudien konnten ebenfalls Assoziationen mit lokalen Eigenschaften der Basalganglien wie Rezeptordichte, Transmittersynthesekapazität und dem Volumen der grauen Substanz (VdGS) finden. Mögliche Assoziationen mit neuronaler Konnektivität sind allerdings noch nicht charakterisiert worden. Um dies zu untersuchen, haben wir diffusionsgewichtete Daten von N

= 105 genotypisierten Probanden gesammelt und individuelle strukturelle Konnektome auf Basis eines kortikalen und subkortikalen Atlases rekonstruiert. Es zeigte sich ein Effekt vom DRD2 Genotyp auf die mittlere strukturelle Integrität (fraktionale Anisotropie, FA) zwischen allen frontalen Netzwerkknoten und den Basalganglien. Träger des C/C Genotyps, die in vorangegangenen Studien im Vergleich zu anderen Genotypträgern verbesserte kognitive Fähigkeiten bei reduziertem VdGS zeigten, wiesen eine verstärkte kortiko-striatale Konnektivität auf. Dieser Effekt zeigte sich in beiden Hemisphären unabhängig vom Alter der Probanden. Der Befund passt zu der Hypothese, dass DRD2 Varianten kortiko-striatale Kontrollschleifen beeinflussen, die kognitiven Kontrollprozessen unterliegen.

Variationen in cholinergen und dopaminergen Genen tragen zur Variabilität von Nikotineffekten bei Aufmerksamkeitswechsell bei

Thiel, Christiane

Carl von Ossietzky Universität Oldenburg

Der cholinerge Agonist Nikotin beschleunigt das Reorientieren der Aufmerksamkeit und reduziert Distraction. Genetische Variationen im cholinergen und dopaminergen Neurotransmittersystem beeinflussen die Effekte von Nikotin, welche generell eine große interindividuelle Variabilität zeigen. In der vorliegenden Studie haben wir untersucht, inwiefern die neuronalen Nikotineffekte von Variationen im cholinergen CHRNA4 und dopaminergen DRD2 Gen abhängig sind. 50 Nichtraucher wurden genotypisiert, mit Nikotin (7mg Pflaster) oder Placebo behandelt und im Magnetresonanztomographen (MRT) mit einem Hinweisreizparadigma untersucht. Auf Verhaltenzebene zeigten sich die größten Nikotineffekte bei Probanden die im DRD2 Gen kein T Allel und im CHRNA4 Gen mindestens ein C Allel trugen. Neuronal konnten wir mit einer multivariaten Analyse (Partial Least Square Diskriminanzanalyse) zeigen, dass die verschiedenen Genotypgruppen anhand ihrer Hirnaktivität im Pulvinar, Striatum, Frontalcortex, Precuneus und mittlerem temporalen Gyrus klassifiziert werden konnten. Die Befunde verdeutlichen, dass Variationen im cholinergen und dopaminergen Neurotransmittersystem zur interindividuellen Variabilität von Nikotineffekten beitragen können.

Dispositionale Angst und frühe neuronale Mechanismen der Handlungsüberwachung

Osinsky, Roman; Karl, Christian; Hewig, Johannes

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Handlungsüberwachung bezieht sich auf die fundamentale Fähigkeit des Gehirns, verhaltensrelevante Ereignisse wie z.B. Handlungsfehler zu erkennen und auf diese mit einer Anpassung kognitiver Kontrolle zu reagieren. Allerdings kann eine Hyperreaktivität der beteiligten Mechanismen vermutlich auch dysfunktional sein. So deuten zahlreiche aktuelle Untersuchungen daraufhin, dass eine hohe dispositionale Angst mit einer gesteigerten Reaktion des posterioren medialen frontalen Kortex (pmFC) auf Verhaltensfehler, negatives Feedback oder auch Konflikte einhergeht. Die bisherigen Studien haben hierbei insbesondere ereigniskorrelierte Potentiale als Signaturen der pmFC Aktivität untersucht. In der hier vorgestellten Studie konzentrierten wir uns hingegen auf frontalmidiale oszillatorische Aktivität im Theta Bereich (4-7 Hz). Diese agiert vermutlich als ein allgemeines ‚need for control‘ Signal des pmFC. In einer Stichprobe von 168 Probanden fanden wir eine positive Korrelation zwischen selbstberichteter Ängstlichkeit und der frontal-medialen Theta-Reaktion auf einfache Musterabweichungen in einer Two-Choice Reaktionsaufgabe. Allerdings war dieser Zusammenhang nur bedeutsam, wenn die Probanden einen späteren psychosozialen Stressor (öffentliche Rede) antizipierten. Fehlte dieser Stressor, war der besagte Zusammenhang signifikant kleiner und statistisch auch nicht bedeutsam. Somit scheint ein basaler Mechanismus der Handlungsüberwachung im pmFC durch die Interaktion dispositionaler Angst und situativen Stresses beeinflusst zu sein. Die Befunde sollen in Hinblick auf das Wechselspiel von Angst und Handlungsüberwachung diskutiert werden.

Altruistische Bestrafung: Feedback-related Negativity (FRN) als Prädiktor fairnessbezogener Normverletzungen und assoziierter Bestrafungsentscheidungen

Enge, Sören; Mothes, Hendrik; Strobel, Alexander

Technische Universität Dresden

Das anteriore Cingulum (ACC) besitzt eine zentrale Rolle in der Konflikt- und Fehlerdetektion, der Handlungs-

überwachung und der Regulation kognitiver Kontrolle im Rahmen der adaptiven Verhaltensanpassung. Neue Modelle zur Funktionalität des ACC betonen zudem die Bedeutung spezifischer ACC Regionen bei der Bewertung potentiell aversiver bzw. negativer Ergebnisse, die mit aktuellen Erwartungen konfliktieren. Solche Erwartungsverletzungen besitzen vermutlich auch für Prozesse altruistischer Bestrafung Relevanz, als evolutionär verankerte Tendenz Normverletzung anderer zu bestrafen, um etwa kooperatives Verhalten zwischen unverwandten Individuen aufrechtzuerhalten. Indes sind die neurophysiologischen Prozesse und die Rolle individueller Unterschiede in altruistischen Bestrafungs- und Entscheidungsszenarien bis dato noch unzureichend verstanden. In der vorliegenden Studie wurde daher ein Dictator Game mit Bestrafungsoption durchgeführt und die ACC-modulierte feedback-related negativity (FRN) abgeleitet (N=45). Die Befunde zeigen eine stärkere Negativierung der FRN bei unfairen vs. fairen Diktatorzuweisungen, wenn die Rezipienten selbst (first person), als auch wenn sie nicht selbst von der Zuweisung betroffen waren (third party). Zudem prädizierte die FRN anschließendes Bestrafungsverhalten (geldwerter Punkteabzug beim Diktator), was insgesamt auf eine Sensitivität der FRN für fairnessbezogene Normverletzungen und darauffolgende Bestrafungsentscheidungen hindeutet. Weiterhin zeigte sich ein Einfluss der finanziellen Situation sowie der Empathiewerte der Rezipienten auf die FRN Auslenkung, was mit Bezug auf die Funktionalität dieser Komponente diskutiert werden soll.

Sind Gefühle und Gedanken gleichermaßen regulierbar? Zum Zusammenhang von kognitiver Inhibitionskontrollfähigkeit und erfolgreicher Emotionsregulation

Gärtner, Anne; Strobel, Alexander

Technische Universität Dresden

Die erfolgreiche Regulation von Emotionen spielt im Alltag eine bedeutende Rolle und geht mit größerem Wohlbefinden und höherer Lebenszufriedenheit einher. Eine dysfunktionale Regulation von Emotionen ist ein wesentlicher Bestandteil verschiedener psychischer Störungen, z.B. Depression, Angststörungen und Posttraumatische Belastungsstörung, ADHS, Substanzstörungen und Störungen der Impulskontrolle. Um Emotionen willentlich erfolgreich zu regulieren, ist das Aufwenden kognitiver Res-

ourcen notwendig. Inhibitionskontrollfähigkeit stellt eine Kernkomponente für alle weiteren Bereiche kognitiver Kontrollfähigkeit dar (Miyake 2000, Miyake & Friedman, 2012). Um den Zusammenhang zwischen Inhibitionskontroll- und Emotionsregulationsfähigkeit zu untersuchen, absolvierten N = 200 Probanden u.a. eine Stroop-, eine Antisakkaden- und eine Stop-Signal-Aufgabe. Weiterhin wurden während der Anwendung kognitiver Emotionsregulationsstrategien („Distanzieren“ vs. „Zulassen“) subjektive Ratings sowie peripher-physiologische Maße erfasst (Herzratenvariabilität, Hautleitfähigkeit, faziale Muskelaktivität). Berichtet und diskutiert werden erste Zusammenhänge auf Aufgabenebene unter Berücksichtigung interindividueller Persönlichkeitsunterschiede.

Raum: PEG 1.G147

Symposium 6.5: Neurobiologische Marker expositionsbasierter Verhaltenstherapie bei der Panikstörung mit Agoraphobie

Vorsitz: Ulrike Lüken

Universitätsklinik Würzburg

Verändert Psychotherapie das Gehirn? Wirken alle therapeutischen Interventionen gleich? Und lässt sich anhand von neurobiologischen Markern vorhersagen, welche Patienten von einer Behandlung profitieren werden? Anhand von Daten aus dem nationalen BMBF-Forschungsverbund „Paniknetz“ an 301 behandelten Patienten (expositionsbasierte Verhaltenstherapie) möchten wir erste Ergebnisse zu diesen Fragen vorstellen und diskutieren. Das Symposium soll anhand der Beispielerkrankung Panikstörung verdeutlichen, wie multimodales Imaging die Charakterisierung von neuroplastischen Veränderungsprozessen durch psychotherapeutische Interventionen unterstützen kann. Die Ergebnisse fördern unser Verständnis der Wirkmechanismen behavioraler Interventionen und besitzen das translationale Potential, zukünftig klinische Expertenentscheidungen im Sinne der personalisierten Medizin unterstützen zu können.

Die neuralen Korrelate prozeduraler Varianten kognitiver Verhaltenstherapie

Straube, Benjamin; Lueken, Ulrike; Jansen, Andreas; Konrad, Carsten; Gloster, Andrew; Gerlach, Alexander; Ströhle, Andreas; Wittmann, André; Gauggel, Siegfried; Pfeleiderer, Bettina; Wittchen, Hans-Ulrich; Arolt, Volker; Kircher, Tilo

Universitätsklinikum Marburg

Veränderte Furchtkonditionierungsprozesse wurden mit der Entstehung und Aufrechterhaltung von Panikstörung und Agoraphobie (PD/A) in Zusammenhang gebracht. Kognitive Verhaltenstherapie (KVT) stellt eine effektive Behandlung für PD/A dar. Wie allerdings therapiebedingte Veränderungen der Symptomatik auf neuraler Ebene repräsentiert sind und wie diese von der Art des Expositionslernens (Therapeutenbegleitet [T+] vs. -unbegleitet [T-]) abhängen ist bisher noch nicht ausreichend erforscht. Im Rahmen einer BMBF - geförderten multizentrums Studie wurden die neuralen Korrelate der Furchtkonditi-

onierung bei PD/A vor und nach Verhaltenstherapie und in dazu gemachten gesunden Kontrollprobanden mittels funktioneller Magnetresonanztomographie (fMRT) untersucht. Die Patienten wurden zufällig einer der beiden Behandlungsbedingungen, T+ oder T-, zugeteilt. Die Ergebnisse der Therapiestudie weisen darauf hin, dass KVT überwiegend auf differentielle Konditionierungsprozesse (CS+>CS-) wirkte, die sich vor der Therapie als Aktivierung im linken inferioren frontalen Gyrus (IFG) zeigten und sich im Laufe der Behandlung reduzierte. Patienten der T+ im Vergleich zur T- Gruppe zeigten eine stärkere Hippocampus-Aktivierung nach der Therapie und eine reduzierte Konnektivität dieser Region zum linken IFG. Diese Ergebnisse weisen darauf hin, dass therapeutisch begleitete Exposition basale hippocampale Lernprozesse bei der Furchtkonditionierung beeinflussen kann. Damit unterstützt diese Studie die Annahme, dass basale Furchtkonditionierungsprozesse zum Ausmaß der Wirkung von spezifischen Formen der KVT beitragen können.

Modulation von Antizipation und Perzeption agoraphobiespezifischer Stimuli durch Kognitive Verhaltenstherapie und Pharmakotherapie unter Berücksichtigung genetischer Marker

Gechter, Johanna; Liebscher, Carolin; Wittmann, André; Schlagenhauf, Florian; Domschke, Katharina; Lueken, Ulrike; Straube, Benjamin; Konrad, Carsten; Gerlach, Alexander; Wittchen, Hans-Ulrich; Pfeleiderer, Bettina; Arolt, Volker; Deckert, Jürgen; Kircher, Tilo; Ströhle, Andreas
Charité Berlin

Kognitive Verhaltenstherapie (KVT) und Pharmakotherapie gelten nach den S3-Leitlinien „Angststörungen“ als die Methoden der Wahl zur Behandlung der Agoraphobie mit Panikstörung. Allerdings ist bislang unklar auf welchen behandlungsspezifischen Effekten und biologischen Wirkmechanismen eine erfolgreiche Behandlung basiert. Hierzu wurden im Rahmen des Paniknetzes folgende Gruppen mit einem störungsspezifischen fMRT-Paradigma untersucht: 51 Patienten vor und nach KVT, 28 Patienten vor und nach einer Pharmakotherapie (SSRI/SNRI), 15 Patienten einer Wartekontrollgruppe sowie 51 gesunde Kontrollprobanden. In einer weiteren Stichprobe wurden zusätzlich Patienten und gesunde Kontrollprobanden rekrutiert um die Gruppen zum Baselinemesszeitpunkt zu vergrößern um die Aussagekraft für genetische Fragestel-

lungen zu erhöhen. Allen Gruppen wurde im MRT das „Westphal-Paradigma“ präsentiert, welches agoraphobie-spezifische und neutrale Bilder (die eine hohe Trennschärfe zwischen Patienten und gesunden Kontrollpersonen aufweisen) beinhaltet. Eine Verringerung der Vermeidung phobischer Situationen, gemessen mit dem Mobility Inventory, als störungs-spezifischer Behandlungseffekt, zeigte sich bei der mit KVT behandelten Gruppe signifikant stärker als bei den pharmakologisch und den nicht behandelten Patienten. Die fMRT Ergebnisse zeigten zudem, dass die KVT-Gruppe in der Amygdala (beidseits) zum zweiten Messzeitpunkt im Vergleich zu den anderen Gruppen eine signifikant weniger starke Aktivierung auf die agoraphobiespezifischen Bilder im Kontrast zu den neutralen Bildern aufwies. Die gefundenen neuronale Aktivierungen innerhalb des Furchtnetzwerkes wurden weiterhin auf eine Modulation durch genetische Risikogenvarianten untersucht.

Modifikation der defensiven Reaktivität bei Patienten mit Panikstörung und Agoraphobie durch expositionsbasierte Verhaltenstherapie

Richter, Jan; Gerlach, Alexander; Wittchen, Hans-Ulrich; Lang, Thomas; Alpers, Georg; Deckert, Jürgen; Fydrich, Thomas; Ströhle, Andreas; Kircher, Tilo; Arolt, Volker; Hamm, Alfons

Ernst-Moritz-Arndt-Universität Greifswald

Bis heute bleibt unklar, welche Mechanismen im Rahmen einer Expositionstherapie notwendig oder hinreichend für die Symptomreduktion bei Angstpatienten sind. Daher haben wir im Rahmen des BMBF-Forschungsverbundes „Panikstörung“ in einem therapiebegleitenden (prä – intermediate – post), hoch standardisierten Verhaltenstest den Einfluss der Therapieerfahrung auf die unmittelbar beobachtbare, multimodal erfasste defensive Reaktivität (Verhalten, subjektives Erleben, autonome Aktivierung und Schreckreflexmodulation) während der Konfrontation mit einer agoraphobischen Situation untersucht (enger, von außen verschlossener Raum). Dabei grenzten wir die Reaktionsveränderungen der behandelten Patienten von denjenigen der Warte-Kontroll-Patienten ab, die den Test ebenfalls dreimal zeitlich parallelisiert durchführten. Wir beobachteten eine Abnahme der Reaktivität in der gesamten Stichprobe mit intensiveren Veränderungen bei den aktiv behandelten Patienten. Unsere Befunde legen nahe,

dass das Paradigma damit die Effekte durch die wiederholte Konfrontation mit der phobischen Situation von den Effekten der Generalisierung der Therapiererfahrungen trennen kann. Dabei war der positive Effekt der Psychotherapie in Abhängigkeit der unterschiedlichen Reaktivitätsindikatoren mit unterschiedlichen Therapiephasen assoziiert: während das Vermeidungsverhalten bereits nach der psychoedukativen Phase (intermediate) verstärkt reduziert wurde, zeigte sich eine stärkere Veränderung in den physiologischen Indikatoren erst nach der Durchführung von therapieassoziierten Expositionsübungen (post). Spezifische Veränderungen in den Indikatoren der defensiven Reaktivität lassen spezifische Wirkmechanismen vermuten. Der Vergleich zwischen Patienten mit gute

Charakterisierung der Behandlungsresponse auf expositionsbasierte Verhaltenstherapie bei der Panikstörung mit Agoraphobie: Ein Genomic Imaging Ansatz

Lueken, Ulrike; Straube, Benjamin; Konrad, Carsten; Wittchen, Hans-Ulrich; Wittmann, André; Ströhle, Andreas; Uhlmann, Christina; Pfleiderer, Bettina; Arolt, Volker; Reif, Andreas; Deckert, Jürgen; Kircher, Tilo

Universitätsklinikum Lübeck

Auch wenn die expositionsbasierte Verhaltenstherapie als Leitlinienverfahren der Panikstörung mit Agoraphobie eine hohe Wirksamkeit aufweist, sprechen nicht alle Patienten gleichermaßen gut darauf an. Im Rahmen des nationalen BMBF-Verbundprojekts „Paniknetz“ untersuchten wir daher, ob sich Patienten mit guter vs. schlechter Behandlungsresponse bereits vor der Therapie hinsichtlich neurobiologischer Merkmale unterscheiden (primärer Outcome: Hamilton Angstskala; Response: Reduktion von mind. 50 %). In der fMRT-Substudie wurde eine differentielle Furchtkonditionierung als neurofunktionelle Probe eingesetzt (valide Datensätze: 49 Patienten; Response: 51 %). In der klinischen Gesamtstichprobe zeigte sich ein signifikanter Effekt des MAO-A Polymorphismus auf die Behandlungsresponse. In der fMRT-Stichprobe war eine spätere Nonresponse mit einer verstärkten Aktivierung von Furchtnetzwerkstrukturen (pregenualer anteriorer cingulärer Cortex (ACC), Amygdala, Hippocampus) auf Sicherheitssignale assoziiert. Nonresponder zeigten zudem eine relative Entkoppelung zwischen dem ACC und der Amygdala, welche zusätzlich durch den

5-HTTLPR Polymorphismus moduliert wurde. Diese Ergebnisse verdeutlichen die Relevanz von intermediären (Konnektivitäts-) Phänotypen, die mit dem Ansprechen auf Expositionstherapie assoziiert sind. Patienten könnten durch differentielle Konfigurationen in neurofunktionellen Netzwerken, die mit emotionaler Regulation und dem Extinktionslernen in Zusammenhang gebracht werden, unterschiedlich gut von therapeutischen Interventionen profitieren, die diese Netzwerke rekrutieren.

Machine-Learning Verfahren in der Klinik: Methodische Ansätze zur Entwicklung neurobiologischer Marker zur Einzelfallprädiktion

Hahn, Tim

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Während sich unser Wissen über die mit psychischen Störungen einhergehenden neuronalen Veränderungen in den letzten Jahrzehnten massiv erweitert hat, konnten diese Erkenntnisse bisher nicht in konkrete klinische Anwendungen übersetzt werden. Ein Grund hierfür liegt darin, dass Ergebnisse korrelativer Studien zwar Aussagen über Gruppen, nicht aber belastbare Vorhersagen im Einzelfall erlauben. Vor diesem Hintergrund werden seit einiger Zeit vermehrt methodische Ansätze aus dem Bereich der multivariaten Mustererkennung für funktionelle Magnetresonanztomographie (fMRT) und elektroenzephalographische (EEG) Messungen verwendet. Der Vortrag gibt einen Überblick über solche Ansätze und stellt anhand konkreter Beispiele aus dem Bereich der Angststörungen dar, wie sich Muster neurobiologische Merkmale identifizieren lassen, die klinisch relevante Einzelfallvorhersagen von hoher Genauigkeit erlauben. Besonderes Augenmerk liegt dabei auf konkreten Leitlinien zur Entwicklung solcher Ansätze in der Praxis und auf der Integration neuronaler Daten mit anderen Informationsquellen wie genetischen Informationen oder Daten aus Fragebogenuntersuchungen.

Raum: Festsaal 1

Symposium 7.1: Brain-state dependent perception: How prestimulus neuronal oscillations shape perception

Vorsitz: Joachim Lange

Institute of Clinical Neuroscience, Heinrich-Heine-University

A number of recent studies suggest that perception does not only depend on external stimulus parameters but also on the internal current brain state at the time the stimulus impinges on the neural system.

The present symposium will present comprehensive new insights that these prestimulus brain states are determined by neuronal oscillations in distinct frequency bands and how these brain states affect perception. We will demonstrate that prestimulus neuronal oscillations in local cortical areas but also large scale networks determine how subsequent stimulation will be perceived. We will show that external stimulation by tACS modulates neuronal oscillations and how such modulation of brain states affects perception. Finally, we will demonstrate that brain states can be modulated pharmacologically by dopamine in Parkinson's disease and that such modulation crucially affects perception.

Prestimulus alpha and beta oscillations modulate perception

Lange, Joachim; Baumgarten, Thomas J.; Kapala, Katharina; Schnitzler, Alfons

Institute of Clinical Neuroscience, Heinrich-Heine-University

Perception of constant external stimuli is not an invariant process, but can vary substantially on a trial-by-trial basis or inter-individually. We present a series of studies that demonstrate how such variable perception is crucially influenced by the internal state of the brain prior to stimulation. By using uni- and multimodal stimuli and magnetoencephalography (MEG), we demonstrate that these brain-states are defined by neuronal oscillations in the alpha- (8-12 Hz) and beta (14-30 Hz)-band. Fluctuations of neuronal activity within these frequency bands crucially determine how subsequent stimulation will be perceived. The relevant frequency bands, however, are not invariant but seem to be modulated by task. We demonstrate that brain states show considerable similarities between visual

and somatosensory areas but also substantial differences in terms of frequency band and activation pattern. Finally, we provide evidence that prestimulus oscillations in the beta-band determine the temporal resolution of perception in the somatosensory domain by defining perceptual “windows of perception”.

The results highlight a functional role of prestimulus alpha and beta oscillations for perception and shed new light on the interplay of brain states, perception and behaviour.

Investigating the window to consciousness – prestimulus effects in near threshold experiments

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One of the main goals in cognitive neuroscience is to understand mechanisms and determinants of conscious perception. Previous research showed that alpha band (8-14Hz) oscillatory activity prior to upcoming near-threshold stimuli – considered to reflect local cortical excitability – influences conscious perception. We recently proposed however that besides alpha power levels also distinct prestimulus network states (‘windows to consciousness’) determine whether a near-threshold stimulus will be consciously perceived. Findings from several MEG studies in different modalities support this framework. Specifically, sensory areas not only show alpha power decreases, but also enhanced integration into a distributed network prior to conscious perception. These network effects reflect pre-established pathways prior to stimulus presentation, which ‘guide’ subsequent information flow. Importantly, using a stratification approach, we show that the network effects are largely independent from the alpha power effect. This supports the notion that pre-stimulus network states constitute an additional mechanism related to conscious perception.

Intersensory attention and temporal orienting are reflected in distinct patterns of cortical oscillations and neural connectivity

Keil, Julian; Pomper, Ulrich; Senkowski, Daniel

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Knowledge about the sensory modality in which a fort-

coming event occurs modulates intersensory attention (IA). Information on when an event occurs enables temporal orienting (TO). Both attention mechanisms can facilitate sensory stimulus processing. Previous studies have investigated the neural mechanisms underlying IA and TO separately but so far, it is unknown whether and how they may interact. In this EEG study we presented a continuous stream of temporally and spatially aligned visuo-tactile stimuli that were preceded by an auditory cue. Tactile inputs were delivered to the left hand. Participants were instructed to respond to occasional bimodal targets by a button-press with their right hand. To manipulate IA, we used an auditory cue indicating to which modality participants had to attend (visual or tactile). We manipulated TO by presenting stimuli block-wise either at fixed or variable inter-stimulus intervals.

EEG data were projected into source space using spatial filtering. We analyzed power, and functional connectivity of frequency transformed data. Moreover, we computed graph theoretical measures to identify local and global networks underlying IA and TO.

Reaction times were faster when stimuli were presented with fixed compared to variable inter-stimulus intervals, demonstrating a facilitating effect of TO. The effects of IA and TO were reflected in distinct patterns of alpha- and beta-band power and functional connectivity. Local and global network measures revealed attention specific integration and segregation mechanisms.

Our study demonstrates that power and functional connectivity of neural oscillations in distributed cortical networks differentially reflect IA and TO which operate in parallel.

Transcranial alternating current stimulation modulates EEG and perception

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Experimental Psychology Lab, European Medical School, University of Oldenburg

Recently, multiple stimulation methods have been developed that are able to modulate human brain activity non-invasively. Among these, transcranial alternating current stimulation (tACS) is especially suitable to modulate brain oscillations which have been identified as electrophysiological correlates of cognitive functions. We will review a series of experiments that demonstrate how oscillations in

the human electroencephalogram (EEG) are modulated by tACS both during and after stimulation. In addition, we will demonstrate how visual and auditory perception are modulated by tACS. We will discuss different stimulation protocols, electrode montages, and will demonstrate a model that predicts intracranial current densities.

The role of alpha oscillations in visual attention and its dysfunction in Parkinson's Disease

van Dijk, Hanneke

Institute of Clinical Neuroscience, Heinrich-Heine-University

Alpha oscillations (~10 Hz) have been found to play a crucial role in sensory perception. For instance spontaneously increased prestimulus alpha band power reduces the probability of perceiving a nearthreshold stimulus in the visual and sensorimotor domain. Additionally, alpha band power is retinotopically modulated with respect to the allocation of visuospatial attention. Could a dysfunction in this alpha band mechanism explain difficulties in attentional functions? Next to the wellknown motor symptoms, patients with Parkinson's Disease (PD) have difficulties controlling attention. Most symptoms of PD are thought to arise from a disturbance of the dopaminemodulated network. Since a substantial part of the basal ganglia connections to the cortex are directed at frontal areas involved in executive functions, dopamine is likely to be involved in the cognitive symptoms of PD. In an MEG study we investigated the relationship between dopamine, disease severity and alpha band oscillations using a visuospatial attention task in PD patients. In this study we have shown for the first time that dopamine modulates alpha band activity. The individual alpha frequency peak (IAF) is modulated with dopamine intake as well as the lateralization of alpha band power by visuospatial attention. Alpha band power lateralization was correlated with the reduction of motor symptoms with dopamine replacement. The results suggest that dopamine normalizes the alpha lateralization towards an optimal moderate state, resulting in a focus on the instructed task (topdown) while retaining cognitive flexibility. We propose that dopamine is an important component needed to ensure the cognitive flexibility within the visual attention system.

Raum: 1.802

Symposium 7.2: Neurobiology of anger and aggression – from animal models to patient studies

Vorsitz: Ulrike Krämer¹ & Katja Bertsch²

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Aggressive behavior is common in animals as well as in humans. Moreover, excessive aggression, often associated with heightened anger, is characteristic for many psychiatric disorders. It remains challenging, though, to study complex and highly interactive behavior as aggression with neuroscientific methods. In this symposium, we want to present and discuss recent methodological advancements to investigate the neural basis of aggression. The focus will be on reactive aggression, i.e. aggression that is elicited by some kind of provocation and typically linked to affective responses like anger. The talks will span research with rodents, different patient groups as well as with healthy persons. The studies will provide evidence for the relevance of different modulators of aggression such as testosterone and oxytocin and elucidate the role of the orbitofrontal cortex and amygdala as key players for aggression in healthy and psychiatric people.

Measuring virgin female aggression in the female intruder test (FIT): Effects of oxytocin

de Jong, Trynke R.; Rabi, Fruzsina A.; Neumann, Inga

University of Regensburg

Translational animal models of aggression traditionally test male rodents in the Resident-Intruder Test (RIT). Since aggressive disorders are prevalent in both sexes, we developed a modified RIT to study the sex-specific neurobiology of aggression, with a particular interest in the neuropeptide oxytocin (OXT).

We exposed various cohorts of female resident rats to smaller, unfamiliar, female intruder rats for 10-min (the Female-Intruder-Test or FIT). Considerable aggression was reliably elicited in 25% of residents in the first FIT (FIT-1), which increased to 75% of residents after five consecutive daily FITS (FIT2-5). The average time spent behaving aggressively increased from $6.7 \pm 1.0\%$ (avg \pm sem) in FIT-1 to $15.3 \pm 1.6\%$ in FIT-5 ($p < 0.001$).

Aggressive residents showed reduced neuronal activation (pERK-IR) in OXT neurons and reduced OXT release in the paraventricular hypothalamic nucleus (as measured

with in vivo microdialysis) in response to the intruder, compared with non-aggressive residents. Consistently, intracerebroventricular infusion of oxytocin (OXT, 0.1µg/5µl/animal) inhibited aggression. Counter-intuitively, intranasal administration of OXT (20µg/20µl/animal) reliably increased aggression in both untrained and trained female residents, suggesting that intranasal OXT administration may have unexpected effects on the endogenous OXT system in female rodents.

Taken together, aggression in young virgin female rats can be elicited by a smaller female intruder, increases following repeated exposure to the FIT, and is under considerable OXT control. Additional detailed investigation of the way external (pharmacological) manipulation of the OXT system affects aggressive behavior is currently underway.

Approach-Avoidance, Anger, and Aggression in Borderline Personality Disorder – Influence of Gender and Testosterone

Bertsch, Katja; Volman, Inge; Nagy, Krisztina; Mancke, Falk; Gescher, Dorothee Maria; Roelofs, Karin; Herpertz, Sabine

Universitätsklinikum Heidelberg

Reactive aggression is a core symptom of patients with borderline personality disorder (BPD). BPD patients are hypersensible for social threats, which triggers intense feelings of anger. Reactive aggression might be a dysfunctional strategy to regulate anger. Neurobiologically, this might be associated with increased limbic activations and reduced prefrontal inhibition of these limbic regions. Gender differences and the role of endocrine alterations have not been studied yet.

Male and female BPD-patients and healthy volunteers took part in two neuroimaging experiments to investigate neural correlates of threat approach/avoidance and of induced anger and imagined aggressive reactions. Cortisol and testosterone levels were assessed in saliva.

BPD-patients reported more frequent reactive aggression and had increased testosterone and cortisol levels compared to healthy volunteers. Aggressiveness, testosterone, and reduced dorsolateral prefrontal cortex activations were positively related to BPD-patients reduced avoidance tendencies for angry faces. During anger induction, female BPD-patients showed increased amygdala activa-

tions, while, during imagined aggression, activations in the amygdala, OFC, and pregenual ACC were reduced in female BPD-patients compared to healthy women. Preliminary analysis of male BPD-patients indicated gender-specific alterations.

These results suggest reduced avoidance of social threats as one mechanism related to increased reactive aggression in BPD-patients. This may be related to alterations in sex and stress hormone systems and, neurobiologically, to increased limbic reactions to anger-inducing situations, while imagined aggression seems to be associated with a calming-down of emotions in BPD.

Psychopathy and testosterone: the neuro-endocrine correlates of approach-avoidance behavior

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Social emotional actions can be roughly divided into approach and avoidance. When control of these actions fails, aggression-related disorders like psychopathy can be observed. Such emotional control can be experimentally elicited using the approach-avoidance task, in which participants have to respond to affective faces (happy, angry) with approach and avoidance movements. During affect-incongruent conditions participants have to control their emotional tendencies (approach-happy, avoid-angry faces) in order to comply with task demands (approach-angry, avoid-happy faces). The anterior part of the prefrontal cortex (aPFC) is crucial for control of emotional actions, thereby down-regulating emotion-related amygdala signals. Endogenous testosterone levels modulate this prefrontal-amygdala circuit.

Here I will focus on two studies testing participants with criminal psychopathy and after testosterone administration. Psychopaths, especially those with high endogenous testosterone levels, showed less control-related aPFC activity and aPFC-amygdala coupling during trials requiring emotional control, when compared to healthy controls. Testosterone administration in healthy females however increased amygdala responses during social threat approach, while aPFC activity remained unaffected. Whereas the first findings suggest that reduced prefrontal coordination underlies reduced emotional control in criminal psychopaths, testosterone administration modula-

tes motivation-specific amygdala tuning. These divergent effects of aggression-related factors on the aPFC-amygdala circuit show the importance of this network for social emotional behavior and provide relevant insights for advancement of treatment and reduction of recidivism.

The neural network of provocation and aggression and its clinical relevance

Habel, Ute

RWTH Aachen, Psychiatry

We implemented a social reactive aggression paradigm, employing provocation in a two-player game to elicit aggressive behavior in fMRI and physiological settings. We applied this task to healthy men and in another study to autism spectrum disorder patients (ASD).

Participants responded more aggressively after high provocation reflected in taking more money from their opponents, proving effectiveness of the paradigm. Patients' responses were not influenced by the level of social provocation, although in both groups aggression was higher after lost compared to won trials. Physiologically, controls showed fewer but higher EDA amplitudes when responding aggressively, whereas patients displayed the opposite pattern of more but lower EDA amplitudes. Brain activation during provocation was significantly increased in the healthy men sample in aggression-related regions such as amygdala, insula, orbitofrontal cortex (OFC) and inferior temporal cortex, when contrasting individuals with more and less aggressive behavior. Therefore, data suggest there is greater susceptibility for provocation, rather than less inhibition of aggressive tendencies, in individuals with higher aggressive responses.

Notably, insula and amygdala activation during high provocation predicted subsequent activation during the aggression phase in a complex network known to be involved in aggression such as insula and amygdala as well as prefrontal areas. This further supports the hypothesis that aggression can be seen as a consequence of provocation of aggressive emotional responses (insula, amygdala) and parallel regulatory processes mediated mainly by prefrontal areas.

Investigating the angry brain: Increased extrinsic validity and model-free analysis techniques in neuroscience research on aggression

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¹University of Lübeck, Neurology, ²Universität zu Lübeck

Research on the neural basis of aggression highlights two important needs for development.

First, classical aggression paradigms as the Taylor Aggression Paradigm (TAP) are limited in the behavioral options offered to the participant, thus reducing their extrinsic validity. We have designed a novel aggression task, in which the participant has the options of retaliating aggressively against an aggressive opponent, acting non-aggressively or avoiding the interaction altogether. We investigated threat reactivity, measured as fear potentiation of the startle response, in 27 women. We found a negative relationship between threat reactivity and aggressive behavior towards an aggressive opponent ($r = -.48$).

Second, the more complex aggression paradigms are designed to be, the more problematic is the use of classical approaches for fMRI-data analyses, which require a-priori models of the neural processes underlying the task. Here, we used independent component analysis (ICA) to re-analyze an fMRI-dataset from a study implementing video feedback of an opponent during the TAP. 31 healthy male volunteers were investigated. In part of the trials, the opponent looked angry while selecting a punishment for the participant. The ICA revealed a range of task-related neural networks. Networks associated with social information processing, including medial prefrontal cortex, superior temporal gyrus and precuneus, were activated more strongly in angry than neutral trials. We also observed frontoparietal networks with increased activity following angry trials, possibly reflecting the processing of the preceding trial or the planning of future actions.

Raum: 1.811

Symposium 7.3: Hirnmechanismen der Flexibilität und Stabilität

Vorsitz: Christiane Thiel

Department für Psychologie

Die erfolgreiche Reaktion auf Reize und Situationen in unserer Umwelt ist von zwei Mechanismen abhängig. Zum einen ist eine flexible Anpassung an sich verändernde Bedingungen notwendig, zum anderen eine gewisse Stabilität, die es ermöglicht, auch unter störenden Einflüssen ohne Performanzeinbußen zu reagieren und erfolgreiche Verhaltensweisen aufrecht zu erhalten. Das Symposium beschäftigt sich mit den Hirnmechanismen, die diese Flexibilität und Stabilität gewährleisten. Dabei werden in einzelnen Vorträgen neben Verhaltensdaten bei Tier und Mensch elektrophysiologische und bildgebende Daten mit neurocomputationalen Modellen erklärt und die Rolle neurochemischer Modulation untersucht.

Dopamine modulation of prefrontal cortex attractor dynamics

Durstewitz, Daniel

ZI Mannheim, Theoretische Neurowissenschaften

I will briefly review our 'dual-state model' of dopamine function in prefrontal cortex, and discuss recent experimental evidence for it from in vivo multiple single-unit recordings. The dual-state theory was derived from biophysical neural model simulations based on in vitro electrophysiological assessment of the dopamine modulation of different ionic conductances in neocortical cells. It proposes a D1-receptor dominated regime with highly stable attractor states and convergent dynamics, favoring the robust maintenance of information (e.g. in working memory), and a D2-receptor dominated regime with only weakly stable attractors, thus favoring cognitive flexibility and switching among attractor states. Due to recent advances in multiple single-unit recording techniques and statistical and machine learning tools, it became possible to assess neural trajectory flows and attractor dynamics empirically from electrophysiological measurements. I will present results from one such study which confirms core predictions of the dual-state theory.

Attraktorbasierte Arbeitsgedächtnisrepräsentationen als neuronale Grundlage von kognitiver Stabilität und Flexibilität

Ueltzhöffer, Kai

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Wir untersuchen die neurocomputationalen Grundlagen des cue-basierten Aufgabenwechsels (kognitive Flexibilität) sowie der Distraktorinhibition (kognitive Stabilität). Hierzu entwickelten wir ein physiologisch plausibles neuronales Netzwerkmodell, welches die jeweils relevanten Aufgaben im Arbeitsgedächtnis als Attraktorzustände von Neuronenverbänden repräsentiert und welches Entscheidungen durch Integration der jeweils aktiven Aufgabenrepräsentation mit aktuellen perzeptuellen Reizen generiert. Dieses Modell fitten wir an Verhaltensdaten von n=20 Probanden, die eine kombinierte Aufgabenwechsel- und Distraktorinhibitionsaufgabe (Armbruster et al., 2012) bearbeiten. Die individuell angepassten Modelle sind in der Lage, das Verhalten jedes einzelnen Probanden widerzugeben. Aufgrund der physiologischen Natur unseres Modells können wir zudem für jeden Probanden den individuellen fMRT-Zeitverlauf des simulierten Arbeitsgedächtnismodules vorhersagen. Dieser korreliert mit dem Zeitverlauf eines frontoparietalen Netzwerkes, welches die linke inferofrontale Kreuzungsregion (IFJ) und den intraparietalen Sulcus umfasst, ein Netzwerk, welches wiederholt mit Aufgabenwechsel assoziiert wurde. Desweiteren können wir aus den gefitteten Modellen ein individuelles Maß der Attraktorstabilität der Regelrepräsentation ableiten, welches mit der Aktivierung eines thalamocortico-striatalen Updating-Netzwerkes im Kontrast der Aufgabenwechsel- und Distraktorbedingung korreliert. Beide Ergebnisse legen nahe, dass kognitive Flexibilität auf dem Wechsel zwischen attraktorbasierten frontoparietalen Arbeitsgedächtnisrepräsentationen basiert und dass dieser Wechsel durch frontostriatale Netzwerke implementiert wird.

Testung von kognitiver Flexibilität und Stabilität in der Maus

Vollmayr, Barbara

Zentralinstitut für Seelische Gesundheit

Wir stellen ein Test vor für die kognitive Stabilität und Flexibilität von Mäusen analog zu einem kürzlich entwickel-

ten humanen Paradigma: Mäuse wurden in Touchscreen-Boxen trainiert, sich mittels visueller Reize, zwischen zwei Hebeln für eine Belohnung zu entscheiden. Erfasst wurden die Geschwindigkeit und die Fehlerrate bei gleich bleibender Aufgabe und bei Seitenwechseln. Zusätzliche Distraktorreize dienten zur Messung der Ablenkbarkeit und ambige Reize zur Feststellung der spontanen Tendenz zum Wechsel.

Die steigende Schwierigkeit der Aufgabe zeigte sich in einem Anstieg der Fehlerraten von gleichbleibender Aufgabe ohne Distraktor bis zum Seitenwechsel mit Distraktor. Mäuse mit häufigeren spontanen Wechseln zeigten mehr Flexibilität beim Seitenwechsel, aber gleichzeitig auch mehr Ablenkbarkeit.

Dieses Ergebnis unterstützt die Dichotomie von Flexibilität und Stabilität, die von der Dual State Theory postuliert wird. Das Tiermodell repliziert zentrale Ergebnisse der vorausgegangenen humanen Studie und kann dazu dienen, zelluläre Mechanismen, die kognitiver Flexibilität und Stabilität zugrunde liegen, aufzuklären.

Dopaminerge und cholinerge Genvariationen beeinflussen die nikotinerge Modulation der Distraktorverarbeitung

Ahrens, Stefan

Universität Oldenburg, Department für Psychologie

Selektive Aufmerksamkeit bedarf Fokussierung auf relevante und Resistenz gegenüber irrelevanten Reizen. Dies erfordert eine Balance zwischen Stabilität gegenüber irrelevanten Distraktoren und flexibler Reorientierung zu relevanten Reizen. Sowohl Nikotin, als auch der Einzelnukleotid-Polymorphismus (SNP) rs1044396, im für die $\alpha 4$ Untereinheit des nikotinergeren Azetylcholinrezeptors (CHRNA4) kodierenden Gen, modulieren die visuell räumliche Aufmerksamkeit und Distrahierbarkeit. Zudem interagiert dieser SNP synergistisch mit dem SNP rs6277 im dopaminergen Typ 2 Rezeptor (DRD2) Gen. In einer doppel-blinden pharmako-genetischen Verhaltensstudie untersuchten wir in 58 gesunden Nichtrauchern, ob diese SNPs den Effekt von Nikotin auf Distraction beeinflussen. In einem Innersubjekt Design wurde ein 7 mg Nikotinpflaster oder ein inaktives Placebo Pflaster für 1 Stunde verabreicht und anschließend eine Aufgabe zur selektiven Aufmerksamkeit durchgeführt. Separat betrachtet modulierte nur der DRD2 nicht aber der CHR-

NA4 Genotyp den Effekt von Nikotin auf die Distrahierbarkeit, wobei DRD2 CC Träger am stärksten von Nikotin profitierten. Eine weitere Analyse zeigte, dass dieser Effekt von Probanden getrieben war, die zusätzlich mindestens ein C Allel im CHRNA4 SNP trugen. Der CC Genotyp im DRD2 SNP steht mit einem erhöhten Dopamin Tonus im Striatum in Verbindung, was mit erhöhter Flexibilität / Distrahierbarkeit assoziiert wird. Möglicherweise veränderte Nikotin hier die dynamische Balance dopaminerg Neurotransmission zwischen Striatum und Präfrontalem Kortex und ermöglichte somit mehr Stabilität gegenüber Distraktoren.

Die Leistung in Mehrfachaufgaben korreliert mit der Stabilität und Flexibilität komplexer Hirnnetzwerke

Giessing, Carsten

Carl von Ossietzky Universität Oldenburg

Wovon hängt es ab, wie gut ein Mensch zwei kognitive Aufgaben gleichzeitig durchführen kann? Frühere Studien legen nahe, dass unser Gehirn aus einem komplexen Netzwerk interagierender Hirnregionen oder Verarbeitungsknoten besteht. Dieses komplexe Netzwerk weist eine modulare Struktur auf, d.h. Knoten interagieren mit vielen Knoten innerhalb des gleichen Moduls, aber nur mit wenigen Knoten außerhalb des Moduls. In meinem Vortrag stelle ich ein fMRT Experiment dar, in dem untersucht wurde, wie die Stabilität und Flexibilität dieser Hirnmodule mit der Fähigkeit zum Multitasking zusammenhängt.

Versuchspersonen führten eine visuelle und eine auditive Detektionsaufgabe durch, die nacheinander als Einzel- und als Doppelaufgabe bearbeitet wurden. Betrachtet man das funktionelle Netzwerk des gesamten Gehirns, zeigt sich, dass eine starke Überlappung der Module in den beiden Einzelaufgaben mit starken Verhaltenseinbußen in der Doppelaufgabe verbunden war. Dagegen führte eine flexible Anpassung der Module von der Einzel- zur Doppelaufgabenbearbeitung zu besseren Leistungen. Auf der Ebene der einzelnen Netzwerkknoten zeigte sich ein komplexeres Bild. Überlappten sich die Hirnmodule in beiden Einzelaufgaben in Hirnregionen, die zur visuellen Aufmerksamkeit und motorischen Verarbeitung beitragen, führte dies zu schlechteren Leistungen. Dagegen war die flexible Anpassung der Module in einzelnen Hirnre-

gionen positiv und in anderen Regionen negativ mit der Verhaltensleistung korreliert. Insgesamt zeigte sich, dass die erfolgreiche Bearbeitung einer Doppelaufgabe von einer spezifischen Balance flexibler und stabiler Module abhängt.

Raum: 1.812

Symposium 7.4: Social information processing in the developing brain

Vorsitz: Stefanie Höhl & Sarah Weigelt

Universität Heidelberg

How social information is processed in the developing brain is of great interest in current developmental cognitive neuroscience. We will discuss research on how infants and children process faces, eye gaze, and voices. The first talk will focus on the categorical distinction between animate and inanimate stimuli in infants. In the second talk, fast periodic stimulation is used to show that 4- to 6-month-olds detect human faces among various objects. In the third talk, an eye tracking study will be presented demonstrating that 4-month-olds' encoding of novel objects is enhanced when the objects are cued through someone else's eye gaze. In the fourth talk, ERP evidence for voice discrimination in 2- to 4-month-olds using the mismatch negativity (MMN) will be presented. The fifth and final talk will report evidence on face recognition depending on visual perspective in school children. Findings will be discussed in the broader context of social cognitive development and the social brain.

Categorization of Animate versus Inanimate Stimuli Across Development: A Fast Periodic Visual Stimulation Study

Peykarjou, Stefanie; Hoehl, Stefanie; Rossion, Bruno; Pauen, Sabina

Universität Heidelberg

Distinguishing between animate and inanimate stimuli in the environment is an important prerequisite to identify potential social partners. Behavioral work suggests that with 7 months, infants are able to discriminate animate from inanimate items and vice versa (Pauen, 2002). But can younger infants already form such broad categories, and to which extent do low-level cues associated with animate and inanimate categories (Oliva & Torralba, 2003) contribute to categorization? We recorded EEG while presenting 4-month-olds ($N = 51$), 7-month-olds ($N = 48$), and adults ($N = 12$) with animal or furniture items at a fixed rate of $F = 6$ Hz. Every fifth image belonged to the other category ($F/5 = 1.2$). Discrimination was indexed

by significantly increased activity at 1.2 Hz and harmonics. In all three age groups, discrimination of original categories was observed, despite the short presentation time of individual images (i.e., ~ 180 ms) (adults SNR > 4.4, $p < .0001$, infants all SNRs > 1.4, all $ps < .01$). However, whereas adults' discrimination was severely reduced by phase-scrambling images (SNR = 1.5, $p < .01$), indicating that high-level semantic processing contributed to categorization, both 4- and 7-month-olds showed similar performance for phase-scrambled (all SNRs > 1.2, all $ps < .01$) and original conditions. This indicates that (1) from 4 months of age, infants can discriminate broad visual categories, but (2) in this paradigm, with very short exposition times, infants' categorization can be explained via online categorization processes associated with low-level cues, whereas adults' cannot.

Rapid Categorization of Natural Face Images in the Infant Right Hemisphere

de Heering, Adélaïde; Rossion, Bruno

Université catholique de Louvain

Human performance at categorizing natural visual images surpasses sophisticated automatic algorithms, but how and when this function arises and develops remain unanswered. We recorded scalp electrical brain activity in 4-6 months infants viewing images of various objects in their natural background at a rapid rate of 6 images/second (6 Hz). Widely variable natural face images appearing every 5 stimuli generated an electrophysiological response over the right hemisphere exactly at 1.2 Hz (6 Hz/5). This face-selective response was absent for phase-scrambled images, showing that it is not due to low-level visual information. These findings indicate that right lateralized face-selective processes emerge well before reading acquisition in the infant brain, who is able to perform figure-ground segregation and generalize face-selective responses across faces varying in size, viewpoint, illumination as well as expression, age and gender. They open an avenue for clarifying the developmental course of natural image categorization in the human brain.

Looking times hint at eye gaze detecting neurons in infants

Michel, Christine; Pauen, Sabina; Hoehl, Stefanie

Universität Heidelberg

Eye gaze acts as an important cue influencing infants' attention and social learning processes. In a study by Hoehl, Wahl, and Pauen (2014), 4-month-old infants saw a person turning her eye gaze toward one object and away from another one. When both objects were presented again, infants looked longer to the previously not cued object than to the cued one. The cued object presumably was already more familiar to the infants while the not cued object was more novel to them and attracted more attention.

One possible mechanism that may account for such attention cueing effects is the Direction of Attention Detector (DAD) that builds on the discovery of neurons in the superior temporal sulcus in the macaque. These neurons were found to be sensitive to eye gaze direction (Perrett & Emery, 1994; Perrett, Hietanen, Oram, & Benson, 1992). If such neurons exist already in infants, eye gaze cueing should possibly also occur in response to eye gaze without the context of a complete face.

We therefore adopted the paradigm of Hoehl et al. (2014) and presented 4-month-olds in a between-subjects design either schematic eyes with a black pupil on a white background as the cue ($n=21$) or the inverted contrast with a white dot on a black background ($n=21$).

As in the study by Hoehl et al. (2014), infants showed longer relative looking times to the previously not cued object ($M=0.49$) compared to the previously cued object ($M=0.36$), ($F(1,20)=12.385$, $p=0.002$, $\eta^2=0.382$) but only if the natural eye contrast was presented. The effect was not found in the inverted contrast condition ($p>0.05$). These results give a hint on the existence of the DAD in infancy as only stimuli with a specific eye-like contrast could affect infants' attention.

Does sleep support voice discrimination learning in infants?

Katharina, Zinke; Thöne, Leonie; Born, Jan

Universität Tübingen

The ability to discriminate voices is an important aspect of social learning in infants. In our current study, we aimed at exploring the impact of sleep on learning processes that are involved in voice discrimination in 2- to 4-month-old infants. As a marker for this kind of auditory processing we used the Mismatch Negativity (MMN) that can be calculated by comparing event related potentials to different stimuli within a so-called oddball paradigm. This paradigm consisted of repeatedly presented recordings of the word “baby” (400ms, ISI = 600ms) pronounced by three different female speakers: an unfamiliar one (frequently presented standard stimulus), the own mother (infrequently presented familiar oddball), and a second unfamiliar one (unfamiliar oddball). While recording EEG, the oddball paradigm was presented for 10 minutes to the awake infant before and after a retention interval of 100-160 minutes. The retention interval included a familiarization phase (recording of a story read by the unfamiliar oddball voice) and a sleep/wake phase where the infants either fell asleep immediately or stayed awake for more than 25 minutes before falling asleep (delayed sleep after wake). Data collection has been successfully conducted with 21 infants (mean age = 100 days) and is still ongoing. Preliminary analyses suggest differences between the ERPs for the mother’s and the unfamiliar voice that change after familiarization and the sleep/wake phase. In subsequent analyses with the complete data set, we will further explore whether the pattern of changes in the MMN depend on the timing of the sleep period after familiarization (immediately or delayed) which would suggest a role of sleep for voice discrimination learning in infants.

Viewpoint and viewpoint change effects in face memory in 5-to 10-year old children and adults

Nordt, Marisa; Weigelt, Sarah

Ruhr-Universität Bochum

The ability to recognize faces under varying contexts and conditions is essential for our social perception. One factor varying strongly in different situations is the viewpoint a face is presented in. Here, we investigated face memory

performance in school-aged children and adults in two experiments: Experiment 1 addressed the effects of different viewpoints on face memory performance in five- to ten-year-old children and adults (N = 110). In a within-group design three versions of a 2AFC-task were completed by each participant, comprising pictures of faces in either front, three-quarter or profile views. Experiment 2 investigated the effects of viewpoint changes on face memory performance in six- to ten-year-old children and adults (N = 180). Three main viewpoint changes between study and test phase were investigated (45°_front: front/three-quarter or three-quarter/front; 45°_profile: three-quarter/profile or profile/three-quarter; 90°: front/profile or profile/front). A between-group design was applied, in which each participant completed one direction of each viewpoint change. Data of experiment 1 revealed a main effect of age group and a main effect of viewpoint – with frontal and three-quarter views being remembered more often than profile views. Experiment 2 revealed a main effect of age group and a main effect of viewpoint change – the difficulty level rising from 45°_front to 45°_profil to 90°. The lack of a viewpoint x age group interaction (Experiment 1) and the lack of a viewpoint change x age group interaction (Experiment 2) indicate similar viewpoint and viewpoint change effects across age groups.

Raum: PEG 1.G147

Symposium 7.5: Sleep-dependent memory consolidation: oscillations, reactivation and schemas

Vorsitz: Gordon B. Feld¹ & Thomas Schreiner²

¹Uni Tübingen, ²Universität Zürich

Sleep benefits memory. The most vigorously examined theory asserts that sleep-specific brain oscillations orchestrate the neuronal reactivation of memory traces that were encoded during prior wakefulness, thereby promoting their strengthening and reorganization. The speakers will present their different approaches to examine the process of sleep-dependent memory consolidation and associated neural activity: Thomas Schreiner will present data on how exogenous cueing can cause interference during sleep. Nora Hennies will show her work indicating that schema related memories are readily consolidated during sleep. Mick Lehman will introduce his work on targeted memory reactivations during sleep and emotional processing. Hong-Viet Ngo will present his efforts to characterise the boundaries of closed-loop stimulation of neuronal oscillations during sleep. Gordon Feld will show how pharmacologically blocking direct electrical coupling between neurons during sleep disrupts declarative memory.

When less is more: Auditory feedback blocks beneficial effects of cueing during sleep.

Schreiner, Thomas; Rasch, Björn

University of Zurich

Maintaining memories for the long-term critically depends upon their reactivation. During wakefulness, reactivated memories are typically strengthened when confirmed correct, while forgetting can occur when conflicting information follows. Reactivation similarly strengthens memories during sleep, although the processes underlying the stabilization of memories after their reactivation are largely unknown. Here we show that the benefits of cueing Dutch vocabulary during sleep are completely blocked when single memory cues are followed by both correct and conflicting information. While successful reactivation using single verbal cues is associated with an increase in fronto-central oscillatory theta and spindle activity, presentation of feedback cues unspecifically suppressed these patterns. The results clearly indicate that single memory

cues are more efficient in stabilizing memories during sleep than cues followed by feedback. Our data suggest that oscillatory processes initiated by single memory cues in the theta and spindle range are necessary for the memory benefits of reactivation during sleep.

Sleep spindles mark hippocampal to neocortical consolidation of schema-related memories

Hennies, Nora; Lambon Ralph, Matthew A.; Kempkes, Marleen; Cousins, James N.; Lewis, Penny A.

University of Manchester

Information that relates to prior knowledge is memorised better than information that does not relate to a pre-existing schema. Recent research suggests that this facilitation, which is often called the 'schema effect', results from accelerated memory consolidation, as schema-related memories are assimilated into neocortical networks more efficiently. Whether sleep plays a role in such schema-dependent consolidation is unknown. To examine this question participants first established an artificial mental schema over two weeks. Next, they encoded a set of new facts (remote facts) which were either related to the schema or completely unrelated. After a retention interval of 24 hours, including a night of sleep, participants encoded a second set of facts (recent facts). Finally, memory for both recent and remote facts was tested in a functional magnetic resonance imaging scanner. We assessed sleep-related differences in brain activity related to both consolidation interval and schema-linkage. Our behavioural results showed that the beneficial effect of schemas on memory increased across the 24 h consolidation period, driven by a protection of schema-related memories against decay. The increase in the schema effect was predicted by spindle density. We also found that higher spindle densities were associated with decreased hippocampal engagement across time, specifically for schema-related memories. These results suggest that sleep spindle activity marks schema-dependent consolidation, possibly through a role in the integration of newly acquired memories into pre-existing neocortical schemas.

Reactivation of emotional memories during sleep

Lehmann, Mick¹; Seifritz, Erich²; Rasch, Björn³

¹University of Zurich, ²Psychiatric University Hospital Zurich, ³University of Fribourg

Sleep is known to promote the consolidation of memories, and the beneficial effect of sleep on memory relies on spontaneous reactivations of memories during NREM sleep. A recent study suggests a differential role of reactivation on the content of memories as compared to the memory-associated emotional arousal. In this respect, especially the role of REM sleep in emotional processing is still not clarified. Here we investigated whether the cued reactivation of emotional memories during NREM or REM sleep affects the recall of memory content and emotional reactivity differentially. Participants completed an association learning task, consisting of neutral words which were either combined with high- or low-arousing pictures and recall was tested. Additionally, prior to the association learning, arousal ratings for the words were assessed. During the subsequent retention interval, fifty percent of the words were repetitively replayed, either during NREM, REM or wakefulness and both, retrieval and arousal ratings were assessed afterwards. As expected, only re-exposure during NREM sleep improved later recall compared with uncued word-picture pairs while cueing during wake and REM sleep did not lead to a comparable consolidation effect. Interestingly, replay during REM sleep affected the arousal ratings for words associated with high-arousing pictures, resulting in an increased subjective emotional reactivity to the word presentation. This effect was neither observable in the two other groups nor for low-arousing associations, suggesting that REM sleep potentially plays an important role in the preservation of emotionally arousing memories.

Brain stimulation during sleep: Targeting EEG oscillations to investigate the memory function of sleep

Ngo, Hong-Viet V.¹; Mölle, Matthias²; Born, Jan¹

¹University of Tübingen, ²University of Lübeck

Brain oscillations reflect regulatory activity of information processing and communication between neural networks. In this regard the sleeping brain is by no means idle, but during deep sleep is hallmarked by the largest of these oscillations, the so-called < 1 Hz slow oscillation. Emerging

from a highly synchronized alternation between phases of firing and quiescence in neural networks the slow oscillation recruits subcortical structures and thereby mediates the processes of memory consolidation. Against this backdrop the grouping of thalamic sleep spindles and hippocampal sharp-wave ripples in a top-down manner plays a key role. Due to its supraordinate function it is of special interest to which extent slow oscillations can be manipulated by external stimulation in order to influence the formation of memories. Here I will present different approaches utilizing various modalities ranging from sensory over transcranial electrical to optogenetic stimulation to demonstrate that brain stimulation is a promising mean to unravel the functional role of slow oscillations and other essential sleep rhythms.

Blocking gap junctions with mefloquine during sleep impairs declarative memory consolidation

Feld, Gordon; Fritsche, Andreas; Born, Jan; Hallschmid, Manfred

University of Tübingen

Sleep-dependent consolidation of memory relies on the reactivation of traces encoded during prior wakefulness. The sleep slow oscillation (~ 0.75 Hz) orchestrates plasticity promoting thalamically generated sleep spindles and hippocampal sharp-wave/ripples to strengthen and reorganize declarative memories. Sharp-wave/ripples coincide with the reactivation of memory traces in the hippocampus and have been causally linked to memory consolidation in rats. The direct electrical coupling between hippocampal neurons via gap junctions has been shown to be involved in their generation. Mefloquine is a malaria drug that blocks gap junction signalling. In this balanced within-subject placebo-controlled study, 20 young healthy men received 250 mg of mefloquine after learning a declarative associative word-pair task during the afternoon. The next day, after a night containing 8 hours of sleep, participants performance on the word-pair task was reduced compared to placebo. Mefloquine also increased the time spent in slow wave sleep. Our results, for the first time, demonstrate a crucial involvement of the direct electrical coupling between neurons in sleep-dependent declarative memory consolidation.

Postersession A

Poster A01

Brain Painting V2: Development of an easy-to-use and customisable ERP based brain-computer interface for creative expression following the user-centered design

Botrel, Loic; Holz, Elisa; Kübler, Andrea

Julius Maximilians Universität Würzburg

In accordance with the user-centered-design (UCD) approach, Brain Painting, a brain-computer interface (BCI) application for creative expression, has been extensively tested and evaluated by healthy subjects and end-users with different neurological diseases in iterative cycles in the past seven years.

Brain Painting requires the end-user to focus on a grid of choices while being visually stimulated. “P300” Event related potential (ERP) occurrences, related to the user’s choices, are detected by analyzing electroencephalographic signals in real-time, thus allowing to send commands without requiring any motor input.

During the iterative development process of Brain Painting 2 (BP2), we put emphasis on optimizing the usability for all actors implicated, comprising end-user, caregivers and researchers. BP2 also integrated requests from end-users by inserting new painting features and making their grids of commands individually customizable. BP2 has an automatic calibration function to ensure that the system is functional before use. Automated secure data transfer and evaluations allows end-user to paint independently at home and ask for remote support when needed.

Autonomous learning is critical for the adoption at home of BP2 by end-users. We therefore created a 20 min tutorial video that was played in a study with 10 healthy participants. Results ascertained that the tutorial video is sufficient for Brain Painting novices to perform the subsequent Brain Painting session.

BP2 was recently implemented at the home of an end-user (JT) who quickly adopted it and reported high satisfaction. The participation of more end-users is awaited to refine BP2 for a broader adoption.

Poster A02

Neuronale Korrelate der Feedbackverarbeitung bei Sozialer Angststörung

Voegler, Rolf; Peterburs, Jutta; Straube, Thomas

Westfälische Wilhelms-Universität Münster

Die Angst vor negativer Bewertung gilt als zentrales Merkmal der sozialen Angststörung (SAD). Neurowissenschaftliche Untersuchungen haben verschiedene hirnpfysiologische Korrelate der veränderten Informationsverarbeitung bei SAD identifiziert, die bisherige Forschung bezog sich jedoch v.a. allgemein auf die Verarbeitung negativer sozialer Stimuli (z.B. Gesichter) sowie nicht situativ-leistungsbezogener Bewertungen. In der aktuellen Studie wird die Verarbeitung von Feedback bei SAD in Abhängigkeit vom sozialen Kontext im EEG mittels einer probabilistischen Lernaufgabe untersucht. Mit Hilfe einer Kamera wird zudem eine Beobachtungsbedingung realisiert, die die Manipulation des sozialen Kontextes während der Untersuchung erlaubt (Beobachtungs- vs. Nichtbeobachtungsbedingung). Unsere bisherigen Ergebnisse zeigen eine Modulation der feedback related negativity (FRN) in Abhängigkeit sowohl von Gruppenzugehörigkeit als auch von der Kamerabedingung (Beobachtung vs. Nichtbeobachtung). Diese Befunde werden im Rahmen bestehender Forschungsergebnisse und psychopathologischer Modelle bei SAD diskutiert.

Poster A03

Cue validity modulates the response inhibition P3: an EEG study

Rudolf, Anne; Korinth, Sebastian; Fiebach, Christian

Goethe-Universität Frankfurt am Main

Processes of attention and cognitive control are typically studied in isolation, while we can plausibly assume that they strongly interact. Previous work suggests that reflexive deployment of attention may facilitate the inhibition of motor responses. Here, we report an ERP study investigating the effect of attention reorientation on response inhibition to pinpoint the underlying cognitive mechanisms. 41 adults (18-37 years) performed a task where reorientation and inhibition were elicited both separately and simultaneously, resulting in both validly and invalidly (reorienting) cued go and no-go (inhibition) conditions, while EEG was measured (128 channel EGI sensor net).

ERPs elicited during inhibition replicate previous reports of frontocentral N2 and P3, while attention reorientation is associated with a prominent frontocentral P2 reflecting selective attention processes, coupled with reduced posterior P1-N1. In the combined condition, participants perceive a no-go stimulus at the uncued location, inducing attentional re-deployment to the uncued location immediately followed by the inhibition of the response. Commission errors are substantially reduced compared to the valid no-go condition, indicating that attention reorienting facilitates response inhibition. ERPs show the reorientation-specific P2 effect, followed by a significant reduction of the inhibition-P3 at central and frontocentral electrodes, which further supports the facilitation of response inhibition processes. We propose that the need to reorient attention interrupts the preparation of responses for the cued location, thus allowing inhibitory processes to interrupt the planned response at an earlier stage of motor preparation. We will supplement these data by cross-sectional developmental data from a sample of 9-14 year-old children.

Poster A04

Modulation der frontalen Asymmetrie durch Händigkeit und Motorfluency

Reutter, Mario

Julius-Maximilians-Universität Würzburg

Zahlreiche Studien untersuchten Davidsons Theorie der frontalen Asymmetrie. In Ruhe gemessen wird dieses Gehirnsignal als Marker des affektiven Stils – der Ansprechbarkeit auf affektive Reize – interpretiert, es bildet aber auch physische Aktivierungsveränderungen während der Verarbeitung emotionsinduzierender Stimuli ab. Neuere Studien konnten zeigen, dass Annäherungs- und Vermeidungsmotivation einen noch stärkeren Zusammenhang mit der frontalen Asymmetrie zeigen als positiver und negativer Affekt. Währenddessen legen Befunde bei Links- und Rechtshändern nahe, dass Annäherungsverhalten sowie positiver Affekt mit der dominanten Hand und aktive Vermeidung sowie negativer Affekt mit der non-dominanten Hand assoziiert sind. Die Motorfluency – die empfundene Einfachheit bei der Ausführung manueller Bewegungen – scheint dabei vermittelnder Faktor dieser hedonischen Konnotation zu sein. Über den gemeinsamen Nenner von Annäherung und Vermeidung bzw.

positivem und negativem Affekt wird daher ein theoretischer Rahmen zur Verbindung der Themengebiete frontaler Asymmetrie, Händigkeit und Motorfluency vorgestellt und empirisch überprüft. Bei 55 Probanden wurde der Einfluss der Händigkeit und einer Aufgabe zur Manipulation der Motorfluency („Domino Challenge“; Casasanto & Chrysikou, 2011) auf die frontale Asymmetrie in Ruhe als auch deren phasischer Veränderung untersucht. Es konnte kein statistisch bedeutsamer Einfluss der Händigkeit nachgewiesen werden, während die Deskriptivwerte der Richtung der Hypothesen entsprachen. Die Manipulation der Motorfluency zeigte keinerlei Auswirkung.

Poster A05

Acute binge drinking alters the modulation of response inhibition by working memory load: an EEG study

Riegler, Lea; Stock, Ann-Kathrin; Beste, Christian

Universitätsklinikum Dresden

Even though the adverse effects of binge-drinking on response inhibition are well-known, it is unclear how they alter the interaction of working memory load and response inhibition. We therefore investigated the effects of an acute alcohol intoxication on response inhibition as a function of working memory load.

A sample of n=21 healthy young men aged 19 to 32 was tested with a complex Go/Nogo task once sober and once intoxicated (~1.1 ‰) while an EEG was recorded. The paradigm employed both letters and digits which could be either mirrored or non-mirrored as stimuli. Different working memory workloads were induced by rotating the stimuli (30° / 90° / 150°). Furthermore, there were two experimental blocks with different task complexity to induce different degrees of prepotent response tendencies as evoked by 70% Go stimuli.

The results show that the subjects committed more errors while intoxicated and that this behavioral decline was more pronounced in the block with stronger prepotent response tendencies (as induced by task complexity). We further found that in case of high task complexity, the condition with the highest working memory load yielded the smallest behavioral impairment, while the lowest workload yielded the highest impairments. On a neurophysiological level, we found differences in the N2-P3 complex, where the Nogo-P3 was modulated the most by the

observed behavioral effects. The counterintuitive finding that deficits are largest in the supposedly easier conditions allows for new inferences about the control of automatic processes under the acute influence of alcohol.

Poster A06

Räumliche Aufmerksamkeit bei Patienten mit Depersonalisation – eine EEG-Studie

Schabinger, Nadine; Michal, Matthias; Berti, Stefan; Beutel, Manfred E.; Adler, Julia

Universitätsmedizin Mainz

Selektive Aufmerksamkeit ist eine basale neuro-kognitive Funktion. Störungen von Aufmerksamkeitsprozessen können durchaus auch einen Beitrag zum Entstehen oder zur Ausprägung von spezifischen psychischen Störungsbildern liefern. Eine aktuelle Studie konnte zum Beispiel zeigen, dass bei Patienten mit einer Depersonalisation (DP) Prozesse der visuell-räumlichen Aufmerksamkeit beeinträchtigt sind. DP beschreibt das Gefühl des Abgelöstseins vom eigenen Körper und den eigenen mentalen Vorgängen und kann auch bei gesunden Personen z.B. in Situationen mit erhöhtem Stress auftreten. Um den Zusammenhang zwischen DP und räumlicher Aufmerksamkeitssteuerung genauer zu verstehen, haben wir DP-Patienten in einem Spatial-Cueing Paradigma getestet und die zugrunde liegenden neuro-kognitiven Funktionen mittels ereigniskorrelierter Potentiale (EKPs) untersucht. Unterschiede zwischen den EKPs der DP-Patienten und denen der Kontrollprobanden zeigten sich sowohl auf frühen, sensorischen Komponenten (P100-Zeitfenster), als auch auf späteren, mehr kognitiven Verarbeitungsstufen (P300-Zeitfenster). Dies deutet darauf hin, dass bei DP eine zentrale Veränderung der Aufmerksamkeitsfunktion vorliegt, aber auch spätere Verarbeitungsebenen beeinflusst sind.

Poster A07

Network centrality of prefrontal and parietal brain regions is associated with general intelligence

Hilger, Kirsten¹; Ekman, Matthias²; Fiebach, Christian J.¹; Basten, Ulrike¹

¹Goethe-Universität Frankfurt am Main, ²Donders Institute for Brain, Cognition, and Behaviour, Radboud University Nijmegen

Graph theory provides a framework for the characterization of complex interactions in brain networks. Using graph

theoretical metrics, previous studies have linked individual differences in intelligence to the global communication efficiency of the human brain. Here, we investigated whether connectivity metrics can further elucidate the neural locus of the relationship between network topology and individual differences in intelligence. Based on fMRI data acquired during wakeful rest, individual functional brain networks of 54 healthy adult participants (NKI Rockland Sample; Nooner et al., 2012) were modeled as graphs. Subsequently, metrics of graph properties were correlated with intelligence scores (Wechsler Abbreviate Scale of Intelligence, Wechsler, 1999). Brighter subjects showed higher network centrality of the right inferior frontal gyrus (IFG) and the dorsal anterior cingulate cortex (dACC), as well as lower centrality of the left temporo-parietal junction area (TPJ). Specifically, these differences in network topology were characterized by variations in (i) degree centrality, reflecting differences in the number of direct neighbors, as well as by (ii) nodal efficiency reflecting differences in the amount of shortest connections from a given region to all other nodes of the network. Our results indicate more efficient communication in brain regions involved in cognitive control and executive attention (IFG, dACC) in more intelligent individuals, while at the same time brain systems related to default mode activity (TPJ) show lower susceptibility for communicating signals from the rest of the network. More generally, this work demonstrates that the topological integration of brain networks may critically contribute to human intelligence.

Poster A08

Psychophysiological mechanisms underlying response selection in multidimensional space

Mückschel, Moritz; Beste, Christian

Universitätsklinikum Dresden

In everyday life response selection requires the processing of two- or three-dimensional spatial information. Common experimental paradigms comprise variations only in one dimension, especially on the left-right axis. Less is known about the neuronal mechanisms underlying response selection process in several dimensions of 2D space. To shed light on this aspect using EEG and source localization techniques, participants completed a two-dimensional flanker task. As the data shows response selection processes were differentially modulated across diffe-

rent dimensions. Though, this modulation was restricted to conditions imposing increased demands on response selection. In such situations, a distributed fronto-parietal network mediates intensified conflict monitoring processes as well as response inhibition processes. Those brain areas were more active when response selection was carried out in the horizontal dimension than during response selection in the vertical dimension. Attentional selection processes were not affected. These findings are of importance for our insight in everyday life situations, because response selection is regularly carried out in multiple dimensions and not only one, as primarily investigated in cognitive neuroscience.

Poster A09

Internal models of face identities in predictive coding

Eisenhauer, Susanne; Brodski, Alla; Wibral, Michael; Paasch, Georg-Friedrich

J. W. Goethe Universität Frankfurt

Our brains constantly solve recognition problems. Solving such problems presumably relies on internally stored representations to complement incomplete sensory evidence. According to predictive coding theory (PCT) in particular, internal representations are accessed in a context specific way to generate a predictive neural code. This predictive code is sent down the cortical hierarchy to be compared to the incoming sensory signal. The discrepancy between the predictive code and the sensory signal is sent up the cortical hierarchy and causes an update process of the predictive code.

Physiological accounts of PCT propose that beta frequency activity is linked to the predictive code, but this remains to be shown. We investigated this hypothesis by means of sensor level statistics and pattern classification of magnetoencephalographic responses from a face identity task using Mooney stimuli. In this task, identification performance was improved by accumulation of visual information about a target identity over trials, as the predictive code related to the target identity reflected richer detail.

We found a behavioural improvement in identification suggesting the enrichment of the predictive code with more detail. This behavioral improvement correlated with an increase in beta frequency power (13 to 21 Hz), supporting the relevance of beta oscillations for the predictive

code. Furthermore, we found increased power at lower gamma frequencies (40 to 49 Hz) during prediction updates, indicating that certain aspects of predictions may not be signalled through beta, but rather through low-frequency gamma activity.

Poster A10

Experimental boundary conditions of return of fear in humans

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Current treatments for anxiety disorders are effective but the high rate of clinical relapse remains a major problem. Relapse can be modeled in the laboratory by so called return of fear (ROF) manipulations in fear conditioning paradigms such as spontaneous recovery (passage of time), renewal (contextual change) and reinstatement (re-occurrence of the aversive event). In the human literature, different qualities of ROF have been reported (generalized and differential), but the factors contributing to these divergent findings have not been investigated systematically. To fill this gap in the literature, we conducted a study investigating the experimental, in particular contextual, boundary conditions of ROF in humans. We present autonomic data on how the context and contextual changes affect ROF in reinstatement and renewal in humans. In total four different groups were tested. All participants underwent fear conditioning and extinction in one context (A) that was either followed by administration of reinstatement (reinstatement groups) or not (renewal groups) in the same context (A) or a second new context (B). Subsequently, ROF was tested in the second context (B) resulting in two different context groups (AAAB or AABB). We present evidence, that autonomic responses are differentially affected by this contextual change for renewal and reinstatement.

In conclusion, this study represents the first steps for establishing systematic investigations on experimental (i.e. contextual) boundary conditions in human ROF studies. Findings from this study contribute to a better understanding of ROF, and may ultimately aid improvement of current treatments and prevention of relapse.

Poster A11

The effects of time on task in healthy aging - an ERP study of mental fatigue

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When people have to perform a cognitive low-demanding and monotonous task for a long period of time they may experience mental fatigue, which leads to problems in information processing and action control. Similar effects could be shown in healthy aging due to changes in the frontal dopaminergic system. The present study tried to investigate, if frontal deficits in older adults may amplify impairments when suffering from mental fatigue. 14 younger (20 - 30 years) and 14 older (56 - 70 years) healthy participants had to perform a monotonous spatial stimulus-response-compatibility task for more than 3 hours. The experiment was divided into 3 equal blocks by short breaks. In this way a detailed analysis of the time course of mental fatigue was possible. Interestingly, the older adults showed an earlier decline in behavioural performance than the younger adults. In contrast, the older participants seemed to benefit more from short breaks. Additionally, the younger adults showed an increase in N2 and P2 amplitude with time on task, whereas those components revealed no changes over time in the older adults. These results indicate that younger adults might be able to adjust their cognitive resources to the given task conditions. In this way they seem to be able to hold their performance on an appropriate level over a long period of time. However, the older adults seem to lack this ability and therefore might be more vulnerable for the effects of mental fatigue than the younger adults.

Poster A12

THE ELECTROPHYSIOLOGY OF PREPULSE INHIBITION

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The acoustic startle response is decreased by a prepulse occurring 30-500 ms earlier. This prepulse inhibition (PPI) is interpreted in terms of the Interruption and Protection hypotheses, in which startle responding interrupts prepul-

se processing, and PPI indicates the degree to which prepulse processing is protected from that interruption. We evaluated this hypotheses by measuring startle responding and evoked potentials (N1, P2) to both prepulse and startle stimuli under different attentional conditions (Attend Startle, Attend Prepulse, Ignore Both). 192 trials were presented in randomized order: Startle Alone (105dB noise), Prepulse Alone (70dB noise), and prepulse+startle stimuli with a stimulus onset asynchrony (SOA) of 120 (PPI120) or 500 ms (PPI500). 36 participants, randomly assigned to the three attention conditions, pressed a key to the startle or to the pre-pulse or did not respond. A 32-channel EEG and eyeblink EMG were measured. Independent of the attentional conditions, the EMG startle response was decreased by a pre-pulse at both SOAs, illustrating PPI. Prepulse N1/P2 amplitude was identical for the Prepulse Alone, PPI120, and PPI500 stimuli independent of the attentional conditions, demonstrating protection of primary sensory prepulse processing. N1/P2 potentials to the startle stimulus were affected by the SOAs and the attentional conditions, suggesting a change in startle processing by both variables. The results suggest a complete protection of prepulse processing. The reduced N1/P2 amplitudes to the startle stimulus at both SOAs suggest that the eliciting properties of the startle stimulus are decreased by the prepulse.

Poster A13

Verstärkt der Duft einer Stresssituation den Startle-Reflex beim Menschen?

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Die Funktionalität des Stresssystems führt dazu, dass die Freisetzung von Hormonen in einer Stresssituation aktuelle Gedächtniskonsolidierungsprozesse begünstigt. In früheren Studien unserer Arbeitsgruppe konnte gezeigt werden, dass Erinnerungen an eine Stresssituation durch Düfte hervorgerufen werden können. In der vorliegenden Studie wird untersucht, ob die potenzielle Fähigkeit eines Duftes, eine implizite emotionale Gedächtnisspur an eine Stresssituation zu aktivieren, sich durch eine erhöhte Startle-Reaktion am nächsten Tag ausdrückt.

Der Trierer Sozial Stress Test (TSST) ist ein etablierter Laborstressor, der durch sozial evaluativen Stress während einer freien Rede des Probanden die Hypothalamus-Hy-

pophysen-Nebennierenrindenschicht (HHNA) aktiviert, was zu einer Erhöhung der Cortisolkonzentration führt. Der vergleichbare „friendly“ TSST (f-TSST), der keine HHNA Reaktion verursacht, diente als Kontrollbedingung.

In einem Zwei-Tages-Design wurden 60 Probanden randomisiert einer der beiden Bedingungen zugeordnet, während derer sich ein unbekannter neutraler Duft im Raum befand. Am nächsten Tag wurde ihr, durch 100 dB weißes Rauschen ausgelöst, Blinzelreflex per Elektrokulogramm aufgezeichnet. Der Duft des Vortages sowie zwei neutrale Distraktordüfte wurden währenddessen über ein Olfaktometer dargeboten. Speichelproben zur Analyse von Cortisol wurden entnommen.

Stress- und Kontrollgruppe sind durch die ermittelte Cortisolkonzentration klar trennbar. Im Gruppenvergleich zeigt sich ein Haupteffekt von Stress auf den Startle-Reflex, 24 Stunden nach der Stressinduktion: Die mittlere Startle Amplitude der Stressgruppe ist über alle Durchgänge größer als die der Kontrollgruppe. Ein differenzierter Effekt im Hinblick auf die unterschiedlichen Düfte konnte nicht gezeigt werden. Dieser Befund deutet auf eine generell erhöhte Startle Reaktivität 24 Stunden nach Stressexposition hin, die Stimulus unspezifisch ist.

Poster A14

Emotions matter: Affektive und kardiale Modulation der Schreckreaktion

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Rezente Studien belegen den Einfluss der kardialen Phase auf die Schreckreaktion, einem Indikator für die viszeralefferente Signalübertragung, in dem Sinne, dass sich die Amplitude der Schreckreaktion während der Systole im Vergleich zur Diastole reduziert. Da die Wahrnehmung von Körpersignalen eine zentrale Rolle für emotionales Erleben spielt, wurde untersucht, ob affektiv-motivationale Zustände alleine und in Interaktion mit dem kardialen Zyklus die Schreckreaktion beeinflusst. In dem Experiment wurden akustische Schreckreize (50 ms weißes Rauschen, 105 dB(A)) zu den beiden kardialen Phasen (R+230ms oder R+530ms) präsentiert, bei gleichzeitiger Darbietung unterschiedlicher, affektiver Bilder (positive vs. negative vs. neutral). Dazu wurden 20 gesunde

Probanden (10 männlich; Durchschnittsalter: 25 Jahre) getestet. Die kardiale Modulation der Schreckreaktion konnte repliziert werden, wie auch die affektive Modulation der Schreckreaktion: Die Darbietung von Bildern negativer Valenz erhöhte die Schreckreaktion (via EMG) im Vergleich zu Bildern positiver oder neutraler Valenz. Es zeigte sich keine Interaktion zwischen beiden Faktoren. Die Ergebnisse weisen auf eine Modulation der Schreckreaktion durch den affektiv-motivationalen Zustand der Versuchsperson als auch die kardiale Phase hin. Offenbar sind beide Einflussfaktoren der Schreckreaktion partiell unabhängig. Diese Unabhängigkeit beider Faktoren lässt sich dabei möglicherweise auf unterschiedliche zugrundeliegende physiologische Prozesse zurückführen: während bei der kardialen Modulation der Schreckreaktion lediglich Strukturen des Hirnstamms involviert sind (z.B. NTS), geht die affektive Modulation u.a. auf limbische Strukturen (z.B. Amygdala) zurück.

Poster A15

Age-related differences in task goal processing strategies during action cascading

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We are often faced with situations requiring the execution of a coordinated cascade of different actions to achieve a goal, but we can apply different strategies to do so. However, the quest is if application of these different action cascading strategies are influenced by possible effects of aging. Hence, we investigated this question in a systems neurophysiological study using EEG and source localization in healthy older adults and employing mathematical constraints to determine the strategy applied. The results indicate that compared to young adults, older adults applied a less efficient strategy to cascade different actions in a task. For the reason that, older adults seemed to struggle to hierarchically organize their actions, which lead to an inefficient and more parallel processing of different task goals. On a systems level, we observed an altered processing of task goals at the response selection level (P3 ERP) and related to changes of neural processes in the temporo-parietal junction, which account for the inefficiency in action cascading.

Poster A16

How to clone a SNP? Oxytocinrezeptor Polymorphismus rs2268498: Von der Assoziation zur Funktionalität.

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Das Oxytocinrezeptor (OXTR) Gen codiert für den Rezeptor des Peptidhormons Oxytocin. Die OXTR-Gensequenz enthält den prominenten Einzelnukleotidpolymorphismus (SNP) rs2268498 C/T, welcher bereits mit individuellen Differenzen in sozialem Verhalten assoziiert wurde. Außer seiner Lage im putativen Promotorbereich des OXTR-Gens ist bisher nichts zur Funktionalität des SNPs bekannt. Das Poster soll einen Überblick über den Ablauf eines Klonierungsexperimentes am Beispiel des rs2268498 geben, welches der funktionellen Charakterisierung des Polymorphismus dient. Somit wird der initiale Schritt von der Assoziation mit dem Phänotyp hin zum molekulargenetischen Erklärungsmodell darstellt. Die Ergebnisse umfassen Expressionsanalysen an humanem, hippocampalem Gewebe (Biopsie-Proben), welche eine zweifach höhere mRNA-Expression bei Trägern der C-Allel Variante im Vergleich zum T-Allel aufweisen. Dieses Ergebnis wird durch die in humanen Zellen durchgeführten Reporterstudien mit den zwei klonierten OXTR-Promotor-Genvarianten bestätigt. Die Transfektion des OXTR-C-Plasmids führt zu einer erhöhten Reporterexpression. Somit wird die Funktionalität des rs2268498 erstmals durch mRNA-Analysen und Klonierungsexperimente nachgewiesen.

Poster A17

Prior probability modulates anticipatory activity in category-specific areas

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Bayesian models are currently a dominant framework for modelling human information processing in a variety of domains. However, neural correlates of major concepts of this framework, i.e., prior, likelihood and posterior probability remain poorly understood. In this study, we addressed the neural underpinnings of priors and their effect on anticipatory activity in category-specific areas. Before scanning, participants were trained in two behavioral sessions to learn the prior probability and correct

order of visual items within a sequence. The items of the sequence were two geometric shapes and one picture (either of a house or a face), which appeared with either a high or a low likelihood. Each sequence was preceded by a cue that gave participants probabilistic information about which items to expect next. This allowed examining cue-related anticipatory modulation of activity as a function of probability in category-specific areas (fusiform face area and parahippocampal place area). Data show that activity in the fusiform face area was higher when faces had a high as compared to a low prior probability. Importantly, these differences were only visible during anticipation and vanished at time of stimulus presentation. Our findings demonstrate that the brain not only anticipates visual events in stimulus-specific areas, but it does so flexibly and proportionally to their prior probability. In addition, this result calls for a careful distinction between anticipation and stimulation when considering effects of prior probability.

Poster A18

Elektrischer Reiz vs. weißes Rauschen: Welcher US eignet sich besser zur Furchtkonditionierung mit vielen Lerndurchgängen?

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In Furchtkonditionierungsexperimenten werden mit am häufigsten elektrische Reize oder akustisch dargebotenes weißes Rauschen als unkontingente Stimuli (US) verwendet. Verschiedene psychophysiologische Methoden zur Charakterisierung der konditionierten Reaktion (z. B. EEG, MEG) erfordern für ein adäquates Signal-Rausch-Verhältnis eine hohe Anzahl an Lerndurchgängen. Die Effektivität eines elektrischen Reizes und von weißem Rauschen als US wurde in einem Zwischensubjektdesign (N = je 16 Probanden) bei einem Akquisitions- und Extinktionsparadigma mit insgesamt 260 Trials und neutralen Gesichtern als konditionierte Stimuli (CS) verglichen. Am darauffolgenden Tag wurde zusätzlich der Abruf des Furcht- und Extinktionsgedächtnisses geprüft. Subjektive Ratings (Arousal/Valenz) und elektrodermale Reaktionen sprechen für eine bessere Konditionierung mit weißem Rauschen als mit einem elektrischen Reiz. Am ersten Tag führte weißes Rauschen zu einer signifikant (Arousal) bzw. tendenziell (Valenz) stärkeren Furchtakquisition,

welche extinktionsresistenter (Arousal) war. Elektrodermale Reaktionen auf den CS zeigten nur beim weißen Rauschen eine erfolgreiche Furchtakquisition, jedoch nicht beim elektrischen Reiz. Am zweiten Tag war der Abruf des Furchtgedächtnisses hinsichtlich Arousal-Ratings bei weißem Rauschen als US signifikant stärker und in Bezug auf Valenz-Ratings nur bei weißem Rauschen tendenziell erfolgreich. Während sich subjektive US-Ratings vor der Akquisition zwischen den beiden US-Typen nicht unterschieden, wurde das weiße Rauschen nach der Akquisition als signifikant unangenehmer beurteilt als der elektrische Reiz. Folglich kann das geringere Ausmaß von Furchtakquisition, Extinktionsresistenz und Furchtabruf bei einem elektrischen US möglicherweise auf eine stärkere Habituation auf den elektrischen Reiz zurückgeführt werden. Weißes Rauschen sollte insbesondere dann als US verwendet werden, wenn viele Lerndurchgänge dargeboten werden und somit die Habituation auf den US besonders stark ausfällt.

Poster A19

Neural mechanisms of goal-directed behavior: Disentangling the representation from the usage of stimulus-response-outcome contingencies

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Goal-directed behavior requires building and using associations between a certain action, a certain situation and the resulting outcome, thereby enabling flexible response selection in different situations according to the current goal. In this fMRI study we aimed at identifying the neural mechanisms that support this outcome-based response selection and disentangling this process from the mere representation of action-contingent outcomes. We compared an outcome-based condition where subjects were explicitly instructed to produce a specific outcome to an otherwise identical stimulus-based condition where stimulus-response mappings were instructed and added a control condition with random outcomes. We found increased activation in the right angular gyrus if outcomes were contingent on a response in a certain situation compared to a control condition where outcomes were unpredictable, suggesting an involvement of the angular gyrus in stimulus-response-outcome representation independent of its usage. The actual integration of outcomes into

response selection was accompanied by increased functional coupling of the angular gyrus with subcortical (hippocampus, caudate head), prefrontal (lateral orbitofrontal cortex, rostromedial prefrontal cortex) and cerebellar areas. Together, these results suggest that the angular gyrus plays a central role in relating actions to their sensory outcomes while the actual usage of these representations, such as when explicitly choosing actions according to outcomes, seems to rely on increased functional coupling of the angular gyrus with other specific areas that are engaged in both explicit and implicit processes of action control.

Poster A20

Behaviorale und neuronale Korrelate der Verarbeitung komplexer störungsspezifischer visueller Szenen bei der Sozialen Angststörung

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Bisherige Studien nutzen vorrangig emotionale Gesichter als visuelle Stimuli zur Erforschung abnormer Gehirnaktivierung bei der Sozialen Angststörung (SA). Es gibt bislang keine Studien, die standardisierte ökologisch valide störungsspezifische Szenen, die beispielsweise Personen während eines Vortrags zeigen, als Stimuli verwenden. In dieser Studie wurde ein standardisiertes Set bestehend aus 50 komplexen visuellen Szenen, die von SA-Patienten gefürchtete Situationen zeigen, und 50 Kontrollbildern erstellt.

SA-Patienten bewerteten die störungsspezifischen Szenen als unangenehmer, erregender und angstauslösender. Die fMRT-Ergebnisse zeigen in einer emotionsunabhängigen Detektionsaufgabe eine stärkere Aktivierung der SA-Patienten gegenüber gesunden Kontrollpersonen auf störungsspezifische Szenen im Vergleich zu Kontrollbildern in limbischen Arealen wie der Insula. Dieser Befund stimmt mit bisherigen Studienergebnissen bezüglich einer Insula-Hyperaktivierung bei SA-Patienten überein, die häufig als Korrelat der verstärkten Aufmerksamkeit auf interoceptive Reize interpretiert wird.

Somit konnte ein Stimulusset entwickelt werden, das bei SA-Patienten soziale Angst hervorruft. Zudem konnte die kritische Rolle der Insula bei der Verarbeitung dieser Stimulusklasse belegt werden.

Poster A21**Behaviorale und neuronale Korrelate der Verarbeitung störungsspezifischer visueller Szenen bei Posttraumatischer Belastungsstörung**

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Bisherige fMRT-Studien zur Untersuchung der Gehirnaktivität bei Posttraumatischer Belastungsstörung (PTBS) nutzen vorrangig emotionale Gesichter oder traumaturyp-unspezifische Bilder als visuelle Stimuli. Es gibt bisher kein standardisiertes Bilderset, das ökologisch valide traumaturyp-spezifische Szenen verwendet. In der vorliegenden Studie wurden 50 visuelle Szenen, die traumaturyp-spezifisch für Patienten mit interaktioneller Gewalterfahrung sind, und 50 Kontrollbilder erstellt und verwendet. Die traumaturyp-spezifischen Bilder werden von den Teilnehmern als unangenehm, erregender und angstauslösender beurteilt als die Kontrollbilder. In einer emotionsunabhängigen Detektionsaufgabe zeigen die PTBS-Patienten, verglichen mit Kontrollpersonen, auf die traumaturyp-spezifischen Bilder Aktivierungen in Arealen, die mit dem neuronalen Furchtnetzwerk assoziiert sind (präfrontale Areale, Insula, Amygdala). In der vorliegenden Studie konnte somit ein ökologisch valides Bilderset entwickelt werden, das auf behavioraler und neuronaler Ebene zwischen PTBS-Patienten und Kontrollpersonen diskriminiert.

Poster A22**The motor inhibitory network: a comparison of MEG and fMRI**

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In classical paradigms to investigate response inhibition like go/no-go or signal stop tasks, attentional processes cannot be differentiated from inhibitory motor processes. We used event-related functional magnetic resonance imaging (fMRI) and magnetoencephalography (MEG) during a modified stop signal task with an attentional capture condition (acSST) to delineate these processes.

MEG-data were analyzed at sensor- and source-level in the beta (16-34 Hz) and gamma (50-100 Hz) frequency ranges. For successful stop (sSTOP) and correct attentional capture (cAC) conditions, beta-band activity was decreased and gamma-power was increased after the stop and AC signal.

To reveal neural correlates specifically associated with successful inhibitory motor processes while controlling for the attentional processing of the stop signal, sSTOP and cAC trials were directly contrasted on the source-level for MEG data. For fMRI data, an additional conjunction analysis of the contrasts sSTOP > go and sSTOP > cAC was conducted in order to assess brain regions commonly activated during reactive response inhibition.

For these contrasts we found increased activity (fMRI and MEG) localized to the bilateral IFG, right preSMA/PMC, bilateral dorso-lateral prefrontal cortex (DLPFC), anterior cingulate cortex (ACC), as well as parietal regions. In conclusion most of the reconstructed sources are consistent with the spatial fMRI activity patterns. In ongoing analysis we plan to determine information transfer in the inhibitory network when stopping an ongoing action or response.

Poster A23**Motivational effects on prospective memory component processes in the prefrontal cortex**

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Behavioral studies indicate that successful retrieval in prospective memory (PM) tasks strongly relies on the degree to which individuals are motivated for the related intention. No study so far investigated the underlying brain mechanisms subserving the modulatory effects of motivation on PM performance. Based on the hypothesized critical role of the prefrontal cortex (PFC) for integrating motivational and cognitive control functions, we tested whether lateral and medial regions of PFC show increased activity in different PM phases (i.e. encoding, storage and retrieval), when motivation for correct intention retrieval was increased. For that purpose, we used a PM paradigm, where short PM sequences were embedded into an ongoing one-back working memory task. The motivational state was manipulated by providing monetary incentives for correct intention retrieval in half of the blocks in a mixed

blocked and event-related fMRI design. On a behavioral level, we found a generalized effect of motivation on both task types. Whole brain analyses revealed an interaction effect between motivation and prospective memory in the pre-supplementary motor area (pre-SMA) during encoding of the prospective memory cue. Moreover, we used psychophysiological interactions (PPIs) to identify brain regions that showed an enhanced connectivity with pre-SMA during motivated encoding of the prospective memory cue. The PPI revealed an enhanced connectivity between pre-SMA and reward-related regions in the striatum. This indicates that pre-SMA is sensitive to the rewarding value of the prospective memory action set and induces appropriate control mechanisms in interaction with the striatum.

Poster A24

Explicit Emotion Regulation in Anorexia Nervosa

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Self-regulation is a prerequisite for achieving long-term goals. Up to now research has mainly been focusing on the mechanisms of failures of volitional control such as obesity or gambling. The symptomatology of Anorexia Nervosa (AN) displays elevated cognitive control clearly through the ability of suppressing feelings of hunger, and the avoidance of rewarding stimuli such as food.

The current study aims at testing the ability of AN patients to willingly regulate emotions by means of reappraisal. Such strategies have been shown to reduce amygdala or striatal activity respectively. Emotion regulation ability is therefore investigated via behavioral assessment (arousal ratings) and neural activity (fMRT) by using a modified version of Walter et al.(2009) emotion regulation paradigm. Our sample consists of 31 acute AN patients and an age-matched control group.

Preliminary analysis suggests a reduction of arousal in the regulate condition for both valences on a behavioral level. At the same time ROI analysis and extraction of beta values for the amygdala, resulted in a significant main effect of regulation for both valences in the left amygdala. There were no group differences in arousal ratings or neural responses during volitional regulation of positive

or negative emotions. This indicates that AN patients are able to regulate emotions elicited by non-disease relevant via distancing similar to controls. This suggests that an overregulation in AN might only affect processes related to disease-relevant stimuli. Alternatively it is possible that increased cognitive control in AN is achieved via less adaptive regulation strategies such as emotion suppression.

Poster A25

Antizipation einer Interaktions- und Bewertungssituation: Eine Schreckreflex Studie

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Antizipatorische Angst vor sozialen Situationen, beispielsweise mit Unbekannten in Kontakt zu treten oder von anderen bewertet zu werden, sind wesentliche Symptome der Sozialen Angststörung. Die vorliegende Studie untersucht Gemeinsamkeiten und Unterschiede von Interaktions- und Bewertungsängstlichkeit mit Hilfe des Schreckreflex-EMG. 66 Teilnehmer wurden in zwei aufeinanderfolgenden Blöcken instruiert, dass sie im Anschluss an die Untersuchung eine bestimmte Person kennenlernen werden (antizipierte Interaktion) und dass sie von einer bestimmten Person bewertet werden (antizipierte Bewertung). In beiden Blöcken wurden fröhliche, neutrale und ärgerliche Gesichtsausdrücke der zwei relevanten Personen und zwei weiteren Kontrollpersonen wiederholt dargeboten; im Durchschnitt wurde bei jedem dritten Bild ein akustischer Schreckreiz präsentiert. Insgesamt zeigten sich erhöhte Schreckreaktionen bei emotionalen im Vergleich zu neutralen Gesichtern, dieses Muster war insbesondere in der Bewertungsbedingung ausgeprägt. In einer Teilstichprobe mit diagnostizierter Sozialer Phobie (N=12) war die Schreckhaftigkeit spezifisch für fröhliche Gesichter erhöht, wenn eine Kennenlern- bzw. Bewertungssituation mit diesen Personen antizipiert wurde. Zusammenfassend weisen die Ergebnisse auf die besondere Bedeutung sozialer Erwartungsprozesse in der Personenwahrnehmung hin. Bei ausgeprägter sozialer Ängstlichkeit können dabei selbst freundliche Gesichtsausdrücke defensive Reaktionsprozesse auslösen.

Poster A26

Heart rate responses to near outcomes in gambling

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Near outcomes in gambling refer to wins and misses where the current trial would have almost resulted in the opposite outcome. Previous studies on near-misses have found greater physiological responses relative to full-misses, measured via heart rate and skin conductance. So far, no study investigated peripheral physiological responses to near-wins.

42 participants gambled on a wheel of fortune which, following a deceleration phase, delivered full-wins, full-misses, near-wins, and near-misses. We assessed two components of phasic heart rate response (initial decrease and subsequent increase) as well as skin conductance response for each trial. Furthermore, the relation between gambling severity, measured via the South Oaks Gambling Screen (SOGS), and physiological responses was analyzed.

Initial heart rate decrease depended interactively on outcome (win vs. miss) and closeness (near vs. full). Subsequent heart rate increase showed a main effect for outcome, as well as an interaction of outcome and closeness. Scores on the SOGS correlated negatively with heart rate increase following outcome presentation.

In general, subjects exhibited strong responses in phasic heart rate after all types of outcomes. However, the observed interactions do not replicate the main effect of closeness on event related potentials we found in previous studies, which might be due to the characteristics of deceleration of the wheel of fortune differing between studies. The negative correlation between SOGS scores and heart rate increase fits with several previous studies showing blunted responses to gambling outcomes in pathological and problem gamblers.

Poster A27

Modulation of visual sensory processing by associated relevance – Evidence from event-related brain potentials

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Stimuli of emotional content are preferentially processed because of their high intrinsic salience for the organism. This processing advantage has been shown already for initial stimulus analyses at a sensory level much before conscious recognition or elaborate appraisal, as reliably indicated by modulations of event-related brain potentials (ERPs) at short latencies. Interestingly, such early effects are not restricted to the processing of evolutionary or socially relevant stimuli but occur even for symbolic and arbitrary stimuli like written words of emotional content. While sometimes interpreted as an indicator of extremely fast access to inherent meaning, recent research suggested that these effects might instead originate from associative learning mechanisms, particularly in the verbal domain. I will present evidence from ERP studies that directly examine this assumption by employing reinforcement-learning paradigms. These studies provide evidence that newly acquired valence can effectively boost sensory processing of symbolic stimuli at different sub-stages, depending on whether or not they convey inherent meaning. Importantly, these effects do not occur under cross-modality learning conditions, indicating the relevance of the sensory percept in the acquisition of new valence. Taken together, these findings strongly suggest associative learning as a potential source of early emotion effects in visual stimulus processing.

Poster A28

The familiar size congruency effect depends on consistent bottom-up cues: Evidence for a prior coding of bottom-up distance information

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Perceiving and judging an object's size is critically influenced by external distance cues. The current study provides evidence that there are different types of distance information, which are processed temporally separated,

and which affect size judgments in distinct ways. It has been shown before that familiar size can influence retinal size judgments (Konkle & Oliva, 2012). This finding was replicated in our Experiment 1. Additionally, Experiment 2 showed that familiar size affects distance judgments as well. Analyses of reaction time distributions suggest that the distance information provided by familiar size is processed later in time. Evidence that it is not only processed temporally separate but that it also affects size perception in an indirect manner comes from a third experiment: Introducing interfering bottom-up distance information by means of occlusion impacted directly on size judgments, while at the same time eliminating the impact of familiar size on size perception. We conclude that on the one hand, occlusion as a bottom-up distance cue is integrated early and is hence able to affect size judgments directly. On the other hand, familiar size as a knowledge based cue for distance did only affect size indirectly. Familiar size was only relevant and affected the reaction times after retinal size and bottom-up distance had been integrated.

Poster A29

Effects of attention and magnitude of deviance on Mismatch Negativity (MMN) – Towards a normative database

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The event-related potential Mismatch Negativity (MMN) is commonly used to investigate residual cognitive functioning in patients with disorders of consciousness. To design optimal paradigms and recording conditions, and to judge the arising ERPs in patients, it is important to have a normative database from healthy participants available. In the present study, we applied three oddball paradigms aiming at the elicitation of an MMN to N=100 healthy participants aged between 25 and 56 years. A unifeature and a multifeature paradigm were used. The former comprised 900 standards (75 ms) and 100 deviants differing in duration (50 ms and 37 ms). The latter comprised 800 standards and 800 deviants in four dimensions (200 each: duration, frequency, intensity, location). In each dimension, 100 deviants differed slightly and 100 deviants differed distinctly from the standard with exception of the location

domain where 100 deviants were shifted to the left and 100 were shifted to the right. All paradigms were presented with an ignore instruction and a passive instruction. The ignore task required the participants to watch a silent movie and count a predefined scene, while the passive task required them to only listen. Results revealed small effects of attention (ignore vs. passive) and large effects of paradigm (uni- vs. multifeature) and magnitude of deviance (small vs. large). Larger amplitudes were elicited in the multifeature paradigm in the passive task and by deviants highly different from the standard. Taken together, multifeature paradigms with distinctly different deviants seem most appropriate for patient settings.

Poster A30

Emotionale Vokalisationen beeinflussen die Betrachtung von Gesichtern bei Sozialer Angst

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Im alltäglichen Leben ist der Anblick von emotionalen Gesichtsausdrücken häufig von Lautäußerungen begleitet, das heißt, wenn wir ein freudiges Gesicht sehen, dann hören wir auch ein Lachen. Gerade für sozialängstliche Menschen, sind Gesichter von besonderer Relevanz. Wie Vokalisationen die Betrachtung emotionaler Gesichtsausdrücke beeinflusst und welche Rolle soziale Ängstlichkeit dabei spielt, wurde bisher selten untersucht.

In der vorliegenden Studie wurden 26 Versuchspersonen Bilder von freudigen, ängstlichen und neutralen Gesichtsausdrücken in Kombination mit freudigen, ängstlichen und neutralen Vokalisationen präsentiert. Während der Präsentation wurden die Augenbewegungen bei der Betrachtung der Gesichter aufgezeichnet.

Die Ergebnisse zeigen zunächst, dass bei ängstlichen Gesichtern länger und häufiger die Augenregion betrachtet wird als bei freudigen oder neutralen Gesichtern. Zusätzlich zeigt sich ein Einfluss der emotionalen Vokalisationen auf die Bildbetrachtung: während ängstliche Gesichter kürzer betrachtet werden, wenn sie mit ängstlichen (kongruenten) Vokalisationen präsentiert werden, zeigt sich, dass freudige Gesichter länger betrachtet, wenn sie mit freudigen Vokalisationen (ebenfalls kongruent) kombiniert werden. Der Einfluss der Vokalisationen auf die Bildbetrachtung wird durch die Ausprägung der sozialen Ängstlichkeit moduliert: Die Präsentation von freudigen

Vokalisationen führt dazu, dass hochhängstliche Personen vor allem ängstliche (d.h inkongruente) Gesichter länger betrachten, während niedrigängstliche Personen in diesem Fall freudige (kongruente) Gesichter länger betrachten. Die Ergebnisse zeigen, dass die visuelle Wahrnehmung emotionaler Gesichter durch emotionale Lautäußerungen beeinflusst wird und dass soziale Ängstlichkeit diese Effekte moduliert. Inwiefern Multimodalität sozialer Reize bei der Entstehung und Aufrechterhaltung sozialer Ängstlichkeit involviert sein könnte, wird diskutiert.

Poster A31

Theta response in schizophrenia is indifferent to perceptual illusion

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Patients with schizophrenia are impaired in maintaining coherent perceptual experiences. This is reflected in the oscillatory theta response and can be investigated by visual illusions. Ambiguous stimuli elicit illusory perceptual switches while the stimulus remains unchanged. Theta responses elicited by an ambiguous and unambiguous control stimulus were measured using the EEG during time periods of perceptual switching and perceptual stability (non-switching). For the ambiguous task, theta activity increased during perceptual switching in healthy controls only. For the unambiguous task, the switching-related increase of theta activity was larger in controls than in patients. This reduced modulation of the theta response seems not to be related to a general decrease of theta activity in patients. These findings may be related to disturbances in the spatio-temporal integration of neural activity in patients. Reporting ambiguous and unambiguous perceptual switches seems to be more demanding for patients with schizophrenia than healthy controls. This is one of the first studies on the neurophysiologic correlates of illusory perception in schizophrenia. Focussing on the relation between different brain states (such as switching and non-switching) might integrate different findings about altered theta oscillations in schizophrenia.

Poster A32

Signale von Aggressivität: Die Facial Width-to-Height Ratio ist mit interpersonellen Distanzpräferenzen assoziiert

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Hintergrund

Studien zeigen, dass gesunde Menschen Aggressivität in unbekanntem Männergesichtern einschätzen können – wobei das Verhältnis von Gesichtsbreite zu -höhe (Facial Width-to-Height Ratio) bei diesen Männern mit aggressivem Verhalten assoziiert ist (Carré, McCormick & Mondloch, 2009). Inwiefern die Wahrnehmung von Aggressivität in Männergesichtern Auswirkungen auf unser adaptives Nähe-Distanz Verhalten hat, wurde bislang jedoch noch nicht untersucht.

Methode

Wir untersuchten an einer gesunden Stichprobe von 52 Frauen aus der Allgemeinbevölkerung, ob sich Korrelationen zwischen den Einschätzungen von Aggressivität, Attraktivität und der facial WHR, wie auch behavioralen Werten von Aggressivität finden lassen. Zudem untersuchten wir, ob diese Gesichtsmerkmale als nonverbale Stimuli dienen, um automatische interpersonelle Distanzpräferenzen zu evozieren. Hierfür wurden die Probandinnen gebeten, 65 Fotos von Männergesichtern hinsichtlich deren Aggressivität, Attraktivität sowie der bevorzugten Distanz zu diesen Männern zu beurteilen.

Ergebnisse

Es zeigten sich signifikante Korrelationen zwischen den Einschätzungen von Aggressivität und der facial width-to-height ratio ($r = .39$), wie auch den behavioralen Maßen von Aggressivität ($r = .47$). Größere Gesichtsratio waren mit einer größeren bevorzugten interpersonellen Distanz assoziiert ($r = .71$). Zudem zeigten sich hohe Korrelationen zwischen den Verhaltensmaßen der Aggressivität und der bevorzugten interpersonellen Distanz ($r = .59$).

Schlussfolgerung

Unsere Ergebnisse konnten frühere Befunde replizieren, welche suggerieren, dass sich die fWHR in der Evolutionsgeschichte als valides Signal der Aggressionsbereitschaft bei Männern entwickelt hat (Carré & McCormick, 2008; Stirrat et al., 2012). Wir erweiterten bisherige Forschungs-

befunde um die Erkenntnis, dass die Wahrnehmung von Aggressivität Auswirkungen auf unser zwischenmenschliches Distanzverhalten hat. Gesunde Frauen reagieren sehr sensitiv auf diese Zeichen von Aggression und passen ihr Nähe-Distanz Verhalten entsprechend an.

Poster A33

Pharmacological cognitive enhancement in healthy individuals: a compensation for cognitive deficits or a question of personality?

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The bioethical debate on pharmacological cognitive enhancement (PCE) in healthy individuals is commonly legitimated by the assumption that PCE will spread and become desirable for a large public. This assumption was questioned as PCE is not equally safe and effective in everyone and the willingness to use PCE was supposed to be strongly personality-dependent. Accordingly, we compared the cognitive performance and personality of 25 healthy individuals with regular nonmedical methylphenidate (MPH) use for PCE and 39 stimulant-naïve controls that were matched for age, sex, verbal intelligence, and education. Cognitive performance and personality was examined by a comprehensive neuropsychological test battery including social cognition, prosocial behavior, decision-making, impulsivity, and personality assessment. Substance use was determined through self-report and verified by quantitative hair and urine analyses. Recently abstinent PCE users showed no cognitive impairment but superior strategic thinking and decision-making together with higher levels of impulsivity, novelty seeking, and Machiavellianism as well as lower levels of social reward dependence and cognitive empathy. Finally, PCE users reported a smaller social network and exhibited less prosocial behavior in social interaction tasks. We conclude that regular MPH use for PCE is not associated with cognitive deficits which does not support the hypothesis that PCE is used for compensation for cognitive deficits. Moreover, the assumption that PCE use will become epidemic is not supported as we demonstrated that PCE users show a specific personality profile that shares a number of features with recreational stimulant users.

Poster A34

Neural Correlates of Health Anxiety

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Health anxiety is characterized by excessive worry about having a serious illness. Cognitive-behavioral theories of health anxiety suggest that an attentional bias for illness-related information, reassurance and checking behavior are a core feature for the development and maintenance of the disorder. Thus far relatively little is known about the neural correlates of health anxiety. The present study examined EEG correlates of performance monitoring (error-related and correct-related negativity; ERN, CRN) and the processing of emotional stimuli (late positive potential; LPP) in 20 high and 20 low health anxious individuals. First analyses indicate that high anxious individuals show enhanced LPP amplitudes to illness-related stimuli supporting that they show an attentional bias towards these stimuli. Furthermore, the high anxious group was characterized by enhanced ERN and CRN amplitudes suggesting hyperactive performance monitoring. Enhanced performance monitoring has also been observed in obsessive-compulsive disorder and has been linked to doubt, stereotyped behavior and checking, all aspects of behavioral and cognitive alterations with substantial overlap to symptoms in health anxiety. Altogether the present ERP results support the presence of an attentional bias for illness-related information in the pathophysiology of health anxiety and link the observed checking behavior in health anxiety to overactive performance monitoring.

Poster A35

Patch-leaving decisions and the role of GABA and glutamate in anterior cingulate cortex

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Deciding when to leave a depleting resource to exploit an alternative is a fundamental problem for decision makers. The appropriate decision should be based on the accumulated evidence in favour of changing one's policy. Patterns of neural activity in the anterior cingulate cortex (ACC) have been suggested to encode the evidence in favour of

abandoning a depleting patch for an alternative. There is evidence to suggest that these patterns are governed by a competition via mutual inhibition that is mediated by the balance between GABAergic inhibition and glutamatergic excitation.

We developed a novel patch-leaving task requiring trial-by-trial accumulation of evidence in favour of leaving the current patch. Crucially, the task also featured value-guided choices that were explicitly decorrelated from the patch-leaving decision. We recorded MEG data from 33 participants performing the task. Individual levels of GABA and Glutamate in five cortical areas related to key behavioural and computational parameters were acquired using magnetic resonance spectroscopy at 7T.

Subjects' choices to abandon the current patch were strongly governed by the accumulated evidence. The balance of GABA and glutamate in the ACC was strongly related to the degree to which subjects' patch-leaving choices were governed by switch evidence. Importantly, no such relationship was found with other behavioural parameters such as the overall frequency of switching between patches, reaction times or value-guided decision making. Our data indicate a specific role for ACC GABA and glutamate in evidence accumulation during sequential decision making.

Poster A36

Der Einfluss von Gegenmaßnahmen auf die Validität des Tatwissentest

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Der Tatwissentest (TWT) deckt verheimlichtes Wissen über eine Straftat auf, indem eine Person Multiple-Choice Fragen zu spezifischen Tatdetails beantwortet. Die Antwortoptionen einer Frage werden einzeln präsentiert und sollten für eine unschuldige Person gleich wahrscheinlich sein. Somit sollen nur Täter die korrekte Antwortoption erkennen und ihr Wissen durch einen Anstieg in der Hautleitfähigkeit, eine Verminderung der Atmungsaktivität sowie der Herzrate sichtbar werden. Wenige Studien haben bisher den Einfluss von Gegenmaßnahmen (GM) auf diese Veränderungen im autonomen Nervensystem im TWT untersucht. GM können mental oder physisch ausgeübt werden und sollen durch eine künstliche Erregungsreaktion bei neutralen Antwortoptionen die Validität

des Tests bei Tätern herabsetzen.

Die vorgestellte Studie teilte 80 Personen auf vier Gruppen auf: Täter ohne GM, Täter mit mentalen GM, physischen GM, sowie Unschuldige. Alle Täter verübten ein Scheinverbrechen. Die GM Gruppen lernten zudem ihre Reaktionen im TWT systematisch zu manipulieren, indem Sie sich ein emotionales Bild vorstellten oder unmerklich die Fußzehen bewegten. Während des TWT wurden elektrodermale, respiratorische und kardiovaskuläre Kennwerte aufgezeichnet.

In den Analysen zeigten sich Sensitivitätsunterschiede zwischen den Reaktionsmaßen. Die Hautleitfähigkeit schien besonders vulnerabel zu sein, wobei physische GM wirksamer als mentale GM waren. Atmung und Herzrate waren weniger anfällig für die Nutzung von GM und ermöglichten die valide Unterscheidung von Tätern und Unschuldigen unabhängig von GM. Für einen Kombinationswert der Reaktionsmaße zeigte sich, dass GM die Validität des TWT beeinflussen, aber eine Differenzierung zwischen Tätern und Unschuldigen weiterhin erfolgreich möglich ist.

Poster A37

CORTICAL OSCILLATIONS IN TINNITUS AND ITS DEPENDENCE ON BEING A NOVICE AND MENTAL COMORBIDITIES

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Tinnitus is the percept of sound unrelated to any environmental source. It affects up to 15% of the population, sometimes with significant drawbacks in daily life and a high comorbidity with mental disorders. Despite its presumed peripheral cause in the inner ear its maintenance is assumed to underlie cortical processes. A specific signature in neuronal oscillations has been linked to tinnitus, yet the findings are inconsistent across different studies. To illuminate the topic of neuronal oscillations and tinnitus we analyzed resting state MEG-measurements for different groups: Firstly, a tinnitus group compared to healthy controls (n=36 each), secondly novices, i.e. persons with no previous MEG experience, for both groups (tinnitus n=24, control group n=23) and lastly participants who had been screened for mental disorders (still recruiting). In the first group we could replicate a significant reduction in the po-

wer of the alpha band, yet in sensors over parietal regions, not as proposed over temporal regions. This difference disappears when analyzing novices only. The results point towards the assumption that the arousal level, represented through being a novice in the measurement is an important factor in resting state measurements and might account for mixed results.

Poster A38

Anodale transkranielle Gleichstromstimulation (atDCS) steigert visuo-motorische Adaptationsfähigkeit

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Transkranielle Gleichstromstimulation (tDCS) ist ein non-invasives Verfahren zur Modulation neuronaler Aktivität (Schmicker et al., 2011). Unserer Studie untersucht Effekte von atDCS bewegungsrelevanter Hirnbereiche auf die Adaptationsleistung bei visuo-motorischen Aufgaben (Galea et al., 2011).

Im Doppelblind-Design wurden 52 Teilnehmer (29 Frauen, Alter $M = 24,09$; $SD = 1,87$) randomisiert in drei Gruppen eingeteilt. Die Probanden übten Spiegelzeichnen-Aufgaben für 20 Minuten. Simultan dazu wurden beide Experimentalgruppen CER (Cerebellum) und PAR (P4) anodal stimuliert (1mA; 3,14 cm² Ag/AgCl-Elektroden). Bei der Kontrollgruppe (CG) wurde eine Scheinstimulation appliziert. Die Zeichengeschwindigkeit (s) der dominanten rechten Hand wurde im Spiegelzeichnen zu vier Messzeitpunkten (1.Prätest, 2.Onlinetest nach 10 Minuten Stimulation, 3.Posttest am Ende der Stimulation, 4.Follow-Up-Test nach weiteren 20 Minuten) erhoben.

Eine zweifaktorielle ANOVA der Faktoren TIME und GROUP ergibt für die Zeichengeschwindigkeit einen signifikanten Effekt ($F(3,47) = 170,69$, $p < .001$; $\eta^2 = .77$) für TIME, einen signifikanten Effekt für GROUP ($F(2,49) = 3,99$, $p < .05$; $\eta^2 = .14$) und eine signifikante Interaktion GROUP x TIME ($F(6,96) = 3,36$, $p < .05$; $\eta^2 = .12$). Im Follow-Up-Test zeigt die CER Gruppe ($M = 20,81$ s; $SD = 1,92$) die signifikant ($p < .05$) schnellste Zeichengeschwindigkeit vor der CG ($M = 30,38$ s; $SD = 9,57$) und nicht signifikant ($p > .05$) vor der PAR Gruppe ($M = 26,98$ s; $SD = 6,08$).

Die Resultate unserer Untersuchung zeigen, dass anodale tDCS über dem Kleinhirn die visuo-motorische Adaptationsfähigkeit positiv beeinflusst und verdeutlichen die

besondere Rolle des Kleinhirns bei der motorischen Adaptation. Weitere Forschung ist nötig um kognitive und motorische Aspekte dieser Ergebnisse sowie komplexere visuo-motorische Aufgaben zu untersuchen.

Poster A39

Slow-Wave Sleep Dependent Memory Consolidation and its Effects on Neuronal Oscillations in the Human EEG

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It is assumed that memory consolidation during slow-wave sleep (SWS) promotes the transfer of newly acquired memories from medial-temporal lobe to cortical neuronal networks. Neuronal oscillations measured in the human EEG (e.g. in the theta-, alpha-, and gamma-band) are a useful tool to investigate the cortical processes underlying the formation and activation of cortical memory processes. Here, using a high density EEG during a pre- and a post-sleep retrieval phase, we investigated SWS consolidation dependent changes in the cortical engram. In an associative encoding task, gray scaled pictures were presented on colored backgrounds while participants were asked to form stimulus-color associations. The recollection of the stimuli-color associations was probed immediately after encoding and after three hours of sleep (predominantly SWS, experimental group) or an awake interval (control group). The sleep group showed increased memory consolidation, compared to the awake group. In the sleep group, opposed to the wake group, we found reduced frontal and parietal theta activity, possibly indexing reduced medio-temporal to cortical communication during post sleep retrieval. Furthermore, frontal and parietal alpha activity was reduced, indicating increased cortical processing. Finally, posterior gamma power shifted from posterior to parietal recording sites, indicating the processing in higher visual regions. In summary, our findings further substantiate the assumption that slow-wave sleep dependent memory consolidation promotes the transfer of newly acquired memories from medial-temporal to cortical neuronal networks.

Poster A40**Attentional biases toward pictures of overweight bodies: An ERP study**

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Body related stigmatization is thought to be closely linked to attentional biases. In the present study event-related brain potentials were used to assess attentional processes while viewing body pictures. 24 healthy participants viewed schematic drawings of under-, medium, and overweight male and female bodies, presented in a rapid continuous picture stream (1s each). In order to compare perceptual from more cognitive processes, drawings were overlaid with either congruent or incongruent body-related adjectives (thin or fat) in a second condition. Preliminary results from the first 15 participants revealed an early posterior negativity over visual processing areas (EPN, 160-280ms) especially pronounced for male obese bodies relative to medium-weight shapes. Later stimulus processing was characterized by pronounced late positive potentials (LPP, 400-700ms) for incongruent compared to congruent drawing-adjective combinations regardless of body size (i.e., under- or overweight). These findings suggest that there is an early implicit processing bias specifically for obese body drawings; however, evaluative processing stages (LPP) do not seem to differentiate under- or overweight body shapes.

Poster A41**The Role of the Glucocorticoid Receptor Gene (NR3C1) for the Processing of Aversive Stimuli**

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The glucocorticoid receptor (GR) is a crucial component of the hypothalamus-pituitary-adrenal (HPA-) axis and as such a part of the stress response system. Impairments of the GR not only alter the level of glucocorticoids, but have also been related to symptoms of anxiety and depression (Tronche et al., 1999; Ridder et al., 2005). We tested the effect of GR variations on the processing of emotional stimuli. In a sample of $n = 182$ participants, we found a haplotype of the glucocorticoid receptor gene (NR3C1-

CTGGACA) to modulate the performance in an emotional cuing task. Compared to non-carriers, participants who carried the haplotype were quicker to react after aversive stimuli had been presented. In contrast, the presence of the haplotype had no effect on the processing of neutral stimuli. Carriers of the NR3C1-CTGGACA haplotypes also differed from non-carriers in their action control tendencies, as assessed via the action control scale (Kuhl, 1990). They indicated that they were able to cope with events of failure in a more efficient and productive way than non-carriers. Thus, the NR3C1 haplotype was associated both with the performance in a behavioral task and with the general style of coping with aversive events. We conclude that properties of the glucocorticoid receptor contribute to the processing of emotional stimuli and influence emotion regulation.

Poster A42**Trauma memory recall and its neural correlates**

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Posttraumatic stress disorder is an anxiety disorder characterized by intrusive events. The encoding of traumatic events involves brain structures including the amygdala, striatum, thalamus and anterior cingulate cortex. Activity in these regions was associated with later intrusiveness of memories, as revealed by functional magnetic resonance imaging (fMRI) studies using the trauma film paradigm (analogue study for intrusion development) in healthy participants. However, the neural correlates of implicit and explicit recall of traumatic memories require further investigation. Furthermore, sleep has been shown to play a role in modulating emotional memories, but it still remains to be investigated whether it has an influence on traumatic memories.

We investigated the neurological factors of recall processes of traumatic memories in healthy participants during fMRI measurements. Participants watched either a trauma or a control-film in both a wake - and a sleep group. Subsequently, all participants performed a Sternberg working memory task with emotional distracters (film, scrambled, negative and neutral pictures). Finally, intrusive film memories were directly recalled during a script-driven imagery task.

In general, analyses reveal that the trauma film group perceived neutral film pictures that served as emotional distracters as significantly more negative and arousing than the control group. Moreover, the trauma film group revealed altered neural activity in the posterior cingulate cortex, precuneus and anterior cingulate cortex. Further analyses involve differences between wake and sleep groups. Overall, the results reveal a trauma-memory related modulation of neural processes underlying implicit and explicit memory recall.

Poster A43

Grey Matter Structural Covariance of the Motor Network in Huntington's Disease

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One of the clinical hallmarks of Huntington's disease (HD), a progressive genetically caused neurodegenerative disorder, is the steady deterioration of motor functioning. A substantial body of research has confirmed the presence of neurodegeneration in structural and functional brain networks, affecting diverse subcortical and cortical regions in both pre-clinical HD (preHD) and early manifest HD (mHD) gene carriers. Here, we examined the structural covariance in grey matter (GM) volumes in a pre-defined motor network in 99 patients with manifest HD (mHD), 106 pre-symptomatic gene mutation carriers (preHD), and 108 healthy controls (HC). In contrast to voxel-based morphometric studies, which examine brain regions in isolation, structural covariance analyses enable the assessment of changes in the interrelation of brain regions. After correction for global differences in brain volume, we found an expected stronger positive correlation between regions that had close proximity to each other. Furthermore, we observed a U-shaped effect, expressed by the general trend of high structural covariance among the regions in HC and mHD with an almost absent structural covariance in preHD. Follow-up moderation analysis identified structural connections between fronto-parietal motor regions, critically involved in motor control, to be linearly modified by disease burden score (DBS). Moderator effects of disease load burden became significant at a

DBS level typically associated with the onset of unequivocal HD motor signs. Together with existing findings from functional connectivity analyses, our data indicates a critical role of these fronto-parietal regions for the onset of HD motor signs.

Poster A44

Einfluss subklinischer depressiver Symptome und dopaminerger Medikation auf räumliche Gedächtnisleistungen beim idiopathischen Parkinsonsyndrom

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Depression und kognitive Beeinträchtigungen sind häufige Begleiterscheinungen des idiopathischen Parkinsonsyndroms (IPS). Depressive IPS-Patienten weisen Defizite in Aufgaben exekutiver Funktionen als mögliches Korrelat dysfunktionaler fronto-striataler Interaktionen im Vergleich zu nicht-depressiven IPS-Patienten auf. Es liegen jedoch nur wenige Erkenntnisse zu hippocampal-striatalen Funktionen (z.B. räumliches Lernen und Gedächtnis) und deren Modulation durch depressive Symptome und dopaminerge Medikation vor. Wir untersuchten diese Fragestellung in einer Stichprobe von 34 IPS-Patienten mit niedrigen oder erhöhten subklinisch ausgeprägten depressiven Symptomen (Mediansplit der Montgomery-Asberg Depression Rating Scale). Es wurde die Leistung beim räumlichen Navigieren in einem Virtual Navigation Task on- und off- dopaminerger Medikation untersucht. Die Ergebnisse zeigen einen signifikanten Interaktionseffekt zwischen Medikationsstatus und Ausmaß depressiver Symptome: IPS-Patienten mit hoher depressiver Symptomatik wiesen reduzierte Leistungen im räumlichen Lernen off-Medikation im Vergleich zur on-Bedingung auf. Der effiziente Dopaminersatz verbessert das räumliche Lernen bei IPS-Patienten mit hohen subklinischen depressiven Symptomen, wohingegen im Zustand des Dopaminmangels depressive Symptome mit Defiziten beim räumlichen Lernen einherzugehen scheinen. Ferner könnte das striatale Dopaminsystem bei IPS-Patienten mit subklinischen depressiven Symptomen mit veränderter Funktionalität

und in Folge mit einer Vulnerabilität für striatal vermittelte kognitive Beeinträchtigungen assoziiert sein. Weitere Studien sollen die Mechanismen und Interaktionen von Depression und dopaminerger Medikation, insbesondere unter Berücksichtigung klinischer Depression beim IPS spezifizieren.

Poster A45

Prediction of response to cognitive training by structural and functional markers of the cholinergic system in Mild Cognitive Impairment

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Background

Recent studies suggest that patients with MCI exhibit a significant volume reduction in subfields of the basal forebrain cholinergic system (BFCS). Transcranial magnetic stimulation (TMS) protocols, like short latency afferent inhibition (SAI) of the motor cortex, depict the cholinergic system on a functional level. Subfields of the BFCS and SAI are both related to cognition. Thus, the aim of this study was to simultaneously study structural and functional properties of the cholinergic system in MCI and their usefulness in predicting response to cognitive training.

Methods

20 patients with MCI underwent cognitive assessment, Magnetic Resonance Imaging, and TMS using the SAI protocol, followed by a six week cognitive intervention. The response to cognitive training was assessed one week and 6 months later. Cognitive performance at follow-up was correlated with structural (volumes of BFCS subfields) and functional (SAI) markers of the cholinergic system.

Results

Before training, all five subfields of the BFCS correlated significantly with global cognition as well as nonverbal delayed recall. Volumes of two BFCS subfields correlated with verbal and nonverbal delayed recall directly after cognitive intervention, while only one correlated with global cognition. Only the posterior part of the nbM correlated significantly with verbal and nonverbal delayed recall at 6-months follow-up. SAI correlated significantly with global cognition before training, with nonverbal delayed re-

call directly after training and with verbal and nonverbal delayed recall at 6-months follow-up.

Conclusion

Structural and functional properties of the cholinergic system in MCI are useful in predicting response to cognitive training.

Poster A46

Inter-brain connectivity in borderline patients playing a trust game: an fMRI hyperscanning study

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Instability in interpersonal relationships and distrust are the key symptoms of Borderline Personality Disorder (BPD). Because trust is one of the major foundations of successful human relations, the BPD-patients' distrust impairs their interpersonal interactions. To investigate interpersonal interactions, we used a hyperscanning methodology and a multi-round trust game. Hyperscanning means simultaneous brain imaging of interacting participants.

Three groups: healthy investor and trustee (hc/hc), healthy investor and BPD-patient trustee (hc/BPD), BPD-patient investor and healthy trustee (BPD/hc), were investigated. All participants were female, matched for age and education. Participants were scanned during 20 rounds trust game. Data were analyzed with functional connectivity and Granger causality methodology.

Functional connectivity analysis revealed a covariation between investor's and trustee's brains. This effect was particularly observable in the hc/hc and BPD/hc couples, and almost absent in the hc/BPD group. This pattern was mirrored in the behavioral results: the hc/BPD group showed less congruency between investments and repayments. Consistently, Granger causality analysis showed less bilateral influence in this group compared to others.

We demonstrate that hyperscanning is eligible to identify inter-brain coupling during real interaction. This connectivity changed when a BPD-patient was involved. However, behavioral as well as neural interaction results showed strong dependence on the patient role: Impaired connectivity was only observed when the BPD-patient was the trustee. These results confirm clinical observation showing that the impairments of social interaction in BPD are

stronger when patients have to respond to an interaction initiated by another person.

Poster A47

Switching within working memory is mirrored by the P3a component of the human event-related brain potential

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The flexible access to information in working memory is crucial for adaptive behavior. It is assumed that this is realized by switching the focus of attention within working memory. For the reason that switching of attention is mirrored in the P3a component, the present study tested whether object switching in working memory is accompanied by a P3a. Participants updated a memory list of four digits either by replacing one item with another digit or by processing the stored digit. ERPs were computed separately for two types of trials: (1) trials in which an object was repeated and (2) trials in which a switch to a new object was required in order to perform the task. Object switch trials showed increased response times compared with repetition trials in both task conditions. In addition, switching costs were increased in the processing compared with the replacement condition. Pronounced P3a's were obtained in switching trials but there were no difference between the two updating tasks (replacement or processing). These results suggest that the P3a reflects an initial process of selecting information in working memory but not the memory updating itself. Moreover, the present results support the hypothesis of strong connections between attention and working memory functions as proposed—for instance—by the controlled attention view of working memory.

Poster A48

Nutrition labels influence value computations in the ventromedial prefrontal cortex

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Prevalence of obesity is high in most industrialized nations, and therefore, it is crucial to understand contextual factors underlying food choice. Nutrition labels are public policy interventions designed to adequately inform con-

sumers about nutritional value and overall healthiness of food products. We examined how different nutrition labels, namely a purely information-based label (guideline daily amount, GDA) and a more explicit traffic light (TL) label, influence product valuation and choice in a functional MRI setting. 35 Participants were instructed to value healthy and unhealthy food products in combination with one of the two labels and to state their willingness to pay (WTP) for the product. The labeling methods significantly influenced participants' WTP. Red TL signaling activated a region implicated in self-control in food choice. This region, in case of red signaling, and the posterior cingulate cortex, in case of green signaling, showed increased coupling to the valuation system in the ventromedial prefrontal cortex. Our results suggest that explicitly directing attention towards nutritional values using salient nutrition labels triggers neurobiological processes that resemble those utilized by successful dieters choosing healthier products. Currently we use eye-tracking-based analyses of preferences applying attentional drift-diffusion models of simple choices to further elucidate the effects of nutritional labels on food choice. More salient nutritional labels might influence the time spent on the respective information and the gathering of evidence for the respective items followed by a stronger influence on the subsequent choice than purely information based nutritional labels.

Poster A49

Concurrent information affects response inhibition processes via the modulation of theta oscillations in cognitive control networks

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Inhibiting responses is a challenge where the outcome (partly) depends on the situational context. In everyday situations, response inhibition performance might be altered when irrelevant input is presented simultaneously with the information relevant for response inhibition. More specifically, irrelevant concurrent information may either brace or interfere with response-relevant information depending on whether these inputs are redundant or conflicting. Currently, neurophysiological mechanisms and the network underlying such modulations are unk-

nown. We examine these mechanisms using an EEG-beamforming approach.

The data shows that in comparison to a baseline condition without concurrent information, response inhibition performance can be aggravated or facilitated by concurrent input. This depends on whether the requirement for cognitive control is high, as in conflicting trials, or whether it is low, as in redundant trials. In line with this, the total theta frequency power decreases in a right hemispheric orbitofrontal response inhibition network including the SFG, MFG and SMA when concurrent redundant information facilitates response inhibition processes. Vice versa, theta activity in a left-hemispheric response inhibition network (i.e. SFG, MFG and IFG) increases when conflicting concurrent information compromises response inhibition processes. Thus, concurrent information bi-directionally shifts response inhibition performance and modulates the network architecture underlying theta oscillations, which are signaling different levels of the need for cognitive control.

Poster A50

Bariatric surgery in diabetic patients leads to decreased wanting and liking for food and increase activity in reward and gustatory brain areas

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Background

Neuronal functions are different in obese and diabetic subjects especially when confronted with food stimuli. In a previous study, we could show that such differences seem to be reversible after bariatric surgery (BS) in nondiabetic formerly severely obese patients. Here, postoperative subjects did not show differences to a normal-weight control group when stimulated with food items, however, distinct different neuronal activation pattern to an obese group. In the present study, we aimed to further investigate the impact of BS on neuronal activation pattern in diabetic patients.

Methods

We applied an fMRI study during a wanting/liking rating of food pictures in 28 diabetic subjects: 14 severely obese (SO) without BS (age=52±3; BMI=39.7±1.8; HbA1c=7.1±1.4) and 14 post-operative subjects (POST), who received BS

at least one year ago (age=50±2; BMI=34.4±1.1; HbA1c pre BS=7.2±1.4, HbA1c post BS=6,0±0.9). FMRI analyses were considered significant with $p < 0.05$ family-wise-error corrected and were corrected for age, BMI and hunger.

Results

SO patients showed higher activation in areas associated with self-control (inferior frontal areas) and emotional salience (amygdala). POST patients showed higher activation pattern in reward-related (striatum) and gustatory regions (orbitofrontal cortex, fusiform gyrus) in response to food items. POST patients showed significantly lower wanting and liking ratings ($p < 0.05$).

Conclusion

After surgery, neuronal changes indicate that food items are more rewarding and less emotional challenging for (formerly) severely obese diabetic patients and behavioral changes indicate a reduction in temptation for food consumption.

Poster A51

Dresdner Burnout Studie

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Unter den verschiedenen pathologischen Konsequenzen von chronischem Stress wird zunehmend häufiger ein Syndrom beschrieben, das als „Burnout“ bezeichnet wird. Zahlreiche wissenschaftliche Studien belegen, dass eine zunehmende Zahl an Menschen an diesem Krankheitsbild leiden – und dass durch das Syndrom eine erhebliche volkswirtschaftliche Last bedingt wird. Trotz steigender Präsenz von Burnout, sowohl im klinischen Alltag als auch in den Populärmedien, fehlt es bisher an validen, international anerkannten Befunden zur Entstehung, Definition und Diagnose des Burnout-Syndroms.

Die Dresdner Burnout Studie (DBS) hat sich daher zum Ziel gesetzt unter dem Einsatz innovativer Forschungsstrategien und –Methoden bedingende und modulierende Faktoren des „Ausgebrannt-Seins“ zu erkennen, belastbare Modelle zu entwickeln, und den Risikofaktoren präventiv und therapeutisch zu begegnen.

Die DBS versteht sich als groß angelegte, prospektive Studie mit mehrfachen Querschnitts- und Längsschnittuntersuchungen. Über einen Zeitraum von 12 Jahren sollen jährlich von angestrebten 10.000 Personen aus dem gesamten Bundesgebiet und dem deutschsprachigen

Ausland Selbstauskunftsdaten, biologische Stressindikatoren (Haar-Cortisol, Metabolom, Herzratenvariabilität), kognitive Faktoren und genetische Informationen erhoben werden. Zielgruppe der Studie sind sowohl bereits Betroffene mit manifester Burnout-Symptomatik als auch Personen verschiedener Hoch-Risikogruppen ohne Burnout und Gesunde, unabhängig von ihren beruflichen Rahmenbedingungen.

Seit Beginn der ersten Erhebungswelle im Januar 2015 bis zum aktuellen Zeitpunkt haben sich bereits über 3000 Teilnehmer auf der Studien-Homepage (www.dresdner-burnout-studie.de) registriert. Ab April 2015 soll mit der Erhebungen der biologischen Stressindikatoren begonnen werden.

Im Rahmen des Posters werden Studienaufbau, Methodik sowie querschnittliche Ergebnisse aus der ersten Erhebungswelle vorgestellt.

Poster A52

Explorative Untersuchung zum Einfluss von Cortisol auf Frequenzbandkopplungen zwischen neuronalen Quellen während der Durchführung einer Task Switch Aufgabe

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Im präfrontalen Kortex ist die Dichte von Cortisolrezeptoren hoch. Dies legt nahe, das Cortisol modulierend auf Frontalhirnfunktionen, z. B. kognitive Kontrolle, einwirkt. Task-Switching ist ein typisches Instrument zur Erfassung kognitiver Kontrolle. Frühere Studien ergaben, dass bei der Bewältigung dieser Aufgabe ein frontoparietales Netzwerk beteiligt ist. Dieses Experiment soll die ereigniskorrelierten und spektralanalytischen Befunde ergänzen und untersucht Phasen-Amplitudenkopplungen explorativ über ein breites Frequenzspektrum. Von insgesamt 38 Probanden erhielt die Hälfte eine Infusion von 4 mg Cortisol, die andere Hälfte ein Placebo. Anschließend bearbeiteten sie eine emotionale Task-Switch-Aufgabe, bei der abhängig vom Cue entschieden werden musste, ob ein Gesicht männlich beziehungsweise weiblich oder glücklich beziehungsweise ärgerlich ist. Per Independent Component Analysis wurden zeitlich maximal unabhängige neuronale Quellen extrahiert und für jeden Proban-

den semiautomatisch eine frontal und parietal gelegene Quelle ausgewählt. Die Modulation der Amplitude von Frequenzen zwischen 25 bis 110 Hz in der parietalen Region durch die Phase von Frequenzen zwischen 2 und 12 Hz in der frontalen Region wurde nach der Methode von Cohen (2014, MIT Press) erfasst. Die Befunde legen nahe, dass Teile des frontoparietalen Netzwerkes unter Stress stärker gekoppelt (Theta-niedriges Gamma) sind während andere Teile unabhängiger voneinander agieren (Theta-hohes Gamma) als unter Ruhe. Kognitive Kontrolle scheint unterschiedlich implementiert zu werden. Die Verhaltensdaten weisen darauf hin, dass der Einfluss basaler Cortisollevel diese Befunde differenzieren könnte. Die Relevanz von Thetaoszillationen wurde bereits mehrfach belegt und mit Top-Down-Prozessen in Verbindung gebracht. Die hier durchgeführte explorative Analyse soll durch konfirmatorische Frequenzbandkopplungsanalysen repliziert werden, die den zeitlichen Verlauf der Kopplung über die Task-Switch-Aufgabe aufgreift.

Poster A53

Objective, Subjective, and Correct Perspectives onto Decision Making: Evidence from ERP old/new effects

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Discrimination of two or more classes of stimuli can be analyzed from an objective perspective (referring to actual differences in stimulus input), from a subjective perspective (corresponding to participant's decisions), or as the overlap of these two perspectives (correct classifications). Using event-related potentials (ERPs) recorded during an old/new recognition memory test involving emotionally laden and neutral words studied either blockwise or randomly intermixed, we show here how the objective perspective (old items compared with new items) yields late effects of blockwise emotional item presentation at parietal sites that the other two perspectives fail to find, whereas the subjective perspective ("old" decisions compared with "new" decisions) is more sensitive to early effects of emotion at anterior sites than the other two perspectives. Our results demonstrate the potential advantage of dissociating the subjective, the objective, and the correct perspectives onto task performance, especially for investigations of cognitive illusions and biases, in cognitive

neuroscience experiments investigating top-down and bottom-up driven information processing.

Poster A54

Fear Conditioning and Stimulus Generalization in Social Anxiety Disorder

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Meta-Analyses found generalization of conditioned fear to be a robust marker in the pathology of several anxiety disorders, such as panic disorder, posttraumatic stress disorder and generalized anxiety disorder. As there exist no conditioning studies assessing overgeneralization in social anxiety disorder (SAD), the current study examined whether it also plays a role in SAD. 31 patients with a diagnosis of SAD and 31 healthy controls (HC) were conditioned to two neutral female faces serving as conditioned stimuli (CS+: reinforced; CS-: non-reinforced) with a fearful face paired with a loud scream serving as unconditioned stimulus (US). Fear generalization was tested by presenting morphs of the two faces (GS: generalization stimuli) which varied in their similarity to the original faces. During the whole experiment self-report ratings, heart rate and skin conductance responses (SCR) were recorded. Results revealed that SAD patients rated all CS and GS as less pleasant and more arousing, and overestimated the occurrence of the US compared to HC. Moreover, ratings and SCR indicated that both groups generalized their acquired fear from the CS+ to intermediate GS as a function of their similarity to the CS+. Remarkably, only SAD showed generalization in HR responses while HC did not distinguish among stimuli. Overall, the findings suggest that SAD might not be characterized by overgeneralization but quantitative discrepancies in fear reactions to social stimuli per se compared to HC.

Poster A55

When opportunity meets motivation: Differential neural processing during social approach in individuals with high and low BAS

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A key aspect of human social motivation is the pursuit of social reward. Dopaminergic-mediated brain circuits have been implicated in the processing of not only primary and monetary, but also of social rewards. As personality dispositions can influence the reinforcing value of social incentives, we tested whether individual differences in the behavioral activation system (BAS) modulate neural activation when positive social stimuli are connected to approach behavior. Individuals with high (n=20) and low (n=16) BAS completed implicit and explicit social approach-avoidance paradigms during fMRI. Approach and avoidance were evoked by pictures of happy and angry – compared to neutral – facial expressions. Participants executed approach and avoidance movements by pulling or pushing a joystick (implicit task) and rated their tendency to move toward or away the face (explicit task).

Individuals high in BAS showed faster implicit approach reactions as well as a trend for higher approach ratings, indicating increased approach tendencies. During implicit and explicit positive social approach, stronger recruitment of the nucleus accumbens, middle cingulate cortex and (pre-)cuneus was evident for individuals with high BAS compared to low BAS. This extends previous research by showing that individuals with a high BAS activate reward-related circuits more easily - not merely in response to positive stimuli, but especially when these are linked to social approach. These findings underline the interplay between motivational preferences and motivational contexts and further suggest that engaging in social interactions might be experienced as intrinsically rewarding for those with a heightened inclination to seek social rewards.

Poster A56

Evaluative Konditionierung von auditorischen Reizen durch emotionale Bilder: Eine EKP-Studie

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Geräusche spielen im alltäglichen Leben eine große Rolle für unser emotionales Erleben. Allerdings wurde die Verarbeitung emotionaler Geräusche im Vergleich zu emotionalen Bildern bisher wenig untersucht. Ein möglicher Grund dafür ist, dass es schwieriger ist die physikalischen Eigenschaften auditorischer Stimuli zu kontrollieren.

Um die Verarbeitung physikalisch vergleichbarer auditori-

scher Reize mit unterschiedlicher Valenz zu untersuchen, wurde in der vorliegenden Studie ein crossmodales evaluatives Konditionierungsparadigma verwendet. Dazu wurden 28 Versuchspersonen (16 Frauen) kurze Töne (50ms) mit unterschiedlicher Frequenz entweder in Kombination mit 15 positiven, neutralen oder negativen Bildern dargeboten. Während der Habituations-, Akquisitions- und Testphase wurden frühe auditorische Aufmerksamkeitsprozesse mit Hilfe ereigniskorrelierter Potentiale (EKP) auf die Töne untersucht.

Die Ergebnisse zeigen, dass bereits sehr frühe auditorisch evozierte Potentiale (P50 und N1), die mit gerichteter Aufmerksamkeit assoziiert sind, durch die konditionierte Valenz der Töne moduliert werden. Nach der Akquisition zeigte sich eine reduzierte P50 Amplitude auf positiv im Vergleich zu neutral oder negativ konditionierten Tönen. Die N1 Amplituden dagegen zeigten eine intensivere Verarbeitung positiv konditionierter Töne. Zusammenfassend weisen die Befunde darauf hin, dass die Valenz neutraler Töne durch die Paarung mit emotionalen Bildern signifikant beeinflusst wird und sich Valenzunterschiede bereits auf früher neuronaler Verarbeitungsebene zeigen. Selektive Aufmerksamkeit wird also zunächst verstärkt auf negativ und neutral im Vergleich zu positiv konditionierten Tönen ausgerichtet (P50), während im weiteren Verlauf insbesondere positiv assoziierte Töne, die potentiell als Sicherheitssignale dienen, mit verstärkten Verarbeitungsprozessen (N1) einhergehen. Das ist überraschend, da auch hier eine Alarmfunktion vor allem für negativ konnotierte Geräusche zu erwarten gewesen wäre.

Poster A57

Correcting distractor-evoked response activation: Temporal dynamics of the LRP and the conflict-related N2

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Processing of incongruent distractor-target conjunctions is associated with a pronounced N2 component of the event-related potential, assumed to signal cognitive conflict or the need to inhibit an incorrect response tendency. Here, we investigated the processing of distractor-target conflict by recording event-related brain potentials in

a temporal flanker task. In this task, a target stimulus is preceded by a congruent or an incongruent distractor presented in the same location. Previous research has shown activation of the distractor-related response already before target onset, as indicated by the LRP. This effect is enhanced when the ratio of congruent to incongruent trials is increased, suggesting strategic usage of the distractor, that is, enhanced distractor-related response preparation when conflict is unlikely. In two experiments we investigated the time course of distractor-evoked response activation and its relation to the occurrence of a conflict signal. Unlike incongruent trials were associated with a pronounced N2-like component whose onset coincided with a marked reduction of the (distractor-related) LRP. These results are consistent with the notion that the N2-like component reflects a regulatory process rather than acting as a mere trigger for regulation.

Poster A58

State dependent changes in neuronal connectivity and network characteristics in late-life depression: A NIRS study.

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Background. There is a large body of evidence showing a substantial relationship between depression and deficits in cognitive functioning. Especially in late-life Depression cognitive impairments are associated with worse progress in treatment and may lead to neurodegenerative disorders. The study at hand aims to investigate the cognitive control network in late-life depression during a cognitive task and at rest with functional near-infrared spectroscopy (fNIRS).

Methods. Haemodynamic responses were measured at rest and during the Trail-Marking-Test (TMT) via fNIRS in a matched sample of 49 depressed and 51 non-depressed older subjects (age range: 51–83 years; 64.1 ± 6.58 [mean \pm SD]). Functional connectivity and network metrics were derived from the data and analyzed with respect to differences between the subject groups.

Results. Depressed and non-depressed subjects showed significant differences both at rest and during task performance in connectivity strength as well as in network

organization. Results showed a double dissociation of subject group and task regarding connectivity strength and network organization. Depressed subjects showed reduced connectivity in a left frontopolar network during task performance and increased connectivity in a left frontoparietal network at rest. Functional networks were more segregated in the depressed group at rest, but not during task performance.

Conclusions. The results are discussed with regard to late-life depression and cerebral development.

Keywords. Near-infrared spectroscopy (NIRS), Connectivity, late-life Depression, Executive Function

Poster A59

Comparison of ICA and Regression-based Techniques: Artefact Correction of Noisy EEG Data

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New developments on the statistical analysis of EEG data provide new ways in dealing with distortions of EEG recordings due to artefacts and noise. Independent Component Analysis (ICA) for example allows for the detection, identification, and removal of artefact-related components from the data set irrespective of their generators and topographical distribution. Regression-based artefact correction procedures such as the eye movement correction procedure (EMCP), introduced by Gratton, Coles, and Donchin (1983), on the contrary, are confined to the handling of blink- and saccade-related deflections. Especially, recordings collected under suboptimal conditions paralleled by multiple artefacts might benefit substantially from the application of the ICA. The current analyses compare an ICA- with the EMCP-based correction procedure based on EEG data with a highly compromised signal-to-noise ratio due to frequent muscle contractions and eye movements. Results for N1 latency and peak-amplitude evoked by tones of low and high intensity, that is, non-reflex and startle-reflex eliciting white noise, obtained from ICA and EMCP corrected data are presented. Results indicate viable results for both cases. The similarity of results, however, clearly depended on electrode position and thus stresses the necessity of standardizations for the application of the ICA when used as artefact correction procedure.

Poster A60

The importance of sensory integration processes for action cascading

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Action cascading is essential in everyday life and often investigated using tasks presenting stimuli in different sensory modalities. However, very little is known about whether multimodal integration affects performance in action cascading or the underlying neurophysiology. To bridge this gap, we investigated action cascading in healthy young adults who completed a stop-change paradigm using either one or two modalities. The contrast of the unimodal and bimodal groups suggested several effects on the behavioral and neuronal level. The behavioral analysis revealed prolonged response times and increased accuracy when stimuli were presented simultaneously in the bimodal task. In addition to behavioral data, EEG data showed differentially affected bottom-up and top-down guided attentional processes as reflected by the P1 and N1, respectively. Nevertheless, the most pronounced effect was the number of modality dependent modulation of response selection processes, that is, the dissociation of processes eliciting the P3 in the bimodal and unimodal task versions. While the P3 was strongly modulated by the CHANGE stimulus in the bimodal version, it was strongly modulated by the STOP stimulus in the unimodal version. Hence, task goals were formed in a different way depending on the number of modality, that is separate task goals were formed when two different modalities were involved and in the unimodal task conjoint task goal was generated. Moreover, on a systems level, these modality dependent distinct action cascading processes seem to be related to the modulation of activity in fronto-polar regions (BA10) as well as Broca's area (BA44).

Poster A61

The neuronal basis of the letter spacing facilitation effect

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It was recently proposed that increased letter spacing may facilitate reading in dyslectic readers. The nature of this effect, however, is so far not understood. Using eye-tracking

during text reading (n = 24), we demonstrate shorter First Fixation Durations when spaces between letters are wider. This effect was especially pronounced for relatively slow readers. To investigate the neuronal underpinnings of letter spacing-dependent facilitation, two ERP experiments were conducted (n = 38). Experiment 1 demanded semantic decisions on words presented either in standard spacing or with extra space between letters. Experiment 2 required perceptual decisions on strings of the characters “i” and “!”, presented in two length conditions of five (e.g., liili) or seven characters (e.g., !!ili!!) and two inter-character spacing conditions (narrow vs. wide). This rather artificial task allowed controlling for stimulus size and spacing effects. A decrease of P1 amplitudes through wider spacing was only observed in experiment 2 and only significant for relatively slow readers. In both tasks, extra character spacing elicited stronger N170 amplitudes. This amplitude increase was similar for both groups in experiment 1, while in experiment 2 slower readers showed stronger N170 increase due to wider character spacing. The observed P1 modulation through character spacing indicates a basic visual processing source for the letter spacing facilitation effect. Furthermore, the reader group specific modulation of P1 and N170 through a mere physical manipulation of stimulus characteristics supports the notion that reading speed variance depends among other factors on basic visual perceptions factors.

Poster A62

Stress, sleep and memory consolidation during sleep

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Stress affects sleep. Stress leads to longer sleep onset latency, less slow wave sleep and worsened sleep efficiency. Sleep disturbances are an important risk factor for stress-related diseases such as burnout or depression. In addition to the impact on health, disturbed sleep has adverse effects on cognition. Moreover, stress and cortisol modulate memory processes. In spite of the clinical importance and the pertinence of stress-related learning processes in everyday life, the behavioral and physiological mechanisms of the association between stress, sleep and memory are virtually unknown.

In the present study we focus on the influence of acute stress (stress induction using the Montreal imaging stress task) on sleep and memory consolidation during a 90-minute nap-sleep (n=20) or wakefulness (n=19). We expect that the stress level affects sleep parameters. Moreover stress may differently affect memory performance in the sleep and the wake group.

Sleep onset latency after stress induction was prolonged when compared to sleep onset latency in the control condition. In respect to stress effects on memory consolidation, we observed an interaction between the cortisol response and sleep or wakefulness after stress induction. While in cortisol responders the sleep group showed better memory performance than the wake group, this effect was reversed in non-responders. Our results indicate that stress effects on memory consolidation during wakefulness are mediated by the cortisol response while this effect was not observable in the sleep group.

Poster A63

Veränderte autonome Reaktion auf emotionale Stimuli nach limbischer Enzephalitis

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Die limbische Enzephalitis (LE) ist eine autoimmunvermittelte Erkrankung, die Schädigungen des limbischen System, vor allem der Amygdala, hervorruft. Die Amygdala ist wesentlich für die Verarbeitung emotionaler, besonders angstbesetzter Signale. Hier untersuchten wir die Hautleitfähigkeit als autonomes Reaktionsmaß auf neutrale und angstausslösende visuelle Stimuli bei zwei Patienten mit LE und einer gesunden Kontrollgruppe. Die Analyse ergab verringerte Werte der Hautleitfähigkeit für Patienten in Relation zur Kontrollgruppe. In Bezug auf die LE verweisen die Befunde auf eine veränderte Modulation sympathischer Reaktionen nach emotionaler Stimulation.

Poster A64

Neurofunktionelle Korrelate erhöhter Resistenz gegenüber Ablenkung bei Patienten mit idiopathischem Parkinson-Syndrom

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Hintergrund. Das optimale Gleichgewicht zwischen stabiler Abschirmung und flexibler Aktualisierung von Informationen erfordert die Harmonisierung gegenläufiger Prozesse. Auf neuraler Ebene scheint dieser Trade-off durch fronto-striatale Regelkreise vermittelt zu werden. In der Studie wurden die Effekte eines Ungleichgewichts dieser Regelkreise an der Modellstörung des idiopathischen Parkinson-Syndroms (IPS) untersucht und inwiefern die Erkrankung, neben häufig berichteten Einbußen auf die kognitive Flexibilität, auch mit günstigen Effekten auf die Resistenz gegenüber Ablenkung verbunden ist.

Methoden. Es wurden 32 Patienten mit IPS (zu zwei Zeitpunkten: im medikamentösen On+Off), sowie 32 gesunde Kontrollen (KG) mithilfe funktioneller MRT während der Ausführung einer Aufgabe zur kognitiven Abschirmung von Gedächtnisinhalten untersucht. In der Aufgabe müssen zu Beginn eines Durchgangs gezeigte Stimuli über eine Merkphase hinweg aufrechterhalten und mit einem am Ende gezeigten Zielreiz verglichen werden. Resistenz gegenüber Ablenkung wurde in der Merkphase über das Einblenden von Distraktoren unterschiedlicher Schweregrade operationalisiert.

Ergebnisse. Auf behavioraler Ebene zeigten IPS-Patienten ohne Medikation im Vergleich zur KG geringere Distraktorkosten in den Reaktionszeiten, ohne dabei jedoch mehr Fehler zu machen. Diese Interaktion von Gruppe und Distraktor wurde durch neurofunktionelle Daten unterstützt: hier zeigten Patienten gegenüber der KG bei verstärkter Ablenkung eine erhöhte Aktivität im rechten Pars triangularis des Gyrus frontalis inferior.

Diskussion. Die Daten unterstützen die Annahme einer erhöhten präfrontalen Aktivität in unmedizierten Parkinsonpatienten, die möglicherweise auf gestörte fronto-striatale Regelkreise zurückzuführen ist. Während das Ungleichgewicht frontaler und striataler Aktivität günstige Effekte auf das Abschirmen von Informationen gegenüber

Ablenkung hat, fördert es eventuell das Auftreten von rigiden Verhaltensweisen, welche häufig bei Parkinsonpatienten zu beobachten sind.

Poster A65

The impact of acute stress on reward anticipation

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Stress and reward processing are important aspects of the development and persistence of various psychiatric disorders, particularly those related to addiction. However, only few studies investigated this potential link so far and it is largely unknown how stress and reward might influence each other.

The present study investigated the effects of acute stress on reward anticipation. Healthy men were randomly assigned to an acute stress (Trier Social Stress Test, TSST) or to a placebo condition. Immediately after the stress inducing/placebo situation, participants performed a Monetary Incentive Delay (MID) task in a functional magnetic resonance imaging (fMRI) experiment. In each trial one of two cues preceded a simple reaction task. One cue (CS+) indicated that participants could gain a reward for a fast reaction to a target while the other cue (CS-) indicated that no reward could be gained regardless of the reaction time.

First results show activations in stress- and reward relevant areas (e.g. ventral striatum, orbitofrontal cortex). Potential implications for neurobiological theories of addiction will be discussed.

Poster A66

Die Untersuchung des Herzschlag-evozierten Potenzials (HEP) im Zusammenspiel mit Kardiosensibilität und Emotionen bei Jugendlichen

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Der Wahrnehmung körpereigener Signale wird in verschiedenen Emotionstheorien eine hohe Bedeutsamkeit zugesprochen. Die vorliegende Studie hatte zum Ziel, einen möglichen Zusammenhang zwischen der Herz-wahrnehmungsleistung und der Amplitude des Herzschlag-evozierten Potenzials (HEP) bei Jugendlichen zu

untersuchen. Zudem sollte die Beziehung zwischen der Herzwahrnehmungsfähigkeit, der kortikalen Verarbeitung emotionaler Stimuli und dem subjektiven Emotionserleben überprüft werden. Das HEP gilt als psychophysiologischer Indikator für die unbewusste kortikale Verarbeitung kardiovaskulärer Prozesse. Es ist bislang bei Jugendlichen weitestgehend unerforscht. In der vorliegenden Studie wurden 54 gesunde Jugendliche, darunter 28 Mädchen (Alter: 13,9 [1,4]) und 26 Jungen (Alter: 14,3 [1,8]) in einem Herzwahrnehmungstest nach Schandry untersucht und entsprechend ihrer Leistung einer Gruppe guter bzw. schlechter Herzwahrnehmer zugeteilt. Nach einer Ruhephase bewerteten die Probanden negativ valente und neutrale Bildstimuli (IAPS) sowie Bilder von Lebensmitteln (food pics) hinsichtlich Valenz und Arousal, während ein 62-Kanal-EEG, ein EOG und ein EKG abgeleitet wurden. Es wurde untersucht, ob das HEP bei Jugendlichen auftritt und ob es durch die Herzwahrnehmungsleistung und durch emotionale Stimulation moduliert wird. Zudem wurde überprüft, ob sich gute und schlechte Herzwahrnehmer in Ausprägung, Latenzbereich und Lokalisation ihrer HEP-Amplituden unterscheiden. Wie erwartet zeigten die Jugendlichen HEPs, welche mit der Höhe des Herzwahrnehmungsscores interagierten. Die Ergebnisse der Studie liefern relevante Implikationen für die Verarbeitung kardiovaskulärer Signale und die Emotionsforschung im Jugendalter.

Poster A67

Reading Scenes: Irrelevant background scenes modulate neural responses during lexical decisions.

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Usually, linguistic and visual-perceptual operations are studied separately in domain-specific experimental paradigms. But how do these operations interact? Here we tested whether ERPs during lexical decisions are modulated by an irrelevant, visual background scene. Participants were presented with a background scene and a location cue before a string of letters appeared at the pre-cued scene location. The sole task was to decide whether the letter string formed a word or non-word. Words could either be congruent with the scene ('SOAP' on sink), semantically incongruent ('EGG' on sink), syntactically incongru-

ent ('SOAP' on towel rack – i.e., semantically congruent but it in a wrong relative location), or double-incongruent ('EGG' on towel rack).

We found that words that were semantically incongruent with respect to the background scene triggered a negative deflection compared to the consistent words about 400ms after word onset. In the language domain, this N400 response is known to signal difficulties in the semantic integration of a word with its sentence context. Semantically congruent words presented in improbable scene locations, on the other hand, did not significantly affect brain responses. Thus, the syntactic placement of a word on an irrelevant background scene did not modulate neural responses to the extent that semantically incongruent words did. We conclude that a brief visual scene preview — even if task-irrelevant — automatically interacts with linguistic operations on at least the semantic processing level. Therefore, language and visual scene processing may share common parsing mechanisms that are efficiently integrated to function as a unitary whole.

Poster A68

Self-Awareness und die Aufdeckung verheimlichten Wissens

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Die Lenkung der Aufmerksamkeit auf das Selbst (Selbstaufmerksamkeit, Self-Awareness) beeinflusst das Verhalten in Laborexperimenten. Das Verhalten wird dabei konformer mit der salienten Norm, wodurch negative Selbstevaluation reduziert werden soll.

Bei der Aufdeckung verheimlichten Wissens im Concealed Information Test ist die saliente Norm, sich anzustrengen, das eigene Wissen zu verheimlichen.

Da Motivation das Abschneiden im Concealed Information Test negativ beeinflusst, (Motivational-Impairment-Effekt) wurde die Hypothese aufgestellt und untersucht, dass bei Personen, die ihre Aufmerksamkeit auf sich selbst lenken, das verheimlichte Wissen leichter aufgedeckt werden kann.

52 Versuchspersonen wurden auf zwei Versuchsbedingungen aufgeteilt. Nach einem Mock-Crime (Scheinverbrechen) wurden sie einem Concealed Information Test unterzogen. In der Experimentalbedingung (hohe Self-Awareness) sahen die Versuchspersonen während des

Concealed Information Tests ihr eigenes Live-Kamerabild und hörten eine zuvor von ihnen aufgenommene Stimmaufnahme. Die Versuchspersonen in der Kontrollgruppe (niedrige Self-Awareness) hörten eine Stimmaufnahme einer ihnen unbekannt Person und sahen statt des Kamerabilds einen grauen Bildschirm. Während des Concealed Information Tests wurden Hautleitfähigkeit, Atmung, Fingerpuls, phasische Herzrate sowie Reaktionszeiten gemessen.

Die vorläufige Auswertung der Daten ergab, dass die Aufdeckung verheimlichter Wissens in beiden Bedingungen und mit allen erhobenen physiologischen Parametern zuverlässig funktionierte. Eine Verbesserung der Aufdeckung durch die experimentelle Manipulation der Self-Awareness konnte hingegen nicht belegt werden.

Als möglicher Erklärungsansatz wird das experimentelle Setting diskutiert, bei dem durch das Anlegen der Messgeräte bereits die Aufmerksamkeit auf das Selbst gerichtet wird, wodurch auch in der Kontrollgruppe Self-Awareness entstanden sein könnte und die Gruppen sich somit im Sinne eines Deckeneffektes nur noch geringfügig unterschieden.

Poster A69

The Donder's Fallacy – why additional processing demands cannot be inserted into simple reaction time tasks without affecting a variety of processes

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Many elementary cognitive tasks (ECTs) used in mental chronometry follow the logic of Donder's subtraction method, which assumes that very specific processing requirements can be inserted into a simple reaction time task without affecting any other cognitive component. This theoretical assumption is, however, not unproblematic. Although ECTs have rather low task complexities, each task still requires several cognitive processes such as attention, perception, encoding, representation in working memory, decision making, and response preparation. Adding any specific task requirement may affect several of these components simultaneously. To test whether inserting an additional processing demand has an effect on one or multiple cognitive components, 133 participants completed three ECTs (the Hick paradigm, the Sternberg me-

memory scanning paradigm and the Posner letter matching paradigm) while an EEG was recorded. A diffusion model decomposition of the reaction time data indicated that drift, boundary separation and non-decision time varied between conditions of the three ECTs. Moreover, experimental conditions had an effect on several ERP components, namely on both early (i.e., N100) and late ERP components (i.e., P200, P300) in the Hick paradigm, on early (i.e., N100) and late ERP components (i.e., P200, N200, and late positive wave) in the Sternberg paradigm, and on two late components (i.e., P200 and P300) in the Posner paradigm. Taken together, these results indicate that ECT conditions differ in several neuro-cognitive parameters and that the basic assumption of Donder's subtraction method does not hold in the light of empirical data.

Poster A70

Modulation of human CB1 receptor gene on contextual fear generalization

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Sustained anxiety and impaired extinction learning are crucial characteristics of anxiety disorders. Recently, the influence of cannabinoid receptor 1 gene (CNR1) on impaired extinction and overgeneralization of conditioned fear has been demonstrated.

We investigated the impact of CNR1 variants on generalization processes in a cue and contextual fear conditioning paradigm using virtual reality (VR).

Sixty-one participants were genotyped for the functional CNR1 rs2180619 polymorphism.

During acquisition phase, one colored light (fear cue, CS+) was paired with an electric stimulus (unconditioned stimulus, US) in one virtual office (anxiety context, CXT+), whereas a second light (safety cue, CS-) was never paired with the US. In the second virtual office (safety context, CXT-) no US was administered. During generalization phase, participants visited the CXT+, CXT- and a novel generalization context (G-CXT) and saw the colored lights (CS+ and CS-) again in each office. No US was delivered.

After generalization, participants homozygous for the risk allele (homozygous for the A/A allele, $n = 21$) rated the fear cue more arousing and CXT+ and G-CXT more anxiogenic than G+ allele carriers ($n = 40$). Furthermore, A/A homozygous group showed potentiated startle responses to the G-CXT than the G+ carrier group, both indicating stronger generalization of contextual anxiety to the new context. No differences were revealed between the two genotypes in response to the cues.

This suggests an important role of CNR1 gene variation in sustained anxiety, potentially determining overgeneralization of contextual fear.

Poster A71

Information theory reveals neural correlates of predictions – a magnetoencephalography study

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Predictive coding theory suggests that the brain constantly generates predictions to anticipate the incoming sensory evidence. Comparison of sensory evidence to these predictions facilitates and speeds up the perceptual process especially under ambiguous perceptual conditions. We used degraded pictures of faces and houses combined with alternating task instructions („face or not?“ or „house or not?“) in a visual discrimination task during MEG recordings to induce predictions maintained over several minutes. Likely candidates to actively represent this information in the brain are neural processes that a predictable themselves. These processes can be identified using an information-theoretic measure called active information storage (AIS). AIS, which quantifies the amount of stored information used for computation of the next processing step, was used to identify the brain regions where face predictions were stored. We analysed 478 potential brain regions in the whole brain of 42 subjects in the prestimulus interval of the discrimination task and found higher AIS values in the inferior temporal gyrus/FFA and early visual areas when subjects maintained face information in memory. Spectral analysis at these brain regions revealed increased power in the beta frequency range when subjects were instructed to identify faces. Notably, beta frequencies have been linked to the representation of predictions in recent neurophysiological accounts of predictive coding.

Thus, our results not only strongly indicate that AIS is well suited to analyse predictions in the brain, they also provide evidence for the assumption that neural activity in beta frequencies is related to the maintenance of predictions.

Poster A72

Frontal asymmetry as a predictor of behavior in a virtual T-maze.

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Frontal asymmetry, as proposed by Davidson, has been investigated in terms of trait asymmetry, a stable disposition of frontal activation and state asymmetry, representing variable reactions of frontal brain regions to situations. In state based approaches, different stimuli are used to induce frontal asymmetry. One major problem of many state based approaches is the lack of opportunity to show behavior. In this study, desktop virtual reality was used to induce frontal asymmetry, giving participants the opportunity to react to stimuli and showing frontal asymmetry as well. 30 participants explored a virtual T-maze, containing different events with positive, negative and neutral outcomes. The events were either „single events“, showing one stimulus, or „conflict events“, with two stimuli occurring at the same time. Each event was signaled via color cues. Frontal asymmetry was assessed during cueing period, because of different visual properties of the events. Also, behavior in every trial was recorded.

Considering only the events and frontal asymmetry, there is a main effect of the event on frontal asymmetry, showing more alpha power on the left frontal sites during „monster“ condition, where one encounters „monsters“, and potential loss of credits if one is not able to flee from them.

For frontal asymmetry as a predictor of the resulting behavior, there is a fixed effect for frontal asymmetry, showing higher probability to approach a stimulus than to withdraw oneself, if there is a higher score in frontal asymmetry, indicating more brain activation on the left side of the frontal brain.

Poster A73

The neural correlates of affective startle modulation – results from parallel EMG-fMRI

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The startle reflex is a widely used measure of affective states in both rodents and humans. Administration of a brief burst of white noise (“startle probe”) elicits a defensive reflex cascade, which can be measured in humans by facial electro-myography (EMG) of the orbicularis oculi muscle as a blink reflex.

Thereby, response magnitude is modulated by the affective state which manifests as response inhibition in positive and a potentiation in negative states. This presents a great advantage of the startle reflex compared to the commonly measured skin conductance response (SCR), as the startle reflex dissociates between affective state valences whereas SCR, as a measure of arousal, does not.

The neural pathway of affective startle modulation which has been extensively delineated in rodents, critically involves the nucleus reticularis pontis caudalis and the amygdala. In humans, similar work has not been performed due to technical restrictions on parallel EMG-fMRI acquisition.

The aims of this study are twofold. First, we aimed to fill this gap by providing a proof of concept for the feasibility of simultaneously acquired facial EMG and fMRI. The second aim was to investigate the neural pathway underlying affective startle modulation in humans using high-resolution brain stem/amygdala fMRI in combination with parallel facial EMG recordings in order to establish whether the same neural network underlies this effect in both rodents and humans.

Postersession B

Poster B01

The faces of predictive coding: Violations of life-long priors are signaled in the high gamma band

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Recent neurophysiological accounts of predictive coding hypothesized that a mismatch of prediction and sensory evidence – a precision-weighted prediction error (PE) – should be signaled by increased gamma band activity (GBA) in layers 2/3 of the cortical area where prediction and evidence are compared. This novel hypothesis contrasts with alternative accounts where violated predictions should lead to reduced neural responses.

We tested these hypotheses by violating predictions about face orientation and illumination direction in a Mooney face detection task, while recording magnetoencephalographic responses in a large sample of 48 human subjects. The investigated predictions – acquired via life-long experience – show a differential environmental precision and are known to be processed at different time-points during face recognition.

Behavioral responses confirmed the induction of PEs by our task. Beamformer source analysis revealed an early PE signal for unexpected orientation in visual brain areas followed by a PE signal for unexpected illumination in areas involved in 3-D shape from shading and spatial working memory. Both PE signals were reflected by increases in high-frequency (68-140 Hz) GBA. In high-frequency GBA we observed also a late interaction effect in visual brain areas, probably corresponding to a high-level PE signal. No PE signals were found in any of the lower frequency bands.

Our results strongly support the hypothesis that increased GBA signals PEs. Additionally, GBA may represent attentional effects.

Poster B02

The role of frontal & parietal resting alpha asymmetry in individuals with subclinical depressive symptoms in reactivity to emotional videos

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Depression is marked by blunted emotional reactivity to both positive and negative social stimuli. In addition, EEG studies suggest alterations in resting alpha asymmetry with less left than right activity over frontal sides and less right than left activity over parietal sides. Particularly the latter, parietal alpha asymmetry, has received less attention. Moreover, although the influence of trait-like frontal

alpha asymmetry on emotional state reactivity has been frequently examined, the role of parietal alpha asymmetry remains unknown. Thus, the present study examined the role of baseline frontal and parietal alpha asymmetry to a subsequent task with subjective reactivity to social videos, simulating approving/disapproving and non-emotional interpersonal situations, separately for females and males. During the task, 53 (28 female) participants rated their emotional responses to 30 videos of each category (positive/negative/neutral) on the dimension pleasantness. Asymmetry scores were calculated over P4/P3 for parietal and F4/F3 for frontal sides. Results revealed a relationship between higher depression scores and lower unpleasantness responses to negative videos as well as lower pleasantness ratings to positive videos in females, however not in males. These effects were significantly moderated by trait parietal alpha asymmetry, with relative lower right side parietal activation, possibly reflecting lower arousal, enhancing blunted emotional reactivity. Furthermore, greater right side frontal resting alpha asymmetry enlarged the association of higher depression severity and lower unpleasantness responses to negative videos. The present results suggest that the emotional blunting in subclinical depressive individuals is intensified by alterations in trait alpha asymmetry.

Poster B03

Resting GABA concentration in the superior temporal gyrus predicts gamma oscillations and multisensory perception

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Gamma band oscillations (GBO) play an important role in multisensory perception. Moreover, there is recent evidence that GABAergic transmission relates to multisensory processing. This raises the interesting question of whether there is a threefold relationship between GABAergic transmission, GBO, and multisensory perception. In humans, an established method to examine the GABA system is magnetic resonance spectroscopy (MRS). MRS allows the measurement of specific neurotransmitter con-

centrations in preselected brain regions. Here, we present data of a combined MRS-Electroencephalography study examining 41 participants. We investigated the relationships between GABA concentration in the left superior temporal gyrus (STG), source localized gamma band activity in the sound-induced flash illusion, and illusion rate in this multisensory paradigm. Our study revealed highly significant positive correlations ($r = .42$ to $.53$) between the three measures. Importantly, using path modeling we found that GABA concentration in the STG mediated the positive relationship between GBO power and multisensory perception. Glutamate concentration and GBO frequency, which were also examined, did not show relationships to GABA concentration or multisensory perception. Underscoring the critical role of neural oscillations in multisensory processing, our study provides first evidence for a threefold relationship between GABA, GBO, and multisensory perception. This suggests that GABAergic transmission could be a promising target for the neuropharmacologic treatment of altered multisensory processing in clinical conditions.

Poster B04

Zusammenhang zwischen habitueller Sorgenneigung und neuronalen Korrelaten kurzfristiger und überdauernder Effekte von Emotionsregulation

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Mit der generalisierten Angststörung werden übermäßige und unkontrollierbare Sorgen sowie dysfunktionale Emotionsregulationsprozesse assoziiert. Im Rahmen einer zweitägigen funktionellen Magnetresonanztomographie-Studie wurde der Zusammenhang der habituellen Sorgenneigung mit kurzfristigen und überdauernden Effekten von Emotionsregulation untersucht.

Am ersten Tag absolvierten 27 gesunde Frauen ein Emotionsregulationsexperiment mit der Aufgabe, Emotionen mittels kognitiver Neubewertung zu verstärken oder zu verringern, sich abzulenken oder aversive und neutrale Bilder passiv zu betrachten. Um überdauernde Effekte von Emotionsregulation untersuchen zu können, wurden dieselben Bilder ohne Regulationsaufgabe einen Tag später erneut präsentiert. Mittels Regressionsanalysen wurde

der Zusammenhang von habitueller Sorgenneigung und subjektiven und neuronalen Korrelaten von Emotionsregulation überprüft.

Die Ergebnisse zeigen, dass eine verstärkte Sorgenneigung mit einer stärkeren Reduzierung der negativen Gefühle und einer stärkeren Abnahme der Aktivierung in der Insel, im Hippocampus und im ventromedialen präfrontalen Kortex während Ablenkung im Vergleich zum bloßen Betrachten der Bilder verbunden war. Am zweiten Tag ging eine verstärkte Sorgenneigung mit einer stärkeren Aktivierung im vmPFC sowie einer tendenziell stärkeren Aktivierung in der Amygdala und im ventralen anterioren cingulären Kortex beim Betrachten von Stimuli einher, die am Vortag in der Verstärken-Bedingung präsentiert wurden.

Die Ergebnisse sprechen dafür, dass Ablenkung zumindest kurzfristig eine geeignete Strategie bei Personen mit verstärkter Sorgenneigung sein kann, um die emotionale Erregung auf emotionale Stimuli zu reduzieren. Zudem deuten die Ergebnisse darauf hin, dass die Hochregulation von negativen Gefühlen via kognitiver Neubewertung, die dem Prinzip des übermäßigen Sorgens ähnelt, langfristig mit einer veränderten Aktivierung in emotions- und regulationsassoziierten Arealen assoziiert ist. Dies könnte zur Entstehung, Generalisierung und Aufrechterhaltung pathologischer Sorgenprozesse beitragen.

Poster B05

Anesthesia-related changes in information transfer are partly caused by reduction in local information generation

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In anesthesia research it is an open question how general anesthetics lead to loss of consciousness (LOC); it has recently been proposed that LOC may be caused by the disruption of cortical information processing, preventing information integration. Therefore, previous studies investigating information processing under anesthesia focused on changes in information transfer, measured by transfer entropy (TE). However, often this complex technique was not applied rigorously, using symbolized timeseries, or wi-

thout accounting for signal history.

Here, we used current best-practice in TE estimation to investigate information transfer under anesthesia: We conducted simultaneous recordings in primary visual cortex (V1) and prefrontal cortex (PFC) of head-fixed ferrets in a dark environment under different levels of anesthesia (awake, 0.5 % isoflurane with xylazine, 1.0 % isoflurane with xylazine). In addition, we quantified information storage and entropy within cortical areas by estimating active information storage (AIS) and Lempel-Ziv complexity (LZC).

Under anesthesia, we found a reduction in TE and LZC, and an increase in AIS. This reduction in TE indicated diminished information transfer between PFC and V1 with a stronger reduction for the feedback direction (PFC to V1), validating previous results. Furthermore, entropy (LZC) was reduced and activity became more predictable as indicated by higher values of AIS.

We conclude that higher anesthesia concentrations indeed leads to reduced inter-areal information transfer. This reduction may be partly caused by decreases in local entropy and increases in local predictability, however, rather than by changes in effective connectivity between brain areas.

Poster B06

Why is it so hard to wait? Brain responses to delayed gratification predict impulsivity and self-control

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Being able to wait is very important. It means that we do not only focus on immediate outcomes but also on later ones that are bigger. But even if waiting pays out, it is still hard. To investigate mechanisms that are responsible for this, we looked at brain responses during a delay of gratification task.

We conducted a repeated measures EEG study and assessed personality via several questionnaires. In two separate experimental sessions, participants played a game where they could win either a big or small reward either immediately or in six months.

The event-related potential (ERP) after the feedback of the current outcome revealed that participants' brains coded

the small reward in six months as the worst and the big reward immediately as the best outcome. The same pattern emerged in subjective valence and arousal ratings of outcomes. We then computed the ERP differences between the worst and the best outcome, called the reward positivity. High reward positivity predicted higher impulsivity ($r=.6$, $p=.004$) and lower self-control scores ($r=-.5$, $p=.01$). In addition, retest-reliability of the reward positivity was quite high ($r=.6$, $p=.004$), indicating that it reflects a temporally stable mechanism.

The results shed light on the neural processes that are active in delay of gratification. When the brain is making a large difference between immediate and delayed outcomes, participants are more prone to act impulsive and have less self-control.

Poster B07

Deficient memory suppression in PTSD – Behavioral and neuromagnetic evidence

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Introduction:

Posttraumatic stress disorder (PTSD) is characterized by flashbacks and intrusions of the traumatic incident. These symptoms indicate a general deficit in suppressing the retrieval of unwanted memories from long-term memory.

Methods:

To test the assumption of impaired control over retrieval in PTSD, twenty-four traumatized refugees were investigated in a memory suppression experiment with concurrently recorded magnetoencephalographic event-related fields (ERF). In a Think/no-Think-paradigm, participants repeatedly retrieved (think condition) or suppressed (no-think condition) previously studied neutral pictures upon presentation of a reminder. The experiment was accompanied by a structured clinical interview, which allowed the assessment of PTSD diagnoses and memory intrusions in everyday life.

Results:

In a final recognition test, participants without PTSD ($n = 13$) showed forgetting of repeatedly suppressed pictures

(no-think condition), when compared to never retrieved or suppressed baseline stimuli. Individuals with PTSD ($n = 11$), however, were not able to actively reduce memory performance for no-think stimuli below baseline. Across all participants, successful memory suppression in the no-think condition correlated with less memory intrusions in everyday life.

On a neural level, parietal (900-1100 ms) and right frontal (1300-1500 ms) ERFs during suppression attempts were modulated only in subjects without PTSD.

Conclusions:

The present results suggest deficient inhibitory control over retrieval in PTSD. The altered ERFs during suppression attempts may indicate the voluntary avoidance of conscious recollection and the implementation of efficient inhibitory control over retrieval, respectively. Inter-individual differences in memory suppression relate to the experience of intruding memories, suggesting a possible target for prevention and therapy.

Poster B08

NIRS-Neurofeedback bei schizophrenen Patienten zur Regulation verbal auditorischer Halluzinationen

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Die Schizophrenie ist eine der schwerwiegendsten psychischen Erkrankungen, welche sich in einer heterogenen klinischen Repräsentation und einem höchst heterogenen Krankheitsverlauf manifestiert. Sie geht einher mit Beeinträchtigungen in einer Vielzahl psychischer Funktionen sowie mit neuronalen und biochemischen Störungen. Sowohl für Patienten als auch für ihre Angehörigen ist die Erkrankung mit einer sehr hohen Belastung verbunden. Die Kernsymptomatik der schizophrenen Erkrankung stellen meist Positivsymptome dar, wie Wahnphänomene und Halluzinationen. Vor allem akustische Halluzinationen betreffen bis zu 80% der Schizophreniepatienten und sind nicht selten resistent gegenüber antipsychotischer Medikation. Diese werden in Verbindung gebracht mit strukturellen Abweichungen sowie einer erhöhten Aktivität im Temporallappen. Therapeutischen Ansätze für diese Patientengruppe sind begrenzt und es besteht ein Bedarf

an weiteren Interventionsansätzen. Die Neurofeedback-methode, bei welcher die Patienten lernen ihre neuronale Aktivität in bestimmten Gehirnregionen zu regulieren, könnte einen entsprechenden Ansatz darstellen.

In der vorliegenden Studie soll ein Neurofeedback-Training mittels der Methode der Nahinfrarotspektroskopie (NIRS) als Behandlungsmethode bei schizophrenen Patienten mit akustischen Halluzinationen vorgestellt werden. Dabei soll die Effektivität zweier spezifischer Neurofeedbacktrainingsmethoden hinsichtlich der Veränderung der Kernsymptomatik anhand von zwei Experimentalgruppen untersucht werden. Die erste Experimentalgruppe soll dabei erlernen die Aktivität in temporalen Regionen zu verringern, die zweite die neuronale Aktivität im Präfrontalkortex zu erhöhen. Beim eingesetzten NIRS-Neurofeedback ist die kortikale Aktivierung durch einen Anstieg der Konzentration des oxygenierten Hämoglobins (O₂Hb) operationalisiert, eine Deaktivierung durch eine Reduktion der O₂Hb-Konzentration. Eine Wartekontrollgruppe soll die Vergleichbarkeit der Ergebnisse ermöglichen.

Es werden erste Ergebnisse zur kortikalen Selbstregulation mittels NIRS-Neurofeedback bei schizophrenen Patienten mit akustischen Halluzinationen vorgestellt.

Poster B09

Single-subject prediction of response inhibition performance by event-related potentials

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Much research has been conducted to investigate response inhibition and the neuronal processes constituting this essential cognitive faculty. However, the nexus between cognitive sub-processes, behavior and electrophysiological process has remained mostly correlative in nature. We therefore investigated whether classical neurophysiological correlates of inhibition sub-processes merely correlate with behavioral performance or actually provide information expedient to the prediction of behavior on a single-subject level.

Tackling this question, we used different data-driven classification approaches in a sample of n=262 healthy young subjects who completed a standard Go/Nogo task while an

EEG was recorded. Based on their performance, subjects were classified as displaying either good or bad response inhibition. Even though performance was associated with amplitude variations in electrophysiological correlates of response inhibition, the neurophysiological correlates (i.e. N2 and P3) were not predictive for performance on a single-subject level. Instead, amplitude differences in the Go-P2 originating in the precuneus (BA7) were shown to predict behavioral performance on a single-subject level with up to 64% accuracy. The P2 was larger in good than bad performers, suggesting that good performers show higher resource allocation on Go trials. These findings suggest that good inhibitory performance greatly depends on the amount of cognitive resources allocated to early stages of stimulus-response activation. Consequentially, research should take more heed of early processing steps when trying to predict or classify inhibitory control.

Poster B10

Effects of neurofeedback in ADHD affect attentional selection but not response monitoring processes

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In regards to ADHD symptomatology, theta/beta ratio neurofeedback training has been shown to lead to improvements in the domains of hyperactivity, impulsivity and particularly attention. Looking beyond these promising results on the behavioural level, however, the precise underlying neurophysiological mechanisms and effects are still unclear, especially as far as mechanisms of attention and action control are concerned. To examine this question, 25 paediatric patients with ADHD performed the Flanker task before and after 16 sessions (8 weeks) of theta/beta neurofeedback training. The Flanker task is an established measure of motor and attentional interference control in which the patients were required to respond according to the direction of a central arrow while ignoring (in)compatible flanking stimuli. Independent of flanker compatibility, we found significant post-neurofeedback improvements in accuracy, but not in reaction times. Neurophysiologically, perceptual and bottom-up attentional ERP correlates (P1 and N1) were enhanced after training, while no effect was seen for fronto-central correlates of cognitive control (N2). This pattern is in line with behaviou-

ral data. No changes were observed in an 8-week waiting list control group. These results suggest that theta/beta ratio neurofeedback training in ADHD leads to improvements in attentional selection processes, but not cognitive control processes. To broaden the effects of neurofeedback on cognitive control processes, modifications of the neurofeedback protocol could be considered.

Poster B11

Singing in the brain: activation in right anterior insula modulates sensory feedback integration as a function of vocal expertise in trained and untrained singers

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Recent studies on vocal motor production suggest that the right anterior insula plays a pivotal role in experience-dependent modulation of feedback integration during singing when somatosensory feedback from the larynx is perturbed. In the current study, we used fMRI with singers and nonsingers to study the effects of masked auditory feedback on pitch-accuracy and the singing brain network. Participants were recruited from a previous set of experiments on kinesthetic masking. We found that masked auditory feedback altered pitch accuracy only in nonsingers, suggesting a reduced dependency on auditory monitoring in singers. The corresponding BOLD response showed a distinct pattern of increased activation (singers) and decreased activation (nonsingers) within fronto-parietal cortical sensory and motor regions, suggesting that singers compensated for masking with enhanced somatosensory feedback and feedforward control while in nonsingers, the motor network becomes destabilized in the absence of auditory feedback. The activity of the anterior insula dissociated the effect of expertise as a function of masking together with inferior parietal cortex and premotor areas. During masking, activation in right AIC was increased in singers but decreased in nonsingers. Likewise, right AIC functional connectivity was increased in singers with inferior parietal cortices but decreased in nonsingers with left IPC, bilateral S1/M1, right thalamus, and left hippocampus. In nonsingers, increased BOLD response in bilateral AIC was furthermore correlated with larger pitch deviation during masking. We conclude that multimodal

regions, especially the AIC, guide vocal tract movements and cognitive motor control processes by segregating relevant sensory stimuli based on experience.

Poster B12

The impact of mental workload on inhibitory control subprocesses

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The inhibition of inappropriate responses is a function known to rely on prefrontal cortex functioning. Similarly, working memory processes are known to rely on the PFC. Even though these processes are usually closely intertwined and the functional neuroanatomy underlying these processes is largely overlapping, the influence of working memory load on inhibitory control process has remained largely elusive. In this study, we examine how response inhibition processes are modulated by working memory load. We systematically increased the working memory load of participants by integrating mental rotation processes in a Go/NoGo paradigm. To examine the systems neurophysiology of these processes in detail, and to examine whether there are differential effects of working memory load on distinct response inhibition subprocesses, we applied event-related potentials (ERPs) in combination with source localization techniques.

The data shows that after exceeding a certain threshold, inhibitory control processes are aggravated by working memory load. The neurophysiological data paralleled the behavioral data. However, it suggests that distinguishable response inhibition subprocesses are differentially modulated by working memory load: Changes were evident in the NoGo-P3 amplitude but not in the NoGo-N2 amplitude. On a systems level, this distinctive modulation of response inhibition subprocesses was related to differences in neural activity in the left inferior and middle frontal gyrus. We show that inhibitory control processes are impaired when the working memory load surpasses a certain threshold. This, however only applies to situations in which the necessity of inhibitory control processes cannot be easily detected on the basis of perceptual factors.

Poster B13

Changing cocaine use over one year affects self-reported impulsivity and gambling decision-making but not delay discounting

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Background: In cross-sectional studies, cocaine users generally display elevated levels of self-reported and cognitive impulsivity. To what extent these impairments are stable vs. variable markers of cocaine use disorder, and, thus, are pre-existent or drug-induced, has not been systematically investigated yet.

Methods: Therefore, we conducted a longitudinal study with cocaine users who changed their intensity of use within one year, measuring self-reported impulsivity with the Barratt Impulsiveness Scale (BIS-11), and cognitive impulsivity with the Rapid Visual Processing Task (RVP), Iowa Gambling Task (IGT), and Delay Discounting Task (DD) at baseline and at one-year follow-up. We assessed 48 psychostimulant-naïve controls and 19 cocaine users with decreased, 19 users with increased, and 19 users with unchanged cocaine intake after one year as confirmed by hair analysis.

Results: Results of linear multilevel modelling showed significant group*time interactions for the BIS-11 total score and the IGT total card ratio. Increasers showed elevated, whereas decreasers exhibited reduced self-reported impulsivity scores within one year. Surprisingly, increasers' IGT performance was improved after one year, whereas decreasers' performance deteriorated. By contrast, neither the RVP response bias nor the DD score showed substantial group*time interactions. Importantly, BIS-11 and DD revealed strong test-retest reliabilities.

Conclusion: These results indicate that self-reported impulsivity (BIS-11) and decision-making impulsivity (IGT) co-vary with changing cocaine use, whereas response bias and delay discounting remain largely unaffected. Thus, self-reported impulsivity and gambling decision-making were strongly state-dependent in a stimulant-using population, whereas delay of gratification was confirmed as a potential trait marker for drug use.

Poster B14

A lateralized ERP index for semantic activation in the left hemisphere

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Left-lateralization of speech processing in the brain is a well-known phenomenon that has been extensively investigated with neuroimaging studies. Interestingly there is little research regarding event-related potentials (ERPs) of language processing that might reflect specific activity of the Wernicke's area located in the left hemisphere. To investigate possible lateralized ERPs in single-word processing a within study design with three different tasks (passive word viewing, semantic word processing, and silent word naming) was conducted. Differences in terms of increased left-lateralized ERPs in occipito-temporal regions during the semantic task compared to the other tasks were expected. Results suggest a left-lateralized negative component over occipito-temporal areas for semantically processed words that was reduced or absent during the passive viewing task and the silent naming task. The component is discussed in the light of earlier findings as a lateralized ERP index specifically evoked during semantic processing in the left hemisphere what probably can be attributed to activity in the Wernicke's area.

Poster B15

APOE variant moderates compensatory recruitment of fronto-parietal areas in healthy older adults

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Increased brain activity in older adults induced by demanding cognitive tasks might constitute neural compensation. Here, we strived to disambiguate the compensatory nature of increased brain activity in healthy older adults (n=34; M(age) = 68.82, SD(age) = 5.33). Specifically, we investigated a possible moderation by APOE variant ($\epsilon 4$ carrier / non- $\epsilon 4$ -carrier) and age as proxies of neuronal decline in a verbal n-back task.

A multiple regression model predicting task fMRI signal from n-back performance, with APOE variant as mode-

rator variable and age, gender and education as nuisance variables, revealed an APOE-dependent recruitment of bilateral inferior frontal areas (model $R^2 = .67$, $p < 0.001$; interaction $T = 6.40$ $p < 0.05$ FWE corr.). With increasing task performance, $\epsilon 4$ carriers recruited these areas to a greater extent, i.e. showed a compensatory activation pattern, while non- $\epsilon 4$ -carriers showed the reverse effect and did not benefit from activation. Contrarily, a performance \times APOE \times age interaction from a regression model with age as a second moderator, revealed a compensatory effect in left supramarginal gyrus ($T = 3.37$, $p < 0.001$) in non- $\epsilon 4$ -carriers. While they showed a positive performance-activity relationship with increasing age, $\epsilon 4$ -carriers did not benefit from increased activation. These effects cannot be explained by working memory deficits, as $\epsilon 4$ - and non- $\epsilon 4$ -carriers performed equally ($p = .39$).

We conclude that compensatory brain activation at older age is dependent on $\epsilon 4$ variant, such that $\epsilon 4$ -carriers benefit from additional frontal activation, while non- $\epsilon 4$ -carriers showed compensatory activation in parietal cortex.

Poster B16

The Neural Signatures of Controlled and Automatic Retrieval Processes in Memory-Based Decision Making

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Decision making often requires the retrieval of information stored in memory. The neurocognitive dynamics of the contributing memory processes are only poorly understood, however. Drawing on the neural model of the ACT-R theory and other neural models of memory, we delineated the neural signatures of two fundamental and distinct retrieval aspects during decision making: automatic and controlled activation of memory representations. Participants used a decision strategy that demands a sequential retrieval of attribute information from long-term memory. Memory activation was tracked by means of blood-oxygenation-level-dependent signals in material-specific brain areas that represented the different attributes. When the decision strategy required a specific attribute in order to

make a decision, an extra boost of activation was observed in the attribute-specific representation area (controlled activation). Furthermore, the presentation of a decision option triggered activation of all memory representations associated with it (automatic activation). This led to retrieval interference among the activated attributes during strategy execution, prolonging decision times. Within a frontoparietal network of memory control, the dorsolateral prefrontal cortex was found to reflect both automatic and controlled activation, whereas the superior parietal cortex was exclusively active for controlled retrieval, requiring the sequential updating of attribute information in working memory. These results are consistent with the neural ACT-R theory. Overall, our findings constitute an important step towards a neural model of the retrieval dynamics involved in memory-based decision making.

Poster B17

Intimacy moderates the effect of social encounter on the acoustic startle eyeblink response

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The acoustic startle response is the reflexive response to a sudden auditory stimulus of sufficient intensity. Startle magnitude as measured by the eyeblink response has been found to be largest for aversive and smallest for positive contextual cues. Moreover, as Blumenthal et al. (1995) have shown, exposure to a social encounter that leads to social anxiety may cause a decrease in startle reactivity. However, the impact of intimacy and familiarity on this pattern of results not been addressed before. Therefore, the present pilot study was designed to examine the effect of intimacy on startle responses elicited in a social situation. 24 male subjects were presented with 2 blocks of white noise bursts. In one block subjects were alone, in another block a same-sex friend was seated silently behind him. Prior to the test, positive and negative affect, self-esteem, level of anxiety, and ratings of several aspects of the interpersonal relationship had been assessed by means of questionnaires. We found that closeness of the friendship did significantly moderate the effect of the social encounter (test alone vs. test with friend) on startle magnitude, whereas none of the other measures did. This finding suggests that the effect of the presence of other people on startle

responsiveness might depend on their capacity to serve as a safety cue, varying with inter-individual closeness.

Poster B18

Performance monitoring, response control and post-error adjustments in adults with Attention-deficit/Hyperactivity Disorder (ADHD): A NIRS-EEG study

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Objective: Our study aimed at characterizing the neurobiological underpinnings of post-error behavioural alterations in adult patients with attention-deficit/hyperactivity disorder (ADHD) and at relating these alterations to other known endophenotypes of ADHD, such as disturbed response control and performance monitoring deficits. To this end, a modified Eriksen flanker task was used that was embedded within a Go-NoGo paradigm. Simultaneously, neurophysiological responses were assessed using a combined electroencephalography (EEG) – near infrared spectroscopy (NIRS) setup.

Methods: 24 healthy controls and 34 ADHD patients conducted a combined Flanker/Go-NoGo task while EEG and NIRS signals were recorded. Data were analyzed in terms of event-related potentials (EEG) as well as frontal lobe activation (NIRS) elicited by the flanker stimuli, correct and incorrect button presses as well as the inter-trial interval; the correctness of the previous trial was additionally considered (post-correct vs. post-error trials).

Results: EEG data show significant differences between patients and controls for the stimulus-elicited P300 as well as for the error-related negativity (ERN). Moreover, differences were observed with respect to the inter-trial interval, with an opposite effect of previous errors on slow potential shifts in patients vs. controls. Regarding the NIRS data, preliminary results indicate reduced activation in ADHD patients within a prefrontal region of interest (ROI) specifically for go trials following errors.

Conclusions: Our results further support the notion of performance monitoring deficits and attentional alterations in adults with ADHD. Additionally, preliminary evidence is given on the neurobiological basis of deficient post-error adjustments as indicated by recent behavioural findings.

Poster B19

Behaviorale und neuronale Korrelate der Verarbeitung komplexer störungsspezifischer visueller Szenen bei Patienten mit einer Panikstörung

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Bisherige Studien haben vorrangig allgemein bedrohliche visuelle Stimuli zur Untersuchung veränderter Gehirnaktivierung bei der Panikstörung (PA) eingesetzt. Für die gegenwärtige Studie wurde ein standardisiertes Set komplexer störungsrelevanter Szenen entwickelt und mittels funktionelle Magnetresonanztomographie untersucht, welche neuronalen Antworten PA-Patienten und gesunde Kontrollpersonen auf aufgaben-irrelevante panikrelatierte Reize bei gleichzeitiger Lösung einer geometrischen Vergleichsaufgabe aufweisen. PA-Patienten zeigten im Vergleich zu gesunden Kontrollpersonen eine Hyperaktivierung in limbischen Arealen auf emotionale versus neutrale Stimuli, unter anderem in der Insula. Da Aktivierungen in der Insula in früheren Studien mit der Repräsentation körperlichen Erlebens in Zusammenhang gebracht worden sind, spiegelt die hier beschriebene insuläre Hyperaktivierung möglicherweise die gesteigerte interozeptive Sensitivität bei PA-Patienten wider und könnte somit eine entscheidende Rolle für die Ätiologie und Aufrechterhaltung der Panikstörung spielen. Die Ergebnisse zeigen, dass das entwickelte Stimulusmaterial geeignet ist, selbst dann Hyperaktivierungen in limbischen Arealen bei PA-Patienten auszulösen, wenn die Reize aufgaben-irrelevant sind.

Poster B20

Self-resemblance modulates motivational salience in a context-sensitive manner: evidence from inhibition of startle

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Preliminary evidence suggests that not only self-relevance in motivational terms, but also more indirect cues of self-relatedness, such as similarity to the self, can affect emotional responding.

Utilizing startle modulation as an index of the processing of self-resemblance in the context of emotional cues, we

presented participants (N=21; 9 women) with affectively valenced pictures of social situations. In each picture an individual showing a self- or other-resembling (morphed) face was depicted as being either physically threatened or involved in an erotic encounter. At SOAs of either 300 ms or 3000 ms after picture onset, startle responses were elicited by white noise (50 ms, 105 dB), and recorded at the orbicularis oculi via EMG.

Viewing of affective pictures, irrespective of valence, resulted in an overall inhibition of startle at short onset delays, relative to responses evoked both during inter-trial intervals and trials showing 'dull' pictures as controls. For responses at long lead intervals, a pattern suggestive of affective modulation of startle emerged, i.e., attenuated startle with erotic (compared to threat) stimuli. Consistent with previous reports, self-resemblance was associated with a general decrease in startle responsiveness at long onset latencies. By contrast, results for the short SOA condition indicated a differential effect of self-resemblance on the allocation of attention to emotional pictures: higher levels of startle inhibition for threat pictures and less attenuation for erotica.

Overall, the present study suggests that visual cues of general motivational significance and of self-relatedness and can be integrated in a fast, presumably automatic manner.

Poster B21

Shared cortical resources among language, music and natural scenes – Evidence for a cognitive algorithm on hierarchical structure processing from fMRI and RSA

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Numerous imaging studies have investigated the domain specificity of cortical networks underlying the processing of different cognitive functions. Their results indicate some common principles of processing and therefore shared cortical resources. One example is the processing of hierarchical structures or "syntax". Recent studies emphasized comparable neural networks underlying "syntactic violations" in a variety of cognitive functions, e.g. music and natural scenes, within a left-hemispheric frontotemporal network previously assigned to language only.

However, studies investigating more than two cognitive functions simultaneously within a paradigm, based on well-established and similar theoretic and cognitive constructs, are still missing. To overcome the existing gap of a within-subject design investigation of all these cognitive functions, we applied an fMRI paradigm fulfilling these requirements to 20 participants assessing cortical networks and behavioral data (reaction times and hit rates). Despite the recruitment of distinct networks for each cognitive function, a group analysis of functional data revealed brain activation in the left IFG that was commonly activated in all conditions, indicating a common principle of hierarchical structure processing that is applied across language, music, and visual perception.

In order to investigate these similarities more closely, a representational similarity analysis (RSA) was conducted in several functional regions of interest, showing highest similarities between these networks within a subregion of the left IFG. These results indicate a common processing of hierarchical structures and therefore a fundamental cognitive algorithm located in a subregion of the left IFG within otherwise distinctly different localized networks.

Poster B22

Sleep integrates representations across multiple memory systems

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Sleep has been linked to memory consolidation and synaptic plasticity. It supports stabilization of explicit, declarative memory and enhances implicit, procedural memory. Moreover, it has been suggested that sleep-dependent processing may change the quality of memories. Explicit and implicit memory systems can interact during learning. Whether they continue to interact during off-line periods remains unclear. Here, we show for feedback-driven classification learning that sleep integrates explicit and implicit aspects of memory. Using a specially developed behavioral paradigm we show that over sleep, but not wakefulness, the inherent structure of memory representations is modified. In particular, implicit and explicit components of memory become cooperative after sleep. This sleep-dependent change in the memory representation leads to a conversion between implicit and explicit

knowledge of the task. In an additional fMRI experiment we show that concurrent changes in brain activity reflect a symmetric, bidirectional information exchange between implicit and explicit learning systems. After sleep, the hippocampus, usually linked to explicit memory, contributes to implicit task recall, whereas the striatum, believed to govern implicit, habit-driven responses, becomes involved in explicit recollection. Additionally, both memory systems cooperate after sleep: correlations between explicit and implicit performance measures change from negative before to positive after sleep, performance in a task that allows the cooperative use of both types of memory improves, and functional connectivity between the hippocampus and striatum is strengthened. Thus, sleep combines information learned by different routes into an integral structure that helps us respond optimally to contingencies that we encounter in everyday life.

Poster B23

SNARC meets SPARC in the MRI – interdependence of compatibility effects depends on the semantic content

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Stimulus-Response-Compatibility (SRC) plays a major role in choice-reaction tasks. In specific cases, SRC leads to phenomena, such as the Spatial Numerical Association of Response Codes (SNARC, number processing) or the Spatial Pitch Association of Response Codes (SPARC, pitch processing) effect. In these compatibility effects small numbers or low pitches lead to faster responses with the left hand, whereas large numbers or high pitches lead to faster responses with the right hand. We investigated the combination of SNARC and SPARC in one and the same stimulus: numbers spoken in different pitch heights. In a previous behavioral study, results point to an automaticity of both effects. To investigate the nature of the super-additive interaction in the behavioral study, we measured the neural activity during magnitude judgment in an event-related fMRI study. Additionally to the numerical condition (number words) we included a categorical condition (“small” and “large”) as variation of stimulus type. Behavioral results confirmed the super-additive pattern for numerical stimuli. In contrast, categorical stimuli

showed a congruency effect for SNARC and SPARC Compatibility and generally slower responses. The fMRI results show, categorical stimuli led to higher activity in the medial temporal gyrus, which is responsible for semantic processing. Further, the bilateral auditory cortex shows a threefold interaction between Stimulus Type, SNARC and SPARC Compatibility, with different congruency patterns for numerical and categorical stimuli, but still in line with the behavioral data. We conclude that interdependency between SNARC and SPARC compatibility effects, and therefore automaticity, depends on the semantic content of the stimuli.

Poster B24

Perfektionismus und Fehlerverarbeitung: Fehlernegativität und Feedbacknegativität in einer Kraftproduktionsaufgabe

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Diese Studie untersuchte perfektionismus-spezifische Variationen der Fehlerverarbeitung mit zwei Komponenten des Ereigniskorrelierten Potentials. Die Fehlernegativität (Ne/ERN) entsteht im medial-frontalen Cortex ca. 100 ms nach einer fehlerhaften Reaktion. Sie ist ein elektro-physiologischer Indikator für frühe Fehlerentdeckung. In Aufgaben, in denen bei der Reaktion keine frühe Fehlerentdeckung stattfinden kann, gibt ein Feedback den ersten Hinweis auf fehlerhaftes Verhalten. Die neuronale Quelle der Feedbacknegativität ist ebenfalls medial-frontal; sie tritt 250-300 ms nach einem negativen Feedback auf. Die eingesetzte Kraftproduktionsaufgabe sollte zeigen, ob Probanden mit verschiedenen Ausprägungen von Perfektionismus (Concern over Mistakes; CM und Personal Standards; PS) unterschiedliche fehlerbezogene Aktivität nach gegebenem Feedback aufweisen. 67 Probanden wurden aufgefordert, in zwei Experimentanteilen mit jeweils sechs Blöcken eine vordefinierte Kraft zu produzieren. Nach jeder Kraftproduktion erhielten sie ein differenziertes Feedback über die Genauigkeit ihrer Leistungen. Die Ne/ERN zeigte sich sowohl nach fehlerhaften als auch nach richtigen Reaktionen. Das lässt darauf schließen, dass die Probanden nicht in der Lage waren, eine fehlerhafte von einer richtigen Reaktion zu unterscheiden. Die experimentellen Variationen hatten weder auf die Reak-

tions- noch auf die Feedbackverarbeitung einen signifikanten Einfluss.

Bei der Feedbacknegativität zeigte sich jedoch eine Interaktion zwischen der Ausprägung der Perfektionismus-Variablen PS und CM. Probanden mit niedrigen PS-Werten und hohen CM-Werten hatten die größte Feedbacknegativität, Probanden mit hohen PS-Werten und hohen CM-Werten hatten jedoch die geringste feedbackbezogene Aktivität. Diese Ergebnisse lassen vermuten, dass die Ausprägung der Perfektionismus-Variablen CM, d.h. die Sorgen vor schlechter Bewertung durch andere Personen, eine besonders wichtige Rolle bei der Verarbeitung eines Feedbacks spielt.

Poster B25

Down-regulation of the amygdala with real-time fMRI neurofeedback

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Recent research shows that self-regulation of emotion related amygdala activation can be achieved with real-time fMRI neurofeedback (rtfMRI-NF). Borderline personality disorder (BPD) is associated with emotion hyper-reactivity and dysregulation and involves amygdala hyper-reactivity in BPD patients. In a pilot-study, we applied 4 sessions of rt-fMRI NF training in N=10 BPD patients with the aim of amygdala down-regulation. BPD patients successfully down-regulated their right amygdala response to aversive pictures. Functional connectivity (assessed with psychophysiological interaction analysis) between right amygdala and ventromedial prefrontal cortex increased with repeated training sessions. In addition, emotional awareness improved as assessed by the difficulties in emotion regulation scale (DERS), and state-dissociation (assessed with the dissociation stress scale (DSS-4)) decreased with repeated training sessions. The study provides initial evidence for the potential of rt-fMRI NF to improve emotion dysregulation in BPD patients. Amygdala neurofeedback may in future become an add-on in psychotherapy, targeting the mechanism of emotion dysregulation in disorders like BPD.

Poster B26

NEURONALE KORRELATE BEI DER WAHRNEHMUNG und ANTIZIPATION SEXUELLER STIMULI - eine fMRT Studie -

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12% aller existierenden Internetseiten enthalten pornographisches Material, pro Tag werden 2,5 Billionen Mails mit pornographischen Inhalten versendet, 25% aller Anfragen im Internet betreffen Sex und Pornographie: „porn“, „sex“ oder „adult dating“ sind die beliebtesten Suchanfragen im Netz. Unklar ist jedoch, was der für manche Menschen tägliche Kontakt mit Pornographie für Auswirkungen auf das Verhalten und somit das Gehirn haben kann. Bei der Neuauflage des DSM entschied man sich gegen die Aufnahme der Sexsucht bzw. Hypersexualität als psychische Störung.

In einer Untersuchung wurden 29 Frauen und 32 Männern zwischen 19 und 44 Jahren (M= 25,7 Jahren) jeweils 15 erotische sowie neutrale Fotos und Filme in einer typischen picture perception task während einer funktionellen magnetischen Resonanztomographie (fMRT) Sitzung präsentiert. Die Stimuli wurden in einem Block-Design dargeboten, mit jeweils einem Stimulus aus jeder Kategorie. Vor dem jeweiligen Stimulus erfolgte eine Ankündigung (- >Antizipationsphase) über die Kategorie des Stimulus. Nach jedem Video bzw. Foto folgten zwei Ratingskalen, die sexuelles Arousal und sexuelles Craving abfragten.

Erste Auswertungen zeigen, dass früher Pornokonsum mit erhöhter striataler Aktivität während der Antizipation erotischer Stimuli einhergeht. Außerdem konnte ein Zusammenhang zwischen vermehrter Aktivität im anterioren Cingulum und orbitofrontalen Kortex bei der Präsentation erotischer Stimuli gefunden werden. Die Ergebnisse werden in Hinblick auf psychische Störungen diskutiert und bewertet.

Poster B27**Modulation of fMRI resting-state functional connectivity by experimental stress induction**

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Stress in a social context has always been a constant factor of everyday life in human society. A well-known experimental paradigm used to induce stress in the context of social exclusion is the cyberball task. Up to date it remains unclear how experimental stress induction and accompanying changes in affective processing, induced by the cyberball task, might affect the resting human brain, as assessed by resting-state functional magnetic resonance imaging (fMRI). In a large sample of healthy participants, we compared resting-state functional connectivity before and after participants completed the cyberball task, focusing on the default mode network (DMN), the executive control resting-state network (RSN), and the left- and right-lateralised frontoparietal RSN. As a methodological approach, a combination of independent component analysis (ICA) and dual regression was employed. The results of this exploratory study indicate that experimental stress induction modulates resting-state functional connectivity in the DMN and the executive control RSN. Resting-state functional connectivity (i.e., network coherence) decreased following the cyberball task in sub-cortical structures, including the thalamus and the putamen, in cortical structures, including frontal and temporal regions, and in the cerebellum. These results suggest that experimental stress induction and changes in affective processing exert a profound effect on the resting human brain, affecting cortical, sub-cortical, and cerebellar structures. We observed specific reductions of resting-state functional connectivity following experimental stress induction, providing indicative evidence suggesting that social stress might have a widespread influence on the integrity of normal functional coupling during rest.

Poster B28**Contextual Fear Conditioning: The Influence of Vagus Nerve Stimulation on Fear Extinction**

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Fear extinction is the experimental analog of exposure-based therapies. Exposure therapy and anxiolytic drugs are common treatment for anxiety disorders. Recently, animal studies showed the improvement of fear extinction using vagus nerve stimulation (VNS). Here, we investigated the effect of transcutaneous VNS (t-VNS) on fear extinction in humans in a three-day experiment. The study consisted of habituation, fear acquisition, extinction with simultaneous t-VNS, reinstatement and test. Twenty-nine healthy participants were guided through two virtual offices, painful electric shocks served as unconditioned stimuli (US). In the acquisition (Day 1), participants perceived USs in one office (anxiety context, CTX+) but never in the other (safety context, CTX-). During extinction (Day 2), one group of participants received t-VNS, one sham stimulation and another no stimulation. No US was administered when they were again guided through the contexts. On Day 3 before the test started, participants perceived three US to investigate reinstatement. After acquisition, CTX+ was rated with higher arousal and anxiety and less valence than CTX-. The anxiety in CTX+ decreased during extinction. Importantly, we observed fear potentiated startle in CTX+ compared to CTX- on Day 1 and 2. On Day 3, participants did not distinguish CTX+ from CTX-. No group differences were revealed on both Day 2 and Day 3. Our data indicate successful contextual fear conditioning and extinction on a subjective and physiological level and reinstatement by tendency. The combination of fear extinction with t-VNS was expected to increase neuronal plasticity and reinforce learning. However, the small effect requires more participants.

Poster B29

Motivational objects in natural scenes (MONS): A database of >700 objects

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All our surroundings could be assigned motivational value, reflecting how desirable or pleasurable it would be to interact with or encounter something. Objects, for example, may be associated with positive or negative events, and due to these differences in (learned) contingencies reflect varying levels of motivational value. Such values affect how we perceive and interact with the world. Motivation is therefore a relevant topic in a wide range of research fields. Nonetheless, a well-controlled database of motivationally rated objects has been lacking. In the current study, over 700 every-day objects were rated on 7-point Likert scales on motivation, valence, arousal and novelty. Since the main aim of the study was to measure motivational value, the objects were rated on three scales related to motivation: (1) Desirability (“How much would you like to own this object?”); (2) Approach/Avoid (“Do you want to approach or avoid the object?”); (3) Interaction (“How much would you like to interact with the object?”). The objects were taken from newly created visually controlled scenes, containing a maximum of 2-8 decentralized objects with minimal overlap. To attain a high level of visual similarity whilst varying motivational salience, each scene was photographed at least three times while one object was replaced to vary subjective motivational value (appetitive, aversive, and neutral). High interrater reliability and median ratings covering the entire scales were obtained for a large number of Motivational Objects that were taken from well-controlled Natural Scenes (MONS), providing a standardized basis for future studies.

Poster B30

Attentional Bias & Performance Monitoring

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Neural correlates of performance monitoring, such as error-related negativity (ERN) and correct-related negativity (CRN) of the event-related brain potential (ERP), have been extensively studied in psychophysiological re-

search. Several modulating factors to these indices of performance monitoring have been identified and increased ERN amplitudes have been linked to high state and trait negative affect, threat sensitivity, and to internalizing clinical disorders as obsessive-compulsive disorder (OCD), generalized anxiety, and depression. But so far, little is known about experimental modulations that can be used to attenuate overactive performance monitoring in clinical context. One promising approach are trainings of attentional bias modification (ABMT). These trainings have already been shown to reduce attentional bias towards threatening or negative stimuli as well as clinical symptoms in anxiety disorders and OCD. Thus, the present study investigated whether an ABMT can as well serve to decrease ERP indices of performance monitoring.

ERN and CRN were measured during performance of a flanker task before and after single-session ABMT. The training was operationalized with a modified dot-probe paradigm with vertical pairs of negative and neutral words presented before probe stimuli. In order to shift attention away from negative words, location of probes was 100% concordant with the location of the preceding neutral word.

First results indicate that ERN amplitudes are reduced in healthy participants after single-session ABMT. Relation of the intervention to trait and state measures of anxiety and implications for clinical application will be discussed.

Poster B31

Oxytozinerge Genpolymorphismen und neuronale Grundlagen der Verarbeitung emotionaler Gesichter: eine EKP-Studie

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In Reaktion auf Gesichter zeigt sich im ereigniskorrelierten Potential (EKP) eine negative Amplitude, welche ungefähr 150-170ms nach Stimulus-Onset ihr Maximum erreicht (N170). Diese Komponente wurde häufig bei Personen mit Autismus-Spektrum-Störungen (ASS) mittels eines Gesichts-Inversions-Paradigmas untersucht. Bei Gesunden zeigt sich bei Inversion des Gesichtes eine stärkere negative Amplitude und verlängerte Latenz sowie eine stärkere rechtshemisphärische Lateralisierung – Effekte, die bei Personen mit ASS nicht vorhanden sind.

Ferner werden Autismus-Spektrum-Störungen häufig mit Dysfunktionen im oxytozineren System in Verbindung gebracht, da das Neuropeptid Oxytozin bei der Verarbeitung sozial relevanter emotionaler Reize eine zentrale Rolle spielt. Oxytozinerne Genpolymorphismen sollten hierbei zur Aufklärung interindividueller Unterschiede in der Verarbeitung emotionaler Stimuli beitragen.

Gegenstand vorliegender Studie war es, den Gesichtsinversions-Effekt bei gesunden Probanden in Zusammenhang mit molekulargenetischen Markern des Oxytozinsystems zu untersuchen. Es wurde erwartet, dass sogenannte Risikoallelträger des Oxytozinrezeptor-Genpolymorphismus (rs53576) sowie des CD38 (rs379863) ähnliche Reaktionen auf aufrechte und invertierte Gesichter zeigen, wie Personen mit ASS. Gleichzeitig wurde der emotionale Gesichtsausdruck der Stimuli als Variable in die Untersuchung mit aufgenommen, um interindividuelle Unterschiede in der Reaktion auf verschiedene Emotionskategorien feststellen zu können.

N=67 gesunde männliche Probanden absolvierten ein Gesichtsinversions-Paradigma bei gleichzeitiger Aufzeichnung des Elektroenzephalogramms.

In Abhängigkeit der oxytozineren Genpolymorphismen wurden Unterschiede in Reaktion auf invertierte Gesichter festgestellt. Ferner zeigen sich Unterschiede in der Lateralisierung bei emotionalen wie neutralen Gesichtsausdrücken in Abhängigkeit genannter Genpolymorphismen.

Die Ergebnisse werden vor dem Hintergrund Oxytozin-assoziiertes interindividueller Unterschiede in der Reagibilität auf Gesichter diskutiert, die bereits bei sehr frühen physiologischen Prozessen auftreten und damit das menschliche Erleben mit beeinflussen.

Poster B32

User-centered evaluation of an ERP-based brain-computer interface for creative expression during independent home use by two artists diagnosed with amyotrophic lateral sclerosis

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Brain-computer interfaces (BCIs) allow a person to control a computer application by brain activity, e.g., event-related potentials (ERPs), without the need of voluntary muscle control. Hence, BCIs may provide a means of com-

munication for paralyzed people. In the present study, a P300-ERP BCI application for creative expression, Brain Painting, was implemented at the homes of two artists in the locked-in state diagnosed with amyotrophic lateral sclerosis (ALS). Usability of the BCI in expert-independent daily-life use was evaluated by the BCI end-users. Within 30 months end-user HP painted in 310 BCI sessions (in total: 470 hours), end-user JT in 104 sessions within 10 months (in total: 118 hours; both painted 1-3 times per week). BCI use was challenged by many daily and unpredictable factors, such as the adjustment of the EEG cap (e.g., not accurate cap placement; amount of gel), hardware related issues (e.g., cap bulges and position of cap alters within one session), person and disease related (e.g., attention, tiredness) and environmental specifics (e.g., interruption for medical treatments and distraction). With an accuracy of 70-90%, BCI control was mostly moderate and most impressively BCI performance remained stable over 2,5 years. Both end-users were highly satisfied with the BCI as assistive device. As it matches the artists' need for creative expression Brain Painting improved their feelings of happiness, usefulness, self-esteem, well-being, and consequently quality of life. This long-term evaluation study suggests that BCI is a valuable tool for paralyzed people diagnosed with neurodegenerative diseases.

Poster B33

Predictability and context determine differences in conflict monitoring between adolescence and adulthood

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The ability to link contextual information to actions is an important aspect of conflict monitoring and response selection. These mechanisms have been shown to depend on medial prefrontal networks. Although these areas are known to undergo a protracted development from adolescence to adulthood, it has remained elusive how the influence of contextual information on conflict monitoring is affected by developmental progress between adolescence and adulthood. We investigated these aspects using event-related potentials (ERPs) and source localization techniques.

We show that the ability to link contextual information to actions is altered in the developmental process between

adolescence and adulthood and that the predictability of upcoming events is an important factor to consider in this context. The results suggest that in high-conflict contexts, the degree of conflict monitoring is higher in adults than in adolescents. In adolescents, conflict monitoring functions are not as much modulated by predictability factors as in adults. It seems that adults exhibit a stronger anticipation of upcoming events than adolescents do. This results in disadvantages for adults when the upcoming context is not predictable. In adolescents, problems to predict upcoming events can therefore turn out to be beneficial. Two cognitive-neurophysiological factors are important for this: The first factor is related to altered conflict monitoring functions associated with modulations of neural activity in the medial frontal cortex. The second factor is related to altered perceptual processing of target stimuli associated with modulations of neural activity in parieto-occipital areas.

Poster B34

Dopamine D1 and D2 receptors mediate dissociable cognitive-neurophysiological sub-processes during response inhibition

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Inhibition is an important aspect of action control and plays a key role in everyday life. The dopaminergic system is known to play an important role and many lines of psychophysiological research substantiate the existence of distinct response inhibition sub-processes. However, it has remained elusive whether inhibitory sub-processes can be attributed to distinct neurobiological factors governing the dopaminergic system.

We used a standard Go/Nogo task to investigate this question by examining effects of DRD1 (rs4532) and DRD2 (rs6277) receptor polymorphisms on electrophysiological correlates of response inhibition sub-processes (i.e., Nogo-N2 and Nogo-P3) in n=195 healthy human subjects. The results suggest that both intensified pre-motor inhibition and intensified outcome evaluation processes may contribute to superior response inhibition performance. Importantly, we were able to show that the dopamine D1 and D2 receptor systems differentially guide these processes during response inhibition: While the D1 receptor

system mainly influences pre-motor inhibition processes as reflected by the N2, the D2 receptor system is more important for outcome evaluation processes, as reflected by the P3. Therefore, dissociable cognitive-neurophysiological sub-processes of response inhibition can be stated to be (at least partly) attributable to distinct dopamine receptor systems.

Poster B35

Electrophysiology of consumer decision-making

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Decision making in economic context is an everyday activity but its neuronal correlates are poorly understood. The present study aimed at investigating the electrophysiological brain activity (ERP) during purchase decisions of technical products for a lower or higher price relative to a mean price estimated in a pilot study. Expectedly, participants mostly decided to buy a product when it was cheap and not to buy when it was expensive. But in some trials they made non-conform decisions to buy a product for more money than the average prize or not to buy a product despite an attractive prize. These responses took more time and the variability of the response latency was enhanced relative to conform responses. ERPs showed enhanced conflict related fronto-central N2 during both types of non-conform compared to conform decisions. A reverse pattern was found for the P3a and P3b. The response-locked P3 (r-P3) was larger and the subsequent CNV smaller for non-conform than conform decisions. We assume that non-conform decisions elevate the response threshold (larger N2), intensify response evaluation (r-P3) and attenuate the preparation for the next trial (CNV). These effects were discussed in the framework of the functional role of the frontal cortex in economic decision making.

Poster B36**The P3 and Its Functional Anatomy: A Local Context Oddball Paradigm**

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Whenever rare oddball stimuli are embedded in a series of standard stimuli, the brain responds with a prominent P3. The P3 has been associated with numerous cognitive functions and its functional interpretations span processes ranging from (post-)perceptual evaluation to response-related ones.

Despite their diversity, oddball paradigms commonly share a few important features that lead to the engagement of an attentional template for target detection, and need not afford detailed processing of standard stimuli. Furthermore, over the series of stimulus presentations, the brain response should become increasingly tuned to target events.

In two experiments (EEG and fMRI), we introduced a 'local-context' oddball paradigm that should prohibit the engagement of an attentional template. We used images of everyday objects from three categories (Bathroom, Kitchen, Food). Per trial, six images were presented. Five were from the same category, they set the local context against which the category oddball stands out as the task-relevant misfit.

This local-context oddball elicited a parietal P3 500-600ms post-stimulus onset. Thus, a classical P3b, can be evoked even within a local stimulus context without a predefined target stimulus. The most prominent BOLD-response, related to differential processing of the oddball, was found in the medial precuneus. As a part of the attention network and the default-mode network the precuneus is involved in the attention orienting response and should also be sensitive to changes within the default-mode network elicited by the appearance of an oddball. Thus, it is the most conclusive candidate related to P3b's functional anatomy.

Poster B37**The association between the COMT Val158Met-polymorphism, extinction learning and extinction recall**

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Deficits in fear extinction play a pivotal role in the etiology of anxiety disorder. Previous studies showed that the dopaminergic COMT Val158Met-polymorphism is associated to altered extinction learning. However, the underlying neural mechanisms on long-term extinction deficits have not been investigated to date. The current study explored the relationship between the COMT Val158Met-polymorphism and fear conditioning, extinction learning, a 24-hours recall, and a 6-months extinction recall.

A fear conditioning paradigm was conducted on the first day in which the CS+ was associated with electrical stimulation, while another neutral stimulus (CS-) was presented unpaired. On the second day, an extinction learning procedure was applied. On the third day (+24h) and six months later, extinction recall was conducted to investigate the recovery of fear in order to explore the long-term stability of extinction memory.

A significant association was found between the COMT Val158Met-polymorphism, extinction learning and 6-month extinction recall. Deficits in extinction learning were observed in Met/Met individuals in comparison to the Val/Val group, as reflected in elevated skin conductance responses. In contrast, increased amygdala responses were found during extinction learning in the Val/Val group, highlighting the role of the amygdala for changing fear.

Regarding the long-term impact on extinction memory, the Met/Met group showed increased fear responses even after six months. Finally, decreased amygdala responses during extinction learning were correlated with deficits in 6-months extinction recall, indicating that low amygdala activity during extinction reflects a possible neurobiological marker for long-term extinction deficits.

Poster B38**Age differences on motor imagery signatures**

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The mental practice of movements supported by EEG based feedback has been suggested a promising add-on therapy to facilitate motor recovery. The main target group for such an intervention are elderly patients, though research so far is largely focused on young populations (< 30 years). The present study therefore aimed to examine the influence of age on event-related desynchronization (ERD) induced by overt and covert movements (CM). CM were based on kinesthetic motor imagery (MI) or quasi-movements (QM), whereby QM were expected to result in more lateralized ERD patterns and higher classification accuracies.

Independent of CM strategy the elderly (mean age: 62.7 years) were characterized by a significantly reduced lateralization of ERD, due to stronger ipsilateral ERD, and reduced classification accuracies, when compared to young adults (mean age: 23.6 years). QM were generally perceived as more vivid, but no differences were evident between MI and QM in ERD or classification accuracies. EEG feedback enhanced task-related activity independently of strategy and age. ERD measures of overt and covert movements were strongly related in young adults, whereas in the elderly ERD laterality dissociated.

In summary, we did not find evidence in support of more pronounced ERD lateralization patterns in QM. Our finding of a less lateralized activation pattern in the elderly is in accordance to previous research and with the idea that compensatory processes help to overcome neurodegenerative changes related to normal aging. Importantly, it indicates that EEG neurofeedback studies should place more emphasis on the age of the potential end-users.

Poster B39**Neural correlates of building a spatial representation in a complex virtual environment**

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Many studies examine the neural correlates of spatial memory for a known environment, yet only few accompany the process of building a spatial representation of new surroundings. Using fMRI, we investigated the course of spatial learning over two one-hour sessions on two consecutive days, while participants searched for objects in two virtual environments. The spatial layout of one environment was held constant over all trials, allowing for memory formation, whereas the other changed its layout constantly outside the current field of view to prevent spatial learning of any kind. Comparing BOLD signal in both conditions, we find a well-established network of regions involved in spatial processing, including occipital, parietal and frontal regions, with the exception of the hippocampus. Spatial learning is most prominently accompanied by increasing activity in parietal areas, mainly the precuneus and the retrosplenial complex. This effect can be observed over time spent navigating the environment, as well as over the number of previous encounters with a location. The hippocampus, on the other hand, exhibits increased activity in the memorizable environment only during the very first encounters with a location, which supports its role in novelty detection. Moreover, connectivity between the precuneus and hippocampus decreases in response to an increasing number of previous encounters with a location. Together our results point towards memory-related spatial processing further upstream than has previously been assumed, with parietal associative regions supporting an independent spatial memory representation already early in the learning process.

Poster B40

Effects of response modes on inhibitory control processes – EEG-beamforming study

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Response inhibition processes are one of the most important executive control functions and subject to intense research in cognitive neuroscience. However, knowledge on the neurophysiology and functional neuroanatomy on response inhibition is biased because studies usually apply experimental paradigms in which behaviour is susceptible to impulsive errors. Here we investigate if there are differences in neurophysiological mechanisms and networks depending on the response mode that predominates behavior in a response inhibition task. We use EEG-beamforming in two tasks inducing opposite response modes during action selection. We show that differences in response modes during response inhibition are reflected in modulations of theta band activity (TBA), mostly in the left temporo-parietal junction. A response mode that is susceptible to impulsive errors is associated with stronger TBA activity. The results suggest that response modes during response inhibition differ in the encoding of surprise signals as well as related processes of attentional sampling to update internal task representations and to maximize the chances of detecting changes in the environment relevant to behavioural control.

Poster B41

Event-related potential measures in moving subjects. Results from three pilot studies in ergometer rowing

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Measuring brain activity outside the laboratory is of great importance for investigating human behaviour under naturalistic conditions (e.g., in cognition research, ambulatory assessment, and movement research/sports sciences) and for the application of brain-computer interfaces to assist disabled persons in daily life. To measure neuronal activity in moving subjects, only modified NIRS and EEG systems are applicable. Conventional EEG systems are too

big and sensitive to movement artefacts. As the method of choice, artefact sources must be eliminated beforehand to improve signal quality. Three different approaches for EEG/ERP measures with moving subjects were tested: (i) a purpose-built occipitally mounted preamplifier, (ii) a commercial system with active electrodes, and (iii) a headset with wireless data transmission. A standard visual oddball task was applied during rest (without movement) and during ergometer rowing. In the rowing condition, remaining movement artefacts in the data cancelled each other out in the oddball task. All ten single case measures revealed very similar standard ERPs (visual evoked potentials, P300) for rowing and rest (within subjects). The small intraindividual differences between rowing and rest, in comparison to the typically larger interindividual differences in the ERP waveforms revealed that ERPs can be measured reliably even in an athletic movement like rowing. The expected modulation of the motor-related activity by force output, on the other hand, was largely affected by movement artefacts. Therefore, for a successful application of ERP measures in movement research, further developments on artefact handling are required.

Poster B42

Cognitive Control of Emotion and Action: Similar But Not the Same -- Evidence from Neuroimaging Meta-Analyses

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Controlling both our actions and emotions at will is crucial for successful goal-directed behavior. It has been suggested that both regulatory mechanisms are implemented by a shared domain-general brain network. We examined this assumption by conducting two coordinate-based activation likelihood estimation (ALE) meta-analyses of pertinent neuroimaging studies, and then testing for commonalities and differences. Our sample comprised 70 experiments on cognitive emotion regulation (down- or up-regulation by means of reappraisal, suppression etc.) and 203 experiments on cognitive action control (conflict paradigms like Stroop, flanker, or Simon tasks; inhibition paradigms like stop-signal or go/no-go tasks; task-switching and card-sorting paradigms). We observed convergence

across emotion regulation experiments in an extensive bilateral fronto-parietal network and left middle temporal gyrus, while cognitive action control consistently activated a seemingly similar fronto-parietal network. Significant overlap between both activation patterns was, however, restricted to four clusters: bilateral anterior insula/frontal operculum, frontomedial cortex, and right temporo-parietal junction (TPJ). Clusters showing significantly stronger convergence for emotion regulation included inferior frontal gyrus, rostradorsal premotor cortex (PMC), and posterior TPJ. Conversely, cognitive action control showed stronger convergence in bilateral ventrolateral prefrontal cortex, intraparietal sulcus, mediodorsal PMC, and right thalamus. In conclusion, overlap between the two regulatory mechanisms was limited to regions linked to implementing and updating mind sets, suggesting the shared cognitive mechanism may be the intentional activation of a non-dominant but desirable (task-relevant) schema to guide the response. The observed differences may reflect how these task schemata are put into effect for modulating affective versus behavioral responses.

Poster B43

Comparison of a brain-computer interface with eye-gaze based communication: A case study with a participant in the locked-in state

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The participant of this study was in the locked-in state (LIS) due to amyotrophic lateral sclerosis. His slow residual eye movements allowed him to communicate with the help of his caregivers and family using a letter board. He had no means of partner independent communication. On four consecutive days, we tested whether electrooculography, eye tracking or an auditory brain-computer interface (BCI) would be possible access methods to augmentative and alternative communication (AAC) for him. He gained control over all three systems, but would not consider them as additional communication channels due to the level of proficiency achieved by him and his caregivers with his low-tech method. The caregivers could detect more subtle eye movements and react more flexibly to fatigue of eye muscles. The participant rated the ease of use of the BCI as the highest among the tested systems, but also as the most tiring. In case control over eye muscles

was lost, he would consider using the BCI as a communication channel. The development of eye-gaze independent BCIs that are easy-to-use is important as they could allow communication for persons in the complete locked-in state or serve as an alternative input channel to AAC for persons with severe paralysis. Eye-gaze independent BCIs previously proposed by our group include BCIs based on auditory and tactile stimulation. To ease the transition from standard AAC devices to brain-computer interfaces for persons with progressive neuromuscular diseases, a hybrid approach that combines conventional and BCI based AAC should be considered.

Poster B44

Drifting apart: medial and lateral displacements of artificial embodied limbs differentially affect ownership and hand localization

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During the Rubber Hand Illusion (RHI), ownership of an artificial limb can be induced. The effect is evident in verbal judgments of ownership as well as in biases in the perceived position of one's real hand.

We assumed that a naturally occurring drift towards the body-midline facilitates RHI induction and confounds spatial measures of the RHI. We therefore tested if the RHI is weaker if the artificial hand is placed lateral to the real hand.

An artificial hand was presented on a board mounted above the real hand. We induced the RHI by congruently stroking the real and the artificial hand at five positions: directly above the hand as well as 7.5cm and 15cm laterally and medially to it. We assessed real hand localization both using a visual measure (on a ruler) and pointing movements.

Ownership was highest at the position above the real hand and decreased symmetrically with more lateral and medial positions. Localization biases were stronger towards the body-midline than away from it for both methods. The effect of artificial hand location was stronger on pointing movements. However, visual judgments showed a stronger relationship with ownership.

Our results show that (1) ownership can be induced equally well at positions medial and lateral to the real

hand, (2) localization biases are stronger at medial positions, and (3) visual and motor localization seem to capture different aspects. Explicit visual judgments are closer related to verbal report of ownership. Pointing judgments are more strongly affected by visual-proprioceptive conflict.

Poster B45

Zusammenspiel zwischen langsamen Oszillationen und Spindeln im Schlaf in einer grossen Stichprobe

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Schlaf fördert das Gedächtnis. Aktuelle theoretische Ansätze gehen davon aus, dass die förderliche Wirkung des Schlafs auf die Gedächtniskonsolidierung auf einem synchronen Zusammenspiel zwischen neokortikalen langsamen Oszillationen und thalamokortikalen Schlafspindeln beruht. So zeigt z.B. Mölle et al. (2011) in 11 Personen, dass die Aktivität im Frequenzbereich von Schlafspindeln (12-15 Hz) während des negativen Peaks der langsamen Oszillationen unterdrückt wird und nach diesem Peak eine erhöhte Aktivität besteht. Für den Frequenzbereich 9-12 Hz traf dies nicht zu. Die vorliegende Studie hatte das Ziel den zeitlichen Zusammenhang zwischen langsamen Oszillationen und Schlafspindeln in einer grossen Stichprobe zu replizieren und die Ergebnisse der oben genannten Frequenzbänder mit den üblichen Spindelbändern zu vergleichen (langsame Spindeln: 11-13 Hz; schnelle Spindeln: 13-15 Hz). In 862 jungen Versuchspersonen wurde der Schlaf zu Hause mittels eines mobilen Geräts aufgezeichnet. In Übereinstimmung mit den bisherigen Forschungsbefunden zeigte sich eine niedrigere Aktivität während dem Tiefpunkt und eine erhöhte Aktivität während dem Anstieg der langsamen Oszillationen sowohl für langsame als auch schnelle Spindeln in den Frequenzbereichen von 11-13 Hz und 13-15 Hz. Allein für den Frequenzbereich 9-11 Hz trat eine Asynchronizität zum Verlauf der langsamen Oszillationen auf. Die Ergebnisse von Mölle et al. (2011) konnten grundsätzlich repliziert werden. Das asynchrone Muster scheint allerdings nicht spezifisch mit langsamen Spindeln (11-13 Hz), sondern mit Oszillationen ausserhalb des Spindelbereichs (9-11 Hz) assoziiert zu sein. In zusätzlichen Analysen wurde

das Zusammenspiel von Schlafspindeln und langsamen Oszillationen in Relation zum Alter und Geschlecht der Versuchspersonen untersucht.

Poster B46

Gastrisch-evozierte Potenziale: ein neurophysiologischer Indikator für die kortikale Repräsentation afferenter Signale aus dem gastrointestinalen System.

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Dysregulation von Interozeption spielt eine wichtige Rolle für psychische Störungen, die mit körperlichen Symptomen assoziiert sind, wie z.B. Essstörungen, Panikstörung oder somatoforme Störungen. Als Alternative zu konventionellen Verfahren, die Selbstberichte benötigen, um Interozeptionsgenauigkeit zu erfassen (z.B. Herzschlagdetektionstests), existieren eine Reihe psychophysiologischer Indikatoren für Interozeption. Zu den EEG-basierten Verfahren zählen die Herzschlag-evozierten Potenziale (HEPs), sowie die respiratorisch-evozierten Potenziale (RREPs). HEPs und RREPs gelten als psychophysiologische Indikatoren für die kortikale Repräsentation und Verarbeitung von viszeral-afferenten Signalen vom kardiovaskulären, bzw. respiratorischen System. Die vorliegende Studie hatte zum Ziel, zu überprüfen, ob ein elektrokortikales Potenzial existiert, welches die zentralnervöse Repräsentation afferenter Signale aus dem gastrointestinalen System reflektiert. Dazu wurden bei 27 Frauen elektrokortikale Potenziale gemessen, die auf gastrische Kontraktionen (via EGG) zurückgehen. Es zeigte sich 0-500 ms nach einer Kontraktion auf Cz eine größere Negativität nachdem Wasser getrunken wurde, im Vergleich zu einer Bedingung, in der kein Wasser getrunken wurde ($p = .032$). Außerdem korrelierte die getrunkene Wassermenge zu $r = .43$ mit der Negativität auf Cz in diesem Abschnitt ($p = .038$). Dies weist darauf hin, dass gastrisch-evozierte Potenziale Indikatoren für die kortikale Repräsentation afferenter gastrischer Signale sein könnten, welche eine wichtige Grundlage gastrischer Interozeption darstellen.

Poster B47**Längsschnittliche Entwicklung neurostruktureller Korrelate des Lesens über die Grundschulzeit**

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Dem Lesen zugrunde liegende neuronale Systeme sind in einer Vielzahl funktioneller Bildgebungsstudien untersucht worden. Weit weniger Studien widmen sich der Erforschung neurostruktureller Korrelate der Lesefertigkeit, d.h. Unterschieden zwischen besseren und schlechteren Lesern in Bezug auf Eigenschaften der weißen und grauen Substanz des Gehirns. Von besonderem Interesse in diesem Zusammenhang ist die Frage, ob solche Korrelate schon vor dem Leseerwerb bestehen oder sich erst im Laufe des Lernprozesses herausbilden. Um zur Klärung dieser Frage beizutragen, wurden 47 Kinder längsschnittlich über die Grundschulzeit (1.-4. Schulklasse) begleitet. In jährlichen Messungen wurden ihre Lese- und Rechtschreibfertigkeiten mittels standardisierter Tests untersucht. Des Weiteren nahmen die Kinder an bis zu vier Untersuchungen mittels struktureller Magnetresonanztomographie teil (T1-gewichtete und diffusionsgewichtete Bildgebung). Morphometrische Eigenschaften der grauen Substanz (kortikale Dicke und kortikale Fläche; automatische Segmentierung mittels FreeSurfer) sowie der weißen Substanz (Kohärenz fürs Lesen relevanter Nervenfaserbündel; probabilistische Traktographie unter Nutzung anatomischer Vorinformationen mittels TRACULA) bestimmt und mit den kognitiven Fertigkeiten in Beziehung gesetzt. Die Ergebnisse zeigen einen negativen Zusammenhang zwischen der Entwicklung der kortikalen Dicke und der über die Messzeitpunkte gemittelten Lese- bzw. Rechtschreibleistung in Teilen des Gyrus frontalis inferior und der Übergangsregion zwischen Temporal- und Parietallappen. Die Reduktion der Dicke der grauen Substanz wird begleitet von einer positiv mit der Lese- und Rechtschreibleistung assoziierten Zunahme der Kohärenz des temporalen Anteils des Fasciculus longitudinalis superior. Der Erwerb des Lesens geht also mit erfahrungsbhängigen strukturellen Änderungen fürs Lesen relevanter neuronaler Systeme einher, denen ein komplexes Zusam-

menspiel von Abbau irrelevanter und Stärkung relevanter kortikaler Verbindungen zugrunde zu liegen scheint.

Poster B48**Intention to encode boosts memory-related pre-stimulus EEG beta power**

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The state of the brain preceding an incoming stimulus influences whether or not that stimulus will be remembered later. Increased power in theta (5-8 Hz) and low beta (13-17 Hz) bands was found before the onset of later remembered compared to forgotten items. Such pre-stimulus subsequent memory effects (SMEs) were associated with the active preparation for upcoming stimuli. However, it remains unclear whether these effects are based on general processes such as attention or arousal, or whether memory-specific processes are initiated.

Here, we investigated whether the awareness of a subsequent recognition task affects preparatory pre-stimulus activations during encoding. Two groups of 18 participants performed a subsequent memory task during which the EEG was recorded. Subjects were presented with pictures, preceded by a cue, enabling memory-unspecific preparation in both groups. While one group was aware of the upcoming recognition task and the necessity to encode the stimuli (intentional encoding), the other group was not informed about that (incidental encoding). Afterwards, recognition of the pictures was tested and oscillatory pre-stimulus activation during encoding was computed for pictures that were subsequently remembered and forgotten.

Our data demonstrated significant pre-stimulus SMEs in frontocentral theta and low beta bands in the intentional encoding group, with greater power before remembered than forgotten stimuli. In contrast, only weak SMEs were detected for incidental encoding. The beta SME was significantly greater during intentional than incidental encoding. We therefore conclude that beta band activation before stimulus onset is an indicator of memory-specific preparation for an upcoming stimulus.

Poster B49**Analysis of simultaneous EEG/fMRI reveals neurophysiological phenotypes of impulse control**

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Introduction: Response inhibition is the ability to suppress inadequate but prepotent or ongoing response tendencies. A network of inferior frontal cortex (IFC), pre-supplementary motor area and basal ganglia is involved in these processes. Recent findings suggest that inter-individual differences in the variability of intra-individual neural and behavioral responses may be key in the understanding of processes underlying impulse control disorders.

Methods: To explore inter-individual differences in response inhibition we conducted a combined EEG/fMRI study in 38 healthy subjects during a visual Go/Nogo task.

Results: 22 subjects (Nogo-IC-positive) showed reliably Nogo-related EEG components according to our chosen criteria in both latency intervals (before and around RT) while 16 subjects (Nogo-IC-negative) did not. Both groups were matched with respect to age and IQ and did not show significant differences in inhibitory control. However, group comparisons revealed significant differences on subscales of sensation seeking scales (SSS-V), significantly shorter response times in Nogo-IC-positive subjects; a trend towards hyperactivation of right IFC as well as significantly enhanced P3 amplitudes in Nogo-IC-positive subjects.

Conclusions: Using a data-driven approach of IC selection and the resulting the presence or absence of Nogo-specific ERP components as criterion for group selection revealed group differences at behavioral and neurophysiological levels. This may indicate electrophysiological phenotypes characterized by inter-individual variations of neural and behavioral correlates of impulse control.

Poster B50**Cortical activation during phasic fear and sustained anxiety – Evidence from steady-state VEPs**

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Predictable aversive events evoke a phasic fear response, while the unpredictability of an aversive event can lead to

a sustained anxiety response due to the chronic expectation of threat. The present study aimed at differentiating the electrocortical responses elicited by predictable and unpredictable threat, using steady-state VEPs (ssVEPs) with frequency tagging, in a paradigm with three different rooms and three associated persons to manipulate predictability. In one room, an aversive noise burst was cued by the appearance of a person, in the second room the aversive noise was presented unpredictably, independently of the person's appearance, while in a neutral control condition no aversive sound was presented. SsVEPs and explicit ratings in response to context and cue stimuli in all three conditions were recorded. A fear response with enhanced ssVEP-amplitudes in response to the predictable cue compared to the neutral cue and an anxiety response indicated by enhanced ssVEP-amplitudes in response to the context in the unpredictable condition compared to the neutral condition were observed. Interestingly, the context of the predictable condition elicited augmented ssVEP-amplitudes as well. On the explicit level, increased arousal and anxiety ratings and decreased valence ratings for both context and cue in the predictable and unpredictable condition were found. Results suggest that both predictable and unpredictable threat similarly receive increased attentional resources, even when no immediate threat was indicated as for the context in the predictable condition, while imminent threat in the predictable condition elicits a distinct defensive reaction.

Poster B51**Kovarianzen des BOLD-Signals mit Phantom-schmerzintensität**

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Nahezu jeder zweite Armamputierte leidet unter Phantomschmerzen (PS). PS sind sehr schwer zu behandeln. Ein besseres Verständnis neurobiologischer Korrelate von PS könnte zu effektiveren Therapien beitragen. Ein Mechanismus, der zur Entstehung und Aufrechterhaltung von PS beitragen könnte, wäre die Störung sensomotorischer Schleifen (sensorimotor feedback loops). Während die Hand nach einer Amputation physisch peripher nicht mehr existent und visuell nicht mehr validierbar vorhanden ist, existieren vermutlich noch multiple Repräsentati-

onen der Hand im Nervensystem. Wenn die Empfindung einer Phantomhand aversiv und schmerzhaft wird, verändert sich vermutlich die Hirnaktivität in Hirnarealen, die der Wahrnehmung (präfrontal, PCC), der Salienzverarbeitung (MCC, Insula) und dem Stresserleben (sgACC, dACC) zugeordnet werden.

Mittels funktioneller Kernspintomografie (fMRT) wurden in dieser Studie Kovarianzen zwischen BOLD-Antworten von Armamputierten während einer Bewegungsaufgabe (betroffener Arm, intakter Arm, Lippen) und der Intensität von PS lokalisiert. Dazu wurden zwölf Armamputierte vor und nach dem Training mit einer funktionellen Handprothese mit somatosensorischem Feedback untersucht. Kovarianzen zwischen Differenzen der BOLD-Antworten (post vs. prä) und PS zeigten sich in den vermuteten Hirnregionen insbesondere während der Bewegung des betroffenen Armes. Lippenbewegungen waren in dieser Studie nicht mit PS assoziiert.

Die Ergebnisse lassen sich mit der Theorie gestörter sensorischer Schleifen bei PS in Einklang bringen.

Poster B52

Crossmodal inhibition and enhancement in trimodal multisensory integration

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Any instant of conscious perception is shaped by the differential contributions of all of our sensory organs. Complementary information in distinct sensory streams can be exploited by crossmodal integration. The principles that govern these integrative processes are not yet completely understood. The traditional bimodal nature of multisensory research hampers the exploration of the complex interactions of stimulus-driven and attention-related influences on multisensory integration. For this study, a novel trimodal amplitude-matching paradigm including vision, audition and somatosensation was developed in order to investigate multisensory mechanisms in the presence of perceptual competition. We report overall differences in bimodal integration efficiency, congruence enhancement for all bimodal targets and, most crucially, an inverse relation between overall integration efficiency and the magnitude of congruence enhancement. Furthermore, congruence enhancement between unattended/attended pairs

determined the impact of distraction. Our results suggest the existence of multiple distinct mechanisms of inhibition and enhancement in multisensory integration.

Poster B53

Victims of violence and their experience of stress in a performance context

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Introduction

Both mental and social stress may threaten our abilities to cope with demanding situations. In victims of violence the stress reaction might be altered in consequence of their traumatic experiences. The current study investigates behavioral and neural reactivity to social exclusion and performance related stress in victims of violence.

Methods

In the present fMRI study 30 victims of physical, sexual, psychological and economic violence and 30 non-victims were scanned while playing a modified version of Cyberball. Furthermore, the habitual use of the emotion regulation strategies and psychosomatic complaints were assessed with the emotion regulation questionnaire and the brief symptom inventory and related to functional data

Results

Behavioral data showed a successful induction of stress in victims and non-victims. In victims of violence there was a trend for an enhanced subjective stress effect compared to controls. Imaging data showed significant effects for stress due to exclusion in the performance game in occipital regions, insula and frontal regions. Activity in the right inferior frontal gyrus (IFG) in performance exclusion was associated with suppression of emotion. Insular activity in exclusion periods was associated with psychosomatic symptoms, which were also significantly increased in victims of violence.

Conclusions

Emotion regulation in stress situations in victims of violence is associated with increased activity in the right inferior frontal gyrus. The insula may have a role in the awareness of psychosomatic problems in stress situations. Suppression of emotion and psychosomatic problems might be risk factors for an altered stress processing in victims of violence.

Poster B54

Achtsamkeit fördert Aufmerksamkeit – Eine quantitative Meta-Analyse der neurokognitiven Effekte von Meditation

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Verhaltensstudien konnten positive Effekte von Meditationserfahrung auf Aufmerksamkeits- und Emotionskontrolle belegen, die sich nicht nur während einer Meditation zeigen, sondern auch bei der Bearbeitung meditationsunabhängiger kognitiver Aufgaben, die Aufmerksamkeitskontrolle erfordern. Basierend auf der Annahme, dass die positiven Effekte von Meditation auf die Performanz in kognitiven Aufgaben durch trainingsbedingte funktionelle Veränderungen im Gehirn vermittelt werden, haben neurokognitive Studien den Zusammenhang von Meditationserfahrung und Hirnaktivierung untersucht. In einer quantitativen Meta-Analyse (Activation Likelihood Estimation) haben wir Befunde aus insgesamt 12 fMRT-Studien zum Einfluss von Meditationserfahrung auf Hirnaktivierung während der Bearbeitung meditationsunabhängiger kognitiver Aufgaben zusammengefasst. Für Personen mit Meditationserfahrung im Vergleich zu Personen ohne Meditationserfahrung identifiziert die Meta-Analyse signifikante Konvergenz der betrachteten Studien im Bericht von stärkerer Aktivierung im linken lateralen Präfrontalcortex (Gyri frontalis medius und inferior; MFG, IFG) und im anterioren cingulären Cortex (ACC), sowie schwächerer Aktivierung im medialen Präfrontalcortex (MPFC) und Thalamus. Die Ergebnisse belegen einen Einfluss von Meditationserfahrung auf die Funktion des Gehirns auch für die Bearbeitung meditationsunabhängiger kognitiver Aufgaben. Es kann angenommen werden, dass Meditation die Fähigkeit zur Aktivierung von Regionen, die mit kognitiver Kontrolle in Verbindung gebracht werden (MFG, IFG, ACC), sowie zur Herunterregulierung von Regionen, die mit aufgabenunabhängiger Informationsverarbeitung in Verbindung gebracht werden (MPFC), verbessert. Diese Befunde zeigen mögliche Mechanismen auf, wie Meditation bessere Aufmerksamkeits- und Emotionskontrolle bei meditationserfahrenen Personen begünstigt.

Poster B55

Dorsal striatum mediates decisions to avoid boredom

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Boredom can be considered an aversive motivational state that occurs as a reaction to highly repetitive and monotonous tasks. In real-life settings, boredom has been shown to influence consumer decisions. While the experience of boredom has been suggested to involve the insula and the ventromedial prefrontal cortex, it is yet unclear whether these areas contribute to boredom effects on decision making. Using fMRI, we investigated the effect of boring options on valuation processes. In each trial, subjects chose one of two options: A piece of music of moderate subjective value as one option and either a boring task or one of two control tasks as the other option. While task options were free of charge, music options were associated with a price that varied adaptively throughout the experiment. Participants accepted higher prices to avoid boredom compared to control tasks. Analysis of neural activity during option presentation revealed an interaction of task and choice. Decisions in favor of boredom over music were associated with stronger activation in the insula and dorsal anterior cingulate cortex compared to decisions in favor of a control task over music, whereas activation was higher in the caudate nucleus when participants avoided boredom compared to avoiding a control task. Our results confirm the role of the insula in boredom and suggest that the dorsal striatum represents the increased attractiveness of entertainment in the face of boredom.

Poster B56

Does D-cycloserine during sleep affect subsequent declarative learning?

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Long-term memory is consolidated during sleep and sleep has a positive effect on subsequent declarative learning. Memory consolidation is thought to rely on local synaptic potentiation, while subsequent learning is thought to benefit from global downscaling during sleep. In the hippocampus, N-methyl-D-aspartate-receptors (NMDA)

containing the NR2A subunit are responsible for long term potentiation (LTP) and long term depression (LTD) is mediated by receptors containing the NR2B subunit. D-cycloserine (DCS) is a NMDA-receptor co-agonist that preferentially acts through NR2A containing receptors, which may favour LTP over LTD. In a previous study we could show that sleep-dependent declarative memory consolidation is facilitated by DCS administration, probably due to local increases in potentiation. In the present study we investigated, if new learning after sleep is impaired by DCS's potentiating effect that could lead to reduced global downscaling and reduced capacity in the hippocampus. To test this hypothesis we designed a double-blind, placebo-controlled, balanced crossover study, in which participants learned two lists of word-pairs and then orally received (DCS) or placebo before 8 hours of sleep. The next evening they learned two new lists of word-pairs. One list consisted of completely new word-pairs. In the other list, the cue words from one of the lists they learned before sleep were paired with new target words (interference list). Afterwards, participants were asked to retrieve the original word pairs. Unexpectedly, our preliminary results (n=30) indicate that learning after sleep with DCS is increased significantly independent of interference.

Poster B57

Interozeptive Sensitivität bei Bulimia Nervosa und Binge-Eating-Störung

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Eine reduzierte interozeptive Wahrnehmung spielt eine wichtige Rolle in der Entwicklung und Aufrechterhaltung von Essstörungen und Übergewicht. Die Fähigkeit, körperinterne Signale akkurat zu unterscheiden und wahrzunehmen, ist insbesondere bei Essstörungen beeinträchtigt, die sich durch wiederholte Essanfälle kennzeichnen. Diese Studie hatte zum Ziel, interozeptive Sensitivität bei Essstörungen mit Essanfällen (Binge-Eating-Störung, Bulimia Nervosa) und Übergewicht zu untersuchen.

Es nahmen 22 Personen mit einer Essstörung, 20 übergewichtige/adipöse Teilnehmer und 23 normalgewichtige Kontrollprobanden teil. Die Genauigkeit der Wahrnehmung interozeptiver Signale wurde über einen Herzschlagdetektionstest (Kardiosensibilität) quantifi-

ziert. Zusätzlich wurde die Sensitivität für Magenaktivität anhand eines Water load Tests erfasst und die gastrische myoelektrische Aktivität mittels Elektrogastrogramm aufgezeichnet.

Essgestörte Teilnehmer zeigten eine geringere Kardiosensibilität als Kontrollprobanden und übergewichtige Individuen. Es konnte kein Unterschied zwischen der Kontrollgruppe und übergewichtigen Probanden festgestellt werden. Patienten mit Essanfällen nahmen eine größere Menge an Wasser zu sich bis sie erste Signale der Sättigung empfanden und die gastrische Power im normalen 3 cpm-Bereich war nach dem Water load Test signifikant geringer als in beiden anderen Gruppen.

Essgestörte Patienten haben sowohl eine verminderte Sensitivität für Magenaktivität, als auch eine allgemeine Beeinträchtigung, körperinterne Signale akkurat wahrzunehmen. Diese verminderte interozeptive Sensitivität bei Essstörungen ist offenbar unabhängig von Übergewicht oder Adipositas.

Poster B58

Alpträume beeinflussen die wahrgenommene Schlafqualität, jedoch nicht die Schlafarchitektur: eine ambulante polysomnographische Untersuchung

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Alpträume sind ein häufiges Phänomen, nicht nur bei Personen mit psychischen Erkrankungen. Sie sind oft mit Problemen wie verlängerter Einschlafzeit, geringerer Schlafqualität und Tagesmüdigkeit verbunden. Diese Studie untersucht, ob sich die subjektiven Beschwerden auch in objektiven Schlafdaten widerspiegeln.

Siebzehn Personen mit häufigen Alpträumen und 17 gesunde Kontrollprobanden wurden mittels ambulanter Polysomnographie an drei aufeinander folgenden Nächten untersucht. Die subjektive Schlafqualität wurde über verschiedene Fragebögen erfasst.

In den Fragebögen berichteten Personen mit regelmäßigen Alpträumen neben einer schlechteren Schlafqualität auch eine größere Beeinträchtigung im Wachleben. In den objektiven Schlafkennwerten der ambulanten polysomnographischen Untersuchung zeigten sich keine Unterschiede in (a) der Schlafarchitektur, (b) der Dauer der Schlafzyklen sowie der REM- Dichte und REM-Dauer in

den einzelnen Zyklen, und (c) der Schlafarchitektur wenn nur Nächte mit Alpträumen zum Vergleich herangezogen wurden.

Unsere Ergebnisse zeigen, dass Alpträume unabhängig von der Schlafarchitektur zu deutlichen Beeinträchtigungen führen. Es ist somit erforderlich, Alpträume als eigenständiges Problem zu betrachten, welches einer angemessenen Behandlung bedarf.

Poster B59

Autonomic hyperarousal and enhanced reactivity during physical stress in children with social anxiety disorder: a home based ecological study

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Objective: Laboratory studies suggest that social anxiety disorder (SAD) in children is linked to chronic physiological hyperarousal at rest and blunted autonomic responding under social stress. Yet, it remains unclear whether this hyperarousal is specific to stress induced in the lab or also an expression of autonomic dysregulation in the field. Therefore, ordinary tasks were performed in a natural environment in children's homes.

Method: To assess potential autonomic alterations of SAD in a non-threatening environment, sympathetic and parasympathetic autonomic functioning during baseline and physical stress (orthostatic stress, stair stepping) was assessed in children (9-13 years) with SAD (n=27) and controls (n=27) in their homes.

Results: Relative to controls, SAD children showed tonic autonomic hyperarousal indicated by higher heart rate and electrodermal activity throughout the procedure. Further, there was evidence for stronger sympathetic reactivity (T-wave amplitude, Pulse wave transit time) to both physical stressors in SAD children. Groups did not differ during recovery or on para-sympathetic parameters.

Conclusion: The study provides the first evidence for possible chronic sympathetic hyper-arousal and enhanced reactivity in SAD children during daily life. Contrary to previous lab studies, no restricted autonomic flexibility in response to non-social stressors was observed.

Poster B60

Electrophysiological correlates of face processing: do they change with age?

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In the present study we were interested in age effects on processing of face stimuli. We applied the N170 component of the event-related brain potential in order to test whether elderly participants (age range: 53-75 years, M = 65, SD = 4.64) differ in the encoding and storage of face stimuli within an S1-S2 same-different task compared with younger participants (age range: 18-23 years, M = 20, SD = 1.7). We analyzed the ERPs with regard to the memory stimulus (S1) as a pre-requisite for the subsequent memory task. The N170 was increased in elderly compared with younger adults with face stimuli; in a baseline condition—in which watches were presented as S1 and S2—this difference was not that pronounced. In addition, the subsequent P300 component was decreased in elderly compared with younger participants. These results suggest a switch from a more cognitive to a more sensory processing mode with higher age. However, this switch did not abolish the capacity of the older participants to perform the task in general (although there were also some age differences in the behavioral data).

Poster B61

Functional connectivity patterns of visual cortex reflect its anatomical organization

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The brain is continuously active, even in absence of external input or task demands. This so-called resting-state activity exhibits a highly specific spatio-temporal organization. However, how exactly these activity patterns map onto the anatomical and functional architecture of the brain is still unclear. Because of the wealth of data from the visual cortex, this cortical system provides an ideal test bed for addressing this question. The aim of the current study was to comprehensively investigate correlations between

resting-state networks and numerous organizational principles of the human visual system. We acquired standard anatomical, retinotopic mapping, motion localizer, and resting-state fMRI scans for 44 participants. We used the mapping scans to separate for each participant early visual areas V1-V3 and define subregions of those areas with respect to several topographic axes (e.g. fovea vs. periphery or dorsal vs. ventral parts) and explored resting-state connectivity between all visual areas. We found that retinotopically corresponding regions, especially those representing the peripheral visual field, exhibit particularly strong correlations. V1 displayed strong internal correlations between its dorsal and ventral segments and relatively strong correlations with the LGN. In contrast, V2 and V3 showed weaker correlations with the LGN and strong correlations between their respective dorsal and ventral segments, as well as with V4 and hMT+. These results indicate that resting-state fMRI activity closely reflects the anatomical organization of the visual cortex both with respect to retinotopy and hierarchy. These insights give us a deeper understanding of the origins and functional significance of these resting-state patterns.

Poster B62

Olfaction and Social Interaction – Physiological Responses in a Virtual Environment

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Olfactory cues influence social behavior in different ways. For example, pleasant odors have been shown to boost prosocial behavior and perceived attractiveness. A virtual reality paradigm has been established in order to measure the influence of odors of different valence on social interaction in a realistic environment. 60 Participants were first guided into a virtual office (passive trials) and positioned in front of a virtual agent standing in the middle of the room and gazing at the floor while they were exposed to an either positive or negative odor. Then agents looked up toward the participant showing either a happy, neutral, or angry expression. During passive trials, both facial electromyography (EMG), skin conductance level (SCL), and the late positive potential (LPP) were recorded. Between blocks, agents were rated for valence, arousal and sympathy. In following active trials, participants approached the

agents in the office, using a joystick to decide about the distance they wanted to keep from him. Results indicated that pairing of the agents with unpleasant (vs. pleasant) odors led to higher arousal and lower sympathy and valence ratings. Additionally, in trials with unpleasant odor, the SCL was higher and facial mimicry was reduced. On the LPP, no differential effect of odor stimulation could be found. Interestingly, participants approached the agent paired with the unpleasant odor less than they did the one paired with the pleasant odor. In summary, results indicated odor exposure modulates social interaction, that is unpleasant odors facilitates avoidance, whereas pleasant odors approach.

Poster B63

Impaired behavioural post-error re-adaption in adult patients with ADHD

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The present study was conducted to investigate error monitoring and post-error adaptation processes, respectively, in adults with attention-deficit/hyperactivity disorder (ADHD). In a recent innovative study, Yordanova et al. (2011) showed that children with ADHD are characterised by instable post-error performance in terms of an increase in reaction time (RT) variability (RTV) as well as error rates (ER). Up to date, this instability of behavioural performance after errors has not been shown in adults with ADHD.

Design and Methods: 23 healthy controls and 34 adult ADHD patients performed a modified version of the flanker task used by Yordanova et al. which was embedded within a Go-NoGo paradigm. At the same time, cortical activation as well as neurophysiological responses were assessed by means of electroencephalography (EEG) and near infrared spectroscopy (NIRS) [reported elsewhere]. Behavioural performance was analysed regarding RT, RTV and ER overall as well as in post-error opposed to post-correct trials.

Preliminary results show an overall increase in RTV in the group of ADHD patients. Moreover, ADHD patients committed significantly more errors exclusively in post-error trials compared to healthy controls. Post-error slowing

could be revealed in both groups but there was a trend for even slower RTs in ADHD patients.

Our results indicate for the first time that not just children with ADHD but also adults do not only show alterations in behavioural performance during cognitive tasks which require the maintenance of attention, but more specifically are characterised by deficits regarding re-adaptational processes after an error has been committed.

Poster B64

Neuronale Verarbeitung komplexer sozialer Situationen im Social Detection Task bei gesunden Männern und Frauen

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Das korrekte und unmittelbare Erkennen von Emotionen ist unabdingbar für die soziale Integration eines Individuums. Studien zur neuronalen Grundlage sozialer Informationsverarbeitung nutzen fast ausschließlich Gesichter als Stimulusmaterial, wodurch die externe Validität der Studien leidet. Ziel dieser Studie ist die Etablierung einer Emotionserkennungsaufgabe, bei der Bilder naturalistischer, komplexer sozialer Situationen eingesetzt werden, dem Social Detection Task (SoDeTa). Analog zur realen Umwelt müssen Probanden hier zunächst eine Selektion der relevanten Information vornehmen sowie Gestik und den sozialen Kontext miteinbeziehen.

Mittels funktioneller Magnetresonanztomographie wurde die Hirnaktivität von 21 Frauen und 21 Männern während des SoDeTa erfasst. Es wurden Bilder realer Interaktionen in naturalistischer Umgebung für je 1500 ms präsentiert, deren Valenz die Probanden so schnell wie möglich angeben mussten. Verwendet wurden positive und negative soziale Interaktionen, deren Eindeutigkeit systematisch variiert wurde. Als Kontrollbedingung dienten vergleichbare Szenen, auf denen keine Menschen zu sehen waren.

Positive soziale Interaktionen wurden schneller ($p = .000$) und mit höherer Trefferrate korrekt identifiziert als negative ($p = .000$), wobei Frauen in beiden Bedingungen eine höhere Leistung erzielten ($p = .025$). Auf neuronaler Ebene zeigte sich bei der Verarbeitung sozialer Situationen im Vergleich zur Kontrollbedingung stärkere Aktivierung in

Arealen der Gesichtserkennung (fusiformer Gyrus) und Emotionsverarbeitung (Amygdala, Insula).

Handelte es sich um eine negative Interaktion, war die linke Insula stärker aktiviert als bei positiven Interaktionen. Auf Basis der Ergebnisse kann angenommen werden, dass der SoDeTa eine valide Erfassung alltagsrelevanter sozial-kognitiver Fähigkeiten erlaubt und durch die hohe Komplexität der Aufgaben eine gute Differenzierung im Bereich gesunder Personen ermöglicht.

Poster B65

Frontostriatal functional connectivity during non-drug reward processing in alcohol addicted patients

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According to current neurobiological theories of addiction, the ventral striatum (VS), as well as parts of the prefrontal cortex (PFC) contribute to increased incentive salience of alcohol associated cues and weakened strength of cognitive control that are central to addiction. However, only a few studies have discussed the role of disrupted non-drug reward processing as an indicator for either a premorbid risk factor or a symptom of alcohol addiction. Here we used functional magnetic resonance imaging (fMRI) to investigate the neural response and functional connectivity underlying monetary, non-drug reward processing in alcohol-dependent patients (AD). Thirty-five AD inpatients and 35 healthy control subjects (HC) participated in an fMRI reward paradigm, in which brain activation and connectivity during the anticipation of monetary gain and verbal feedback was examined. Region of Interest (ROI) analyses revealed increased activation in the left VS during monetary gain contrasted with verbal feedback in AD compared to HC. ROI analysis of VS connectivity with key areas of the PFC revealed a positive association with the left dorsolateral PFC in HC, but not in AD. These findings suggest an increased sensitivity of incentive neurocircuitry to nondrug rewards, but aberrant fronto-striatal connectivity indicating weakened cognitive control important for response inhibition.

Poster B66**Value tracking and confirmatory signaling in separate cingulate regions subserving exploration and exploitation**

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Two subdivisions of the cingulate cortices are differentially involved in the evaluation of reward-related information and subsequent adjustment of response choices. Recent theories discuss the particular relevance of midcingulate cortex (MCC) for switching behavior into an exploration mode; consecutively, anterior cingulate cortex and adjacent ventromedial prefrontal cortex (ACC/VMPFC) are implied in mediating exploitative behaviors by tracking reward values unfolding after the behavioral shift. The transitional period between both modes, however, is not well understood and has not been subjected to in-depth characterization by computational modelling. Here, we used fMRI data acquired in humans during probabilistic reversal learning in order to parametrically model the serial unfolding of performance feedback processing associated with switching from exploration to exploitation. Our models accurately predicted the divergent involvement of MCC and ACC/VMPFC during feedback processing: MCC signaled the necessity of behavioral switching, while ACC coded trial-by-trial value accumulations. Importantly, our results demonstrate that MCC also carries a prominent confirmatory signal during processing of first positive feedback after switching. Hence, switch proximity might not be sufficient to explain MCC's role in feedback evaluation, not even in simple choice tasks.

Poster B67**Das somatosensorische Profil von Patienten nach Makroreplantation im Bereich der oberen Extremität**Blume, Kathrin¹; Racz, Juliane²; Friedel, Reinhard³; Hofmann, Gunther O.³; Miltner, Wolfgang H.R.¹; Weiss, Thomas¹¹Friedrich-Schiller-Universität Jena, ²Klinikum Bad Hersfeld, ³Universitätsklinikum Jena

Eine erfolgreiche Replantation zeichnet sich neben weitgehender Schmerzfreiheit im Replantationsbereich, einem befriedigenden ästhetischen Ergebnis sowie einer

akzeptablen Dauer der sozialen und beruflichen Wiedereingliederung vor allem durch ein gutes funktionelles Ergebnis aus. Eine Voraussetzung für Funktionalität ist eine ausreichend wiederhergestellte Sensibilität. Bisher liegen zur Sensibilität replantierten Extremitäten nur wenige Ergebnisse vor, die aus standardisierten Testungen entstanden sind. Um zu einem genaueren Verständnis der regenerativen Vorgänge nach Makroreplantation beizutragen, wurden die Fähigkeiten, Berührungen und Schmerz wahrzunehmen, an einem Patientenkollektiv standardisiert untersucht. Mittels der Quantitativ Sensorischen Testung (QST) wurde für 15 Patienten mit einer Makroreplantation der oberen Extremität ein vollständiges somatosensorisches Funktionsprofil für beide Hände erstellt. Dabei wurde ebenfalls überprüft, ob Hinweise auf zentrale Sensitivierungsprozesse vorliegen. Es zeigte sich eine signifikante Hypästhesie für thermische Reize. Paradoxe Hitzesensationen traten im Vergleich zu den Normdaten überdurchschnittlich häufig auf. Wir fanden weiterhin signifikant reduzierte Empfindungsschwellen auf mechanische Berührungs- und Vibrationsreize. Hinsichtlich schmerzhafter Stimulation zeigte sich zum einen eine Hyperalgesie auf Druckreize und zum anderen eine Hypoalgesie auf Hitzeschmerz. Außerdem litt ein Großteil der Patientengruppe an Spontanschmerzen. Das somatosensorische Funktionsprofil der Patienten mit Makroreplantation der oberen Extremität weist Ähnlichkeiten mit neuropathischen Schmerzkrankungen auf. Bei beiden Phänomenen scheinen folglich vergleichbare pathophysiologische Mechanismen zu wirken. Das somatosensorische Profil von Patienten mit Makroreplantationen weist jedoch auch zahlreiche Unterschiede zu neuropathischen Schmerzen auf. Phänomene wie Allodynie, Pinprick-Hyperalgesie und Kälte- bzw. Hitzehyperalgesie, die als typische Kennzeichen neuropathischer Schmerzen gelten, konnten in der vorliegenden Patientengruppe nicht nachgewiesen werden. Makroreplantationen bringen folglich ein spezifisches somatosensorisches Sensibilitätsprofil mit sich, welches bisher nicht im Detail beschrieben wurde.

Poster B68**On the time course of retro-cue induced forgetting in visuo-spatial working memory**

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We investigated the influence of irrelevant working memory representations on further information processing. A retro-cue indicated if the items on the left or right side of a previous memory array remained relevant. Subsequently, a central probe item was presented with a varying stimulus onset asynchrony (SOA: 300, 400, 600, 1000, 1800 ms). Participants had to state whether this stimulus was shown on the cued side of the memory array. The probe was either a cued memory item, non-cued memory item or was not shown in the previous memory array (new probe condition). The ongoing influence of irrelevant working memory representations can be investigated by comparing performance between the non-cued probe condition and the new probe condition. Non-cued probes were associated with delayed response times referred to new probes. This effect was most pronounced for the 300 ms and 400 ms SOA conditions. Thus there was an increased processing conflict for non-cued probes compared to new probes when selection processes induced by the retro-cue were not yet completed. Furthermore, ERP asymmetries were used to investigate probe processing referred to the laterally cued memory items. The non-cued probe condition featured a stronger sustained contralateral negativity over temporal sites compared to cued probes and new probes. This effect was increased for short SOAs (300 and 400 ms) compared to the remaining conditions. The findings suggest that additional top-down control was required to actively suppress the residual representations of non-cued information in working memory when these were not already filtered out following the retro-cue.

Poster B69**Age effects on maintenance and manipulation of information in working memory**

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The n-back paradigm has been used to examine age-related deficits in working memory (WM). As the n-back

task calls for both maintenance and manipulation in WM, it remains still unclear, which of them contributes more to the age-related deficits. Thirty younger (29-44 years, $m=38$, $SD=4$) and 32 older (46-63 years, $m=54$, $SD=6$) healthy employees performed a 2-back task (2B) and a "successive" version of the Sternberg task (SST). In the 2B participants had to press a key if an item was seen in the $n-2$ position. The SST had the same features as the 2B, but participants had to decide whether an item at the end of a memorized subsequence belonged to the subsequence or not. Participants responded faster and more accurate in the 2B than in the SST. In the SST the N2 latency was longer and the slow positive wave (SPW) smaller than in the 2B. In the 2B older participants performed worse than younger ones with no age differences in the SST. Nevertheless, in both tasks an age-related P3 reduction and a N2 prolongation were observed. Compared to the 2B, the prolonged N2 in the SST may be due to a more complex response selection process while the reduced SPW to diminished requirements for memory maintenance. The later circumstance appears to be the main reason for the absence of age effects on SST performance and their presence in the 2-back task.

Poster B70**Abnormally increased attentional allocation under uncertainty in obsessive-compulsive disorder (OCD) as revealed by temporospatial principal component analysis (PCA)**

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Obsessive-compulsive disorder (OCD) is characterized by abnormal levels of doubt and uncertainty. OCD patients perceive uncertainty as highly aversive and disruptive to self-efficacy. Research in healthy individuals associating uncertainty with biased threat estimates and increased attentional and emotional responses suggests that uncertainty is motivationally significant. However, despite its strong implication in OCD, it is still poorly understood whether uncertainty differentially affects attentional processing in patients. We hypothesized that uncertainty-induced resource allocation is increased in OCD.

Twenty-four OCD patients and 24 healthy controls performed a cued picture viewing paradigm where a cue indicated certainty or uncertainty regarding subsequent

picture valence (neutral or aversive). We obtained trial-by-trial and post-experiment estimates of aversive picture frequencies under uncertainty. We examined electrophysiological correlates of attentional allocation by decomposing the picture-locked event-related potential with temporospatial principal component analysis (PCA).

OCD patients overestimated the frequency of aversive pictures appearing after uncertain cues on post-experiment estimates. Importantly, PCA results indicated a frontocentrally maximal P3-like factor showing stronger uncertainty-related increases in amplitude for patients than controls. Additionally, across groups, uncertainty- and valence-related modulations occurred—at least partially—in distinct spatial factors.

Attentional deployment under uncertainty appears hyperactive in OCD, indicating that uncertain events carry prominent motivational significance for patients. Biased retrospective threat estimates in patients further support this notion. Moreover, temporospatial PCA enabled us to partially dissociate systems driving uncertainty- and valence-related increases in attention across groups. Thus, both groups share underlying mechanisms of attentional processing and stimulus discrimination—with an OCD-specific deviation during relatively early uncertainty resolution.

Poster B71

Die Veränderung der interozeptiven Sensitivität im Therapieverlauf bei Anorexia nervosa Patienten

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Eine geringe Sensitivität gegenüber der Wahrnehmung körperinterner Signale resultiert in Unsicherheiten bei der Emotionserkennung und -verarbeitung sowie Schwierigkeiten bei der Differenzierung von Hunger und Sättigung. Diese gelten als Kernpunkte für die Entwicklung einer Essstörung. Erste Studien belegen bereits eine verminderte interozeptive Sensitivität bei Anorexia nervosa Patienten. Die vorliegende Studie hatte die Untersuchung der Veränderung der interozeptiven Sensitivität im Therapieverlauf bei Anorexia nervosa Patienten im Vergleich zu gesunden Kontrollprobanden zum Ziel. Zudem sollte explorativ untersucht werden, ob nach der erfolgreichen Therapie noch ein Unterschied zwischen den Patienten und den Kont-

rollprobanden besteht. Für die Studie wurden insgesamt 32 Probanden erhoben, darunter 16 Patienten mit Anorexia nervosa (Alter: 26.81 [7.94], BMI: 15.74 [1.23]) der psychosomatischen Klinik Windach am Ammersee und 16 Kontrollprobanden (Alter: 27.44 [7.57], BMI: 21.07 [1.79]) der Universität Ulm. Diese wurden über einen Zeitraum von 12 Wochen bei drei Erhebungszeitpunkten in ihrer Herzwahrnehmung untersucht. Es wurde analysiert, ob Kontrollprobanden einen höheren Herzwahrnehmungsscore im Vergleich zu den Anorexia nervosa Patienten über die drei Messzeitpunkte aufweisen. Des Weiteren sollte die Veränderung der interozeptiven Sensitivität über den Therapieverlauf überprüft werden. Wie erwartet, zeigten die gesunden Kontrollprobanden über alle drei Messzeitpunkte einen höheren Herzwahrnehmungsscore. Bezüglich der Verlaufsuntersuchung konnte ein deskriptiver Trend hinsichtlich der Verbesserung des Herzwahrnehmungsscores bei der Patientenstichprobe nachgewiesen werden, welcher sich jedoch nicht inferenzstatistisch bestätigen ließ. Die vorliegenden Ergebnisse unterstützen die Annahme, dass die veränderte Körperwahrnehmung sehr „therapieresistent“ ist, wobei durch den Einbezug eines Trainings zur interozeptiven Sensitivität (z. B. durch Biofeedback) eine Verbesserung dieses Parameters erreicht werden könnte.

Poster B72

Necessity of group- and single-subject-level reliability in fMRI lateralization studies

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As the lateralization of cognitive functions and its underlying processes are from particular interest in functional neuroimaging a variety of paradigms, addressing these questions, appeared. However, the majority of these paradigms were not tested according to their reliability. We therefore aimed to assess the test-retest reliability of routinely used fMRI paradigms for language, visuospatial-attention and face-perception (within two slightly different tasks). All participants (20 subjects, 10 men, 20-30 years) performed all paradigms in two sessions, in a randomised order and within a one-week time interval. Functional data was analysed using standard routines implemented in spm8. In single-subjects as well as on group level, lateralization indices (LIs) were assessed for the whole brain

as well as the activated network. Additionally, test-retest reliability was calculated for each voxel by intra-class coefficients (ICCs). Median ICCs were subsequently calculated for whole brain, the activated network and task specific regions-of-interest (ROIs). All paradigms evoked the expected activation patterns, however ICCs at whole brain and within activated networks were mostly poor, whereas ICCs of specific ROIs were good to excellent. While results at group level were stable at any point, results in single subjects showed a higher variance. Focusing on the conducted LIs, a great variation between the sessions was observed on whole brain level. Furthermore, these results seem to indicate a strong task-dependency, as LIs and ICCs varied greatly between the two different tasks for each condition. Therefore future studies have to consider these findings and address it by improving existing paradigms.

Poster B73

A causal role of the right inferior frontal cortex in the strategies of multi-component behavior

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Many everyday activities, like driving a car, require the application of a hierarchical structure of different actions. While it is well-known that people apply different strategies in such situations, it is elusive which neural mechanisms determine the strategy applied. We investigated the role of the right inferior frontal gyrus (rIFG) in implementing the strategy used to cascade different actions. On three separate experimental sessions three theta burst transcranial magnetic stimulation (TBS) protocols were employed and administered to participant's rIFG prior task execution. Continuous, intermittent and sham TBS was administered, counterbalanced across participants and sessions, in order to impair, boost and control activity levels within the rIFG, respectively. Following TBS, participants performed a stop change task that assessed serial versus parallel response preparation. Continuous theta burst stimulation (TBS) applied to the rIFG resulted in a less efficient strategy to cascade different actions compared to a control condition using SHAM-TBS. On the contrary intermittent TBS caused efficacy of strategy to improve. These effects are predictable on the basis of

EEG data showing that altered response selection processes attributable to activity differences in the rIFG underlie these shifts. The study highlights the possibility to bi-directionally shift the strategy and thereby the efficacy of human multi-component behavior by directly manipulating neural processes in the rIFG.

Postersession C

Poster C01

Modulatory effects of attention on lateral inhibition in the human auditory cortex

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The neural processing of a tone in a sequence is known to be influenced by certain properties of the preceding auditory stimuli. One example is the reduced neural activation elicited by a tone when presented after a sound whose spectral range does not overlap the frequency range of the tone. This observation was explained by the mechanism of lateral inhibition (LI) in the auditory system. So far, several characteristics of bottom-up influences on LI have been identified, while the influence of top-down processes on LI is still relatively unclear. Hence, this study aims at investigating effects of focused attention on LI.

During magnetoencephalographic (MEG) investigation, 30 subjects are presented with two types of masking sounds (white noise vs. white noise passing through a notch filter centered at a 1 kHz), followed by a 1 kHz test tone. The N1m auditory evoked response elicited by the test tone served as the dependent variable to measure LI. Simultaneously, subjects perceive visual input on a screen. On one half of the trials, subjects are instructed to concentrate on the auditory input to detect small changes of loudness in the masking sounds. On the other half of the trials subjects are instructed to concentrate on the visual input and detect target stimuli on the screen. We expect that the focus on the auditory modality will enhance the effect of LI. Likewise, a focus on the visual modality should reduce the effect of LI. Preliminary analysis revealed a tendency in accordance with our hypothesis.

Poster C02

Soziale Merkmale reduzieren den Einfluss physikalischer Salienz auf offene Aufmerksamkeit

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In salienz-basierten Aufmerksamkeitsmodellen wird postuliert, dass offene Aufmerksamkeit beim freien Betrachten visueller Szenen insbesondere auf physikalisch saliente Bildbereiche ausgerichtet wird. Während in ersten Studien empirische Evidenz für diesen Ansatz gefunden wurde, konnte dieser einige Aspekte des Betrachtens von Bildern nicht hinreichend erklären, insbesondere wenn Stimuli unter naturalistischen Bedingungen betrachtet wurden oder sozial relevant waren. Vor diesem Hintergrund vermuteten wir, dass soziale Merkmale in komplexen naturalistischen Szenen ungeachtet ihrer physikalischen Salienz bevorzugt verarbeitet werden. Der Prädiktionswert salienz-basierter Aufmerksamkeitsmodelle für das Blickverhalten sollte demnach sinken, wenn sich soziale Elemente im visuellen Feld befinden. Zum Testen dieser Hypothese wurden unsere Versuchsteilnehmer instruiert, Farbfotografien komplexer naturalistischer Szenen frei zu betrachten, während ihre Blickbewegungen aufgezeichnet wurden. Die eine Hälfte der Fotografien beinhaltete soziale Merkmale (z.B. Gesichter, Körper, Körperteile), die andere Hälfte stellte ausschließlich nicht-soziale Inhalte dar (z.B. Tiere, Objekte, Landschaften). Für die Datenauswertung berechneten wir zuerst eine Salienzkarte für jede Fotografie, um diejenigen Bildbereiche zu ermitteln, welche sich aufgrund ihrer physikalischen Eigenschaften (Helligkeit, Farbe, Orientierung) vom Hintergrund abheben. Anschließend verglichen wir diese Salienzkarten mit dem tatsächlichen Blickverhalten der Versuchsteilnehmer. Wir entdeckten eine signifikant größere Abweichung von Salienzkarten und Blickbewegungsmustern (Kullback-Leibler-Divergenz, DKL) für soziale Szenen sowie - damit übereinstimmend - eine signifikant schlechtere Vorhersage von Blickbewegungsmustern durch Salienzkarten für diese Stimuli (Fläche unter der ROC-Kurve, AUC; Produkt-Moment-Korrelation, r). Diese Daten zeigen somit, dass das Vorhandensein von sozialen Merkmalen den Einfluss von physikalischer Salienz auf offene Aufmerksamkeit verringert und stellen dadurch die Generalisierbarkeit salienz-basierter Aufmerksamkeitsmodelle infrage.

Poster C03

Beeinträchtigte Gedankenkontrolle – Neuronale Korrelate intrusiver Gedanken bei Patienten mit Zwangsstörung

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Das Empfinden von Autorenschaft und Kontrolle über die eigenen Gedanken scheint elementar für das Gefühl von Selbst-Bewusstheit und die mentale Regulationsfähigkeit zu sein. Indes leiden Patienten mit Zwangsstörung häufig unter aversiven und unangemessenen Gedanken, die unkontrolliert ins Bewusstsein einschließen und Anspannung oder Angst auslösen. Zwangsgedanken werden mit Aktivierungen in frontalen Arealen, wie dem LPFC, MPFC und OFC in Verbindung gebracht, während intendierte Gedankenkontrolle mit verstärkter Aktivität in LPFC und ACC assoziiert ist.

Ist das Erleben genuiner intrusiver im Vergleich zu nicht-intrusiven Gedanken bei Patienten mit Zwangsstörung mit einer Hyperaktivierung in diesen Arealen verknüpft? Diese explorative fMRT-Studie untersucht die neuronalen Korrelate intrusiver Gedanken von 9 Patienten mit Zwangsstörung. In einem naturalistischen Ansatz wird das spontane Erleben intrusiver und anderer eigener Gedanken mittels Tastendrucks registriert und die Daten anhand dieses individuellen Gedankenprotokolls modelliert. Die eventbezogene Auswertung des Erlebens intrusiver im Vergleich zu anderen eigenen Gedanken zeigt eine stärkere Beteiligung von frontalen Arealen wie LPFC und ACC, aber auch striatalen und limbischen Strukturen, wie Nucleus caudatus, Pallidum und Parahippocampus. Somit bestätigen unsere Ergebnisse das etablierte Modell fronto-striato-limbischer Hyperaktivierung bei Patienten mit Zwangsstörung und verweisen zudem auf eine Beteiligung von LPFC und ACC als neuronale Korrelate der Gedankenkontrolle. Darüber hinaus sind intrusive Gedanken mit einer verstärkten Aktivierung von Precuneus, PCC, ventromedialem PFC und temporalem Gyrus verknüpft.

Diese Aktivierungsmuster zeigen, dass das Einschließen des intrusiven Gedankens mit verstärkter gedächtnisbasierter und selbstreferentieller Verarbeitung assoziiert ist. Zudem scheint das Auftreten einer Intrusion, als subjektiv erlebtem Kontrollverlust, mit einer kompensatorischen

Aktivierung in mit Gedankenkontrolle assoziierten frontalen Hirnarealen einherzugehen.

Poster C04

Striatal GABA levels predict response inhibition performance and its cortical electrophysiological correlates

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Response inhibition processes play an important role in cognitive control and are mediated via a network that consists of different cortical areas and basal ganglia nuclei. At the basal ganglia level, striatal GABAergic medium spiny neurons are known to be important for response selection. While there is extensive evidence for the role of the nigrostriatal dopamine pathway in response inhibition, quite little is known about the relevance of the striatal GABAergic system it innervates. We therefore examined the relevance of the striatal GABAergic system for response inhibition processes using a novel combination of magnetic resonance spectroscopy (MRS), EEG, and behavioral data of n=40 participants performing a GoNogo task. Our results show that striatal GABA levels predict the efficacy of response inhibition processes with higher striatal GABA levels being related to better response inhibition performance. Moreover, striatal GABA levels show a strong positive correlation with the degree of phase-locking in the Nogo-N2 time range, a frontal midline component that reflects pre-motor processes like conflict monitoring or updating of the response program. This shows that striatal GABA affects specific sub-processes of response inhibition through the modulation of the reliability of neuronal synchronization processes. Specifically, pre-motor inhibitory processes are affected while mechanisms reflecting the evaluative processing of the successful outcome of inhibition remain rather unchanged. To the best of our knowledge, this is the first study providing direct evidence for the relevance of the striatal GABAergic system for response inhibition functions and their cortical electrophysiological correlates in humans.

Poster C05

Motivational consequences of (non-invasive) blood loss stress

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Blood loss represents a serious threat to survival, and elicits strong stress responses. Blood loss may be induced non-invasively by applying lower body negative pressure (LBNP). We here tested whether blood loss stress influences the recruitment of adaptive motivational behavior tendencies, such as the avoidance of aversive, danger signaling cues, and the approach to appetitive, shelter-signaling cues.

In a newly developed stereoscopic first person perspective virtual environment task participants reacted to human-like, three-dimensional, walking avatars displaying dynamically changing happy and fearful facial expressions. They had to perform joystick operations, in order to approach or avoid avatars by either moving themselves (MOVE-SELF) or moving the avatar (MOVE-OTHER) to a different position in the virtual space. At the same time LBNP was applied at 0, -15 and -30 mmHg. LBNP induced sympathetic activation and vagal withdrawal. Approach of “happy” and avoidance of “fearful” avatars (congruent behavioral pattern) was initiated earlier than the incongruent pattern, respectively (so-called ‘congruency effect’). The main result of this study is, that LBNP-induced blood loss stress enhanced the congruency effect, but exclusively in the deep-rooted “MOVE-SELF” condition, leaving the more shallow -rooted “MOVE-OTHER” condition unaffected.

These findings demonstrate that internal body signals mimicking the visceromotor activity of blood loss influence the use of basal motivational movement patterns, and open new questions on the neural as well as evolutionary basis of approach-avoidance behavior.

Poster C06

Neural correlates of extinction in a monetary incentive delay paradigm

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Stress plays an important role in development and relap-

ses of psychiatric disorders as well as in their resistance to treatment. It is assumed that stress influences the acquisition and extinction of appetitive conditioning. The neural correlates of this pathway, however, have only rarely been investigated in human subjects.

Within a three day fMRI appetitive conditioning paradigm healthy male subjects were randomly assigned to a stress inducing (TSST) or a placebo condition. The TSST took place on the first day before subjects performed the monetary incentive delay paradigm in an MRI scanner. Each trial started with one of two neutral cues followed by a simple reaction task. One cue (CS+) indicated that participants would win a small amount of money for a fast reaction to a target while the other cue (CS-) indicated that no money would be gained regardless of the reaction time. On the following day participants performed the same task but could not win money any more (extinction). One week later the extinction memory was tested in a reinstatement procedure.

First results show differences between groups during extinction learning in areas relevant for reward and extinction learning (e.g. dorsal striate, anterior cingulate cortex). The results will be discussed with respect to neurobiological theories for the treatment of psychiatric disorders.

Poster C07

Autoniefördernde soziale Unterstützung, Selbst-Regulation und kardiovaskuläre Reaktivität

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Die Selbstbestimmungs-Theorien nach Ryan und Deci (2000) besagt, dass ein Autonieförderndes soziales Umfeld dazu führt, Stressoren eher als Herausforderung statt als Belastung wahrzunehmen und so aktives Coping-Verhalten fördert. In einer vorangehenden Laborstudie (Zniva & Schulz, 2014) zeigte sich Autonieförderung als Stressreduzierend im Vergleich zu Überfürsorge. In einer Nachfolgestudie wurde nun untersucht, ob sich Autonieförderung auch positiv auswirken kann, wenn Selbst-Regulationsfähigkeiten erschöpft sind und das Potential, aktives Coping gegenüber einem Stressor einzusetzen, eingeschränkt ist.

N = 44 Studenten lösten arithmetische Aufgaben unter Zeitdruck. In der „Lern-Phase“ erhielten n = 22 Teilneh-

mer Autoniefördernde und n = 22 überfürsorgliche Unterstützung. In der folgenden „Anwendungs-Phase“ mussten alle Versuchspersonen ähnliche Aufgaben alleine lösen. Jeweils die Hälfte der Versuchspersonen bearbeitete vor Beginn des Stresstests eine Selbst-Regulations-Aufgabe (Ego-Depletion). Während des Versuches wurden kontinuierlich Herzrate, Blutdruck und Hautleitfähigkeit sowie die subjektive Stress- und Kontrollwahrnehmung erfasst.

Autoniefördernde Unterstützung führte zu einer Stressreduktion von der Lern- zur Anwendungsphase, allerdings nur für Versuchspersonen ohne Ego-Depletion. Überfürsorgliche Unterstützung führte vor allem zu Beginn der Anwendungsphase - unabhängig von der Ego-Depletion - zu einer erhöhten Herzrate, was sich auch in signifikant höheren Stressratings niederschlug. Alle Teilnehmer bewerteten die Aufgaben als gleich schwierig und lösten in der Anwendungs-Phase gleich viele Aufgaben.

Diese Ergebnisse deuten darauf hin, dass der Stressreduzierende Effekt Autoniefördernder Unterstützung unter verbrauchter Selbst-Regulation auf physiologischer Ebene verloren geht, auf subjektiver Ebene aber unabhängig von der Selbst-Regulation erhalten bleibt.

Poster C08

Neural correlates of implicit emotion regulation in patients with anorexia nervosa

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Patients with anorexia nervosa (AN) are characterized by extremely low body weight, restrictive (eating) behavior and difficulties in recognizing and expressing emotions (Jänsch et al., 2009). AN patients also have difficulties in actively regulating emotions (Gilboa-Schechtmann, 2006). Here we use fMRI to investigate neural correlates of cognitive control and emotional processing across stimulus categories and participant groups.

This ongoing study includes 33 acute anorectic patients (acAN) and 33 matched healthy controls (HC). Participants performed a block-designed emotional face n-back (Ladoceur et al., 2009) consisting of a 2-back working memory (WM) task flanked by face pictures (happy, angry, neutral). Performance data were analyzed with repeated

measures ANOVAs [2 (group) x 3 (flanker category)]. fMRI data were preprocessed using SPM8 including artifact detection (ART) and DARTEL toolboxes. Two-sampled T-tests were used to compare whole brain activation between groups.

No group differences were found on a behavioral level. On imaging level, first, task feasibility was confirmed by robust activations of the WM-network when performing the task. Regarding differential neural activity we found increased activation in the right inferior frontal gyrus in acAN when angry in comparison to neutral faces flank the task (uncorrected). Possible interpretations are, that acAN are more distracted and affected by emotional (especially angry) faces. These preliminary results of increased neural activity may indicate higher cognitive effort of acAN to either perform the WM-task or regulate their emotions to achieve similar behavioral results as HC. Those hypotheses should be tested with psychophysiological interaction (PPI) analysis on the prefrontal seed-region.

Poster C09

The effects of binge drinking on spatial aspects of responding and its evaluation: an EEG study

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Binge drinking is a relatively new but very prevalent pattern of alcohol consumption among adolescents and young adults. The high-dose ethanol intoxication associated with binge drinking may impair motor coordination and the power of judgment, often leading to risky and unsafe behavior. Yet, very little is known about the neuronal mechanisms and subprocesses via which alcohol impairs the ability to coordinate and evaluate our movements. We used a Simon task to investigate this question since it has previously been shown to provide elaborate neurophysiological measures of spatial coordination and associated response evaluation processes. For this study, a sample of n=21 healthy young males performed a Simon task while an EEG was recorded. The task was once completed while sober and repeated after consuming a mixture of vodka and orange juice aiming to induce an intoxication level of 1.2‰. Interestingly, intoxication differentially modulated the alcohol-induced decline of behavioral performance (accuracy and response times) and the associated response-locked neurophysiological correlates across conditions.

The finding that the most complicated condition (incongruent trials with crossed hands) was shown to be the least impaired, suggests fundamental differences between sober and intoxicated response evaluation in varying spatial contexts. The counterintuitive finding that the execution and evaluation of movements might be more severely impaired by alcohol when carried out in simple spatial setups in more complex ones, might provide a surprising explanation of why intoxicated individuals display inadequate judgment of their motor skills and coordination.

Poster C10

Structural alterations of the corpus callosum are associated with suicidal behavior in Borderline Personality Disorder

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Background: Structural alterations of the corpus callosum, the major white matter tract connecting functionally related brain regions in the two hemispheres, have been associated with deficits in emotion regulation and impulse control in various mental disorders. The aim of the present study was to investigate whether structural alterations of the corpus callosum are similarly associated with emotional instability and impulsivity in Borderline Personality Disorder (BPD).

Methods: Using diffusion tensor imaging, we investigated the structural integrity of distinct callosal regions in 20 healthy control (HC) participants and 21 BPD participants with marked deficits in emotion regulation and impulse control.

Results: We found distinct structural alterations in the corpus callosum of suicidal but not non-suicidal BPD participants. Suicidal BPD participants showed lower fractional anisotropy (FA) and higher mean diffusivity (MD) in the splenium of the corpus callosum than HC participants. Non-suicidal BPD participants, on the contrary, showed similar FA and MD in the corpus callosum as HC participants. Besides this, we found BPD participants' suicidal behavior to be associated with FA and MD in the splenium of the corpus callosum as well as with MD in the genu of the corpus callosum.

Conclusions: Notably, we only revealed structural altera-

tions in regions of BPD participants' corpus callosum that are connected with prefrontal and tempo-parietal brain regions. It may, thus, be possible that structural alterations in these callosal regions account for structural and functional alterations in brain regions that have previously been shown to be implicated in BPD participants' emotional instability and impulsivity.

Poster C11

Effects of emotional intensity on ERPs in face perception

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We investigated the effect of emotional intensity in emotional facial expressions of different valence levels on visual ERPs while varying the amount of available cognitive resources. For this purpose, a face data set was created providing a representative number of naturalistic, full colored stimuli, for which different emotional intensities were achieved in an ecologically valid way. Participants compared the length of two horizontal bars that were superimposed onto neutral, happy or angry facial expressions of graded intensity (low and high intensity). The availability of cognitive resources for the processing of facial distractors was varied by the difficulty of the foreground task (low and high perceptual load). Although facial stimuli were not task relevant, analyses of ERPs in response to the faces revealed significant intensity and valence effects on N170 and EPN, as well as a significant load effect on LPP. The main effect of valence was further modulated by a valence x load interaction reflecting differential processing of happy and angry expressions under low, but not under high perceptual load. In the time window of LPP increased deflections for highly happy expressions were obtained. Reaction times in the bars task were prolonged for highly negative distractors. Taken together, our results show robust modulations by emotional intensity on N170, EPN and LPP, which occur independent of endogenous attention and generalize to positive affect.

Poster C12

Workload-dependent aging effects on cognitive control processes

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Normal healthy aging is connected with a decline of several cognitive domains, among others the impairment of cognitive control processes. The ability to handle interferences is essential in everyday life, since we are constantly confronted with multiple sources of interference. A large body of studies so far has focused on the effects of interference and aging on information processing, though no study has examined the conjoint effect of multiple sources of interference and their neurofunctional correlates. While recording electrophysiological data, a group of young and elderly participants performed a hybrid paradigm, comprising two different sources of interference: a masked cue resembling a Flanker effect and a Simon effect like lateralized target stimulus. We found a differential modulation of reaction times by aging and the two sources of interference. While overall the increase of the Simon effect was larger in the elderly group compared to the flanker effect, young participants showed a stronger influence of interference when the workload was low. This modulation was reflected on a neurofunctional level by a modulation of the N2 event related potential, indicating that the effect was due to changes in cognitive control processes. This "advantage" for elderly may be due to a decreased ability to maintain context information, inducing interference for young adults.

Poster C13

Analytical q-ball imaging in euthymic bipolar I disorder patients

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Studies on white matter (WM) abnormalities in bipolar disorder I (BD) patients commonly found a worse integrity of tracts connecting emotion regulation regions. Most previous studies used subjectively determined regions-of-interest or analytical algorithms for fiber tractography. However, these techniques cannot reliably determine bundles' diffusion directions in the face of crossing or

bending fibers within a voxel. The present study used a new diffusion weighted imaging (DWI) analysis, analytical q-ball imaging, circumventing this problem, allowing an unbiased whole-brain exploratory analysis of fiber integrity in BD patients. The study comprised of 28 euthymic BD patients (11 females, mean age = 44.78) and 28 gender-, age-, and education-matched controls. DW- and T1-images were processed using Connectomist and BrainVisa. WM integrity was defined by tract's mean general fractional anisotropy (GFA) value. We performed between-group comparisons on GFA values using analyses of covariance (ANCOVA), with age as covariate. GFA values were lower in patients than in controls in the right anterior arcuate fasciculus, cingulum right, right inferior longitudinal fasciculus, bilateral uncinate fasciculus, and in the rostrum, splenium and body of the corpus callosum. Thus, BD patients had worse fiber integrity, not only in bundles related to emotion regulation, but also in tracts supporting interhemispheric communication, e.g., shedding light on possible additional impairments in BD. Results were determined by an anatomically more precise analysis method, enabling an unbiased exploration of WM abnormalities in BD patients.

Poster C14

Gastrische Modulation der Schreckreaktion: eine prä-attentive Methode zur Abbildung afferenter Signale aus dem gastrointestinalen System.

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Die Dysregulation von Interozeption spielt eine wichtige Rolle für psychische Störungen, die mit körperlichen Symptomen assoziiert sind, wie Essstörungen, Panikstörung oder somatoforme Störungen. Als Alternative zu konventionellen Verfahren, die Selbstberichte benötigen, um Interozeptionsgenauigkeit zu erfassen (z.B. Herzschlagdetektionstests), existieren eine Reihe psychophysiologischer Indikatoren für Interozeption. Beispielsweise konnte im Rahmen der viszeralen Modulation der Schreckreaktion gezeigt werden, dass viszeral-afferente Signale aus dem kardiovaskulären oder respiratorischen System die Schreckreaktion beeinflussen. Ziel dieser Studie war es, zu überprüfen, ob afferente Signale aus dem gastrointestinalen System die Schreckreaktion ebenfalls beeinflussen können. Dazu wurden 26 gesunde Proban-

den (16 w) drei Male getestet: bei der Aufnahme von 0, 300 und 600 ml Wasser. Je 20 akustische Schreckreize wurden jeweils vor, sowie 1, 8 und 15 Minuten nach Wasseraufnahme präsentiert. Nach der Wasseraufnahme zeigte sich eine Erhöhung der elektrogastrographischen Power im normogastrischen (3 cpm) Band. Eine Minute nach der Aufnahme von 600 ml zeigten sich höhere, 8 Minuten danach geringere Schreckreaktionen (via EMG) als in beiden anderen Bedingungen ($p = .02$). Dies spricht für die Existenz eines gastrischen Modulationseffekts der Schreckreaktion. Die gastrische Modulation der Schreckreaktion könnte zur Erfassung afferenter Signale aus dem gastrointestinalen System eingesetzt werden, die eine wichtige Grundlage gastrischer Interozeption darstellt.

Poster C15

Erhöhte Konnektivität zwischen senso-motorischem und visuellem Cortex sagt Covariation Bias bei Angst vorher

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Es ist bekannt, dass Menschen mit Angststörungen den Zusammenhang zwischen angstrelevanten Stimuli und aversiven Konsequenzen überschätzen (= Covariation Bias / Illusory Correlation), was möglicherweise zur Aufrechterhaltung von Angst beiträgt. In einer fMRT-Studie wurden Probanden mit einer Spinnenphobie und gesunden Kontrollpersonen Bilder von Spinnen, Pilzen und Welpen gezeigt. Genau der Hälfte der Bilder jeder Kategorie folgte ein schmerzhafter elektrischer Reiz. Nach dem Experiment überschätzten Menschen mit Spinnenphobie den Zusammenhang zwischen Spinnen und elektrischen Reizen. Dieser Covariation Bias korrelierte mit erhöhter Aktivierung im primären senso-motorischen Cortex (Paracentraler Lobulus, PCL) in Reaktion auf elektrische Reize nach Spinnenbildern im Vergleich zu Pilzbildern. Eine Analyse funktioneller Konnektivität zeigte, dass der PCL erhöhte Konnektivität aufwies zum visuellen Cortex, sowie zu einem Salienz- bzw. Schmerznetzwerk aus anteriorem cingulärem Cortex, Insula und sekundärem somatosensorischem Cortex. Je stärker die Konnektivität zwischen PCL, Insula und visuellem Cortex war, desto stärker schätzten die Probanden mit Spinnenphobie den Zusammenhang zwischen Spinnenbildern und elektrischen Reizen ein. Je stärker die Konnektivität zwischen

PCL und rechtem dorsolateralem präfrontalem Cortex (dlPFC) war, desto geringer war dieser Covariation Bias. Eine Konnektivitätsanalyse für die Amygdala zeigte, dass diese bei Spinnenbildern stärker im Einklang mit primären senso-motorischen und visuellen Arealen aktiviert wurde. Möglicherweise trägt die Amygdala bei Angst zur Sensitivierung sensorischer Cortices bei. Eine verstärkte Co-Aktivierung von visuellen und somato-sensorischen Arealen könnte dann dem Covariation Bias zwischen Spinnenbildern und Schmerz zugrunde liegen, während eine Hinzuschaltung des dlPFC helfen könnte, die Zusammenhänge richtig einzuschätzen. Diese Mechanismen sind wahrscheinlich relevant für die Genese und Aufrechterhaltung von Angststörungen.

Poster C16

Sleep increases explicit solutions and decreases intuitive judgments in a semantic coherence paradigm

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Sleep is critically involved in memory consolidation and knowledge restructuring processes. In particular, sleep fosters the transition from implicit into explicit knowledge given that implicit learning occurred prior to sleep. The present study investigated the effect of sleep on explicit solutions and intuitive coherence judgments in the semantic word triads tasks. Participants shallowly encoded word triads prior to eight hours of nocturnal sleep or daytime wakefulness. After this retention phase, participants performed semantic coherence judgments on the previously encoded word triads (coherent versus incoherent) and had to name a common associate for coherent triads. The results show that after sleep, compared to wakefulness, participants generated more explicit solutions (correctly named common associates for coherent triads), but at the same time, they made significantly less correct intuitive decisions (correctly identified coherent triads without being able to name the common associate). Together, these findings indicate that sleep favors the extraction of explicit knowledge at the expense of the ability to make intuitive decisions. It can be speculated that through a process of down-selection during sleep, strong semantic

associations are increased/protected such that they cross the threshold of awareness, whereas weak semantic associations are further weakened/erased thereby eliminating the basis for intuitive judgments.

Poster C17

Single-trial EEG/fMRI analysis reveals deficiency on neural timing in ADHD

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Objectives: Response inhibition is the ability to suppress inadequate but prepotent or ongoing response tendencies. Between-subject differences in the intra-individual variability have been suggested to constitute a key to pathological processes underlying impulse control disorders such as Attention-Deficit-Hyperactivity-Disorder (ADHD). Correspondingly impaired impulse control in ADHD patients is associated with increased intra-individual differences and deficits in motor timing functions.

Methods: To assess group differences in spatiotemporal dynamics of the neural impulse control network, we conducted single-trial EEG/fMRI analysis in adult ADHD patients and healthy controls during visual Go/Nogo task. Event-related potential components with significantly increased amplitude during Nogo trials were classified regarding their occurrence before or around median response time (RT). Single-trial amplitude values of these inhibitory components were included as regressors in the fMRI model.

Results: Classical fMRI analysis revealed a hypoactivation only in striatal regions in ADHD patients. However, single-trial EEG/fMRI showed that in ADHD patients an extensive fronto-striatal network is significantly hypoactivated specifically at the early stage of response inhibition but not on a later stage as compared to healthy controls.

Conclusions: This suggests that ADHD patients rather have a problem in the timing than in the recruitment of the neural inhibitory network per se. Hence, it may be concluded that ADHD is indeed a disease of failed neural timing.

Poster C18**Oscillatory brain activity during the retention of natural objects in visual working memory**

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Maintenance of information in visual working memory is indexed by altered neural oscillatory activity. Elevated gamma (40-90 Hz) and beta (20-30 Hz) oscillations in parietal and frontal regions during retention have been described as neural correlates of stimulus storage. Increased alpha (7-14 Hz) power has moreover been linked to the inhibition of task-irrelevant brain regions and top-down control.

However, most studies used abstract stimuli as the to-be-remembered input. Here, we recorded MEG during a delayed-match-to-sample-task with line drawings of natural objects. By comparing neural activity with that of a non-mnemonic control task, we found increased gamma and beta power over posterior sites during the retention period. Source reconstructions revealed increased activation of early visual cortices and ventral visual stream regions known to be involved in object processing. During early retention periods gamma oscillations were reduced in frontal regions and showed increased power only shortly before retrieval. Lower alpha (7-9 Hz) power decreased in a widespread network comprising occipital, parietal and temporal areas, and no alpha increases were observed.

Our results provide evidence for the proposal that WM content is most notably maintained in sensory areas. Frontal cortex was not associated with maintenance itself but may rather guide retrieval.

Poster C19**Subliminal and supraliminal processing of food stimuli in patients with anorexia nervosa**

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It has been established that subliminally and supraliminally presented stimuli have a positive impact on executive control functions in healthy participants. However it was found that supraliminally presented food pictures

disrupt the working memory ability in patients with anorexia nervosa whereas subliminally presented food stimuli had no such effect. The aim of this study is to investigate whether subliminal presented food stimuli elicit neural responses in the same reward-related brain regions in patients with anorexia nervosa as in healthy controls. There-with we would like to shed light on the question whether patients with anorexia nervosa have a general dysfunction of reward related processing or whether appetitive reactions towards primary rewards (food) is altered due to a volitional over-regulation.

This ongoing study includes twenty-five female patients with anorexia nervosa and twenty-five age-matched healthy controls who underwent an epoch-related fMRI paradigm presenting neutral, social-rewarding and food pictures in a subliminal and supraliminal manner. Individual visibility of the subliminally presented stimuli was evaluated using the same subliminal stimuli and a forced-choice task after each subliminal trial.

Patients with acute anorexia nervosa showed no significant difference regarding their mean probability of detection in the subliminal condition in comparison to healthy controls. Preliminary analyses indicate increased neural activity in prefrontal areas in patients with anorexia nervosa in comparison to healthy controls when presenting food images supraliminally while no such difference emerged when food stimuli were presented subliminally. These first findings suggest heightened volitional control in patients with anorexia nervosa when food stimuli are presented supraliminally.

Poster C20**Consolidation of prospective memory: The effect of sleep on completed and reinstated intentions**

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Sleep facilitates the consolidation of new, especially future-relevant, memories. Recently, we showed that sleep improves prospective memory performance. In this study, subjects were instructed that they would have to detect previously learned cue words within a lexical decision task (serving as ongoing task) two days later and write down their previously learned associates. Following the instruction, subjects either slept or stayed awake for one

night. After a recovery night, sleep participants detected more cue words and remembered more associates than wake subjects. Based on these results, we asked whether the enhancement of prospective memory by sleep would be preserved if the intention was completed before sleep and whether completed intentions could be reinstated for sleep-dependent consolidation. In Experiment I, participants completed the intention already before a night of sleep/wakefulness. Two days later, sleep and wake subjects did not differ in prospective memory performance, suggesting that sleep does not facilitate the consolidation of completed intentions. Experiment II showed that reinstating the intention after its completion was not sufficient for a benefit of sleep on prospective memory. Finally, in Experiment III, subjects were instructed about both tests (before sleep/wakefulness and two days later) immediately after learning. This time, sleep subjects performed better in prospective memory than wake subjects after two days. Together, these data suggest that for intentions to benefit from sleep, they (i) have to be induced in temporal proximity to the initial learning session, and (ii) subjects have to expect the test session to take place after sleep.

Poster C21

Neurofeedback langsamer kortikaler Potentiale (LKPs) zur Erhöhung der Aufmerksamkeitsleistung bei chronischen Schlaganfallpatienten

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Langsame kortikale Potentiale (LKPs) stellen Potentialverschiebungen dar, die 300ms bis mehrere Sekunden andauern und mithilfe des Elektroenzephalogramms (EEG) messbar sind. Negative Potentialverschiebungen repräsentieren kortikale Aktivierung, während positive Verschiebungen ein Korrelat kortikaler Inhibition darstellen. Durch Neurofeedbacktraining können LKPs willentlich kontrolliert werden. Das LKP Neurofeedbacktraining wurde bereits erfolgreich eingesetzt, um die Aufmerksamkeit bei Kindern mit ADHS zu erhöhen. Da auch bei Schlaganfallpatienten häufig chronische Beeinträchtigungen der Aufmerksamkeit bestehen, haben wir die Anwendung eines LKP Neurofeedbacktrainings zur Erhöhung der Aufmerksamkeit bei dieser Zielgruppe untersucht. Fünfundzwanzig Schlaganfallpatienten mit chronischen

Beeinträchtigungen nahmen an unserer Studie teil, wobei N=15 das Training beenden konnten. Sie wurden vor und nach dem Training mit den Subtests „Geteilte Aufmerksamkeit“ und „Alertness“ der Testbatterie zur Aufmerksamkeitsprüfung getestet. Das Neurofeedbacktraining bestand aus acht Sitzungen, die innerhalb von zwei bis drei Wochen absolviert wurden. Es zeigte sich, dass die Probanden lernen konnten, ihre LKP willentlich zu beeinflussen und dass sich die Kontrolle über die Zeit hinweg erhöhte. Im TAP Subtest „Geteilte Aufmerksamkeit“ zeigten die Probanden nach dem Training weniger Auslassungen als vor dem Training. Um Rückschlüsse über die mögliche Anwendbarkeit des LKP Neurofeedbacktrainings bei Schlaganfallpatienten zur Erhöhung der Aufmerksamkeit ziehen zu können, bedarf es weiter Forschung mit größeren Fallzahlen und angemessener Kontrollgruppe.

Poster C22

Independent effects of weight loss and negative energy balance on cognitive performance and gray matter density in obese older women

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Nutritional modifications such as caloric restriction have been suggested to exert beneficial effects on brain function and structure. However, it is unclear whether these effects are caused by “reduced weight” or “negative energy balance.” To answer this question, we investigated changes in cognitive performance and gray matter density (GMD) in 19 obese postmenopausal women a) immediately after a 12 week formula diet intervention (T2; weight loss and negative energy balance) and b) after a period of subsequent weight maintenance (T3; weight loss and balanced energy homeostasis) compared to a control group (n=18). The intervention group showed significant weight loss at T2 (mean 13.45 kg ± 3.08) and was able to maintain reduced weight. This group also showed improvements across different cognitive domains (attention, verbal fluency, memory; all p's < 0.05) and increased GMD in bilateral inferior frontal gyrus (p<0.05, FWE-corrected) at T2, but not at T3 in comparison with the control group. These results support the hypothesis that caloric restriction rather

than weight loss has beneficial effects on brain function and structure. We also found a decrease in GMD in bilateral gyrus rectus, left post-central gyrus, and cerebellar vermis. GMD in the vermis was still reduced at T3 in the intervention compared with the control group, indicating the impact of this brain region in the permanent regulation of nutritional behavior. Since cognitive improvements were specific for weight loss and diminished after weight maintenance, data provide evidence for specific mechanisms initiated by caloric restriction rather than changes in body composition.

Poster C23

Antagonistic size relationship between polar and radial gradients in human visual cortex

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Recent brain-imaging studies have related variability in basic sensory functions to the anatomical and functional characteristics of the associated neural structures. A number of studies focused on the visual domain and found that the size of regions in early visual cortex, especially primary visual cortex (V1) and neighboring areas V2 and V3, are systematically correlated with measures of visual functioning, ranging from acuity, the strength of illusions, working-memory, and attentional functions.

For the identification of regions V1-V3, a procedure called "retinotopic mapping" using functional magnetic resonance imaging (fMRI) is applied, exploiting the systematic organization of the visual-field representation in early visual cortex. The visual system can best be understood in polar coordinates with the fovea as reference point. A coordinate system of visual representation can then be spanned by two axes: (1) the polar axis defined by the angular component around the fixation point, and (2) the radial axis covering different eccentricities. Because these axes are also mapped orthogonally in cortical space, we were wondering how interindividual variations along these axes are related.

We analyzed fMRI retinotopic-mapping data from a large sample of participants (N=52). We charted the lengths of visual areas V1-V3 along polar and radial gradients and investigated the correlation patterns between gradients. We found a strong negative correlation for V1 ($r = -.49$, p

< 0.001) and V2 ($r = -.50$, $p < 0.001$). Our findings suggest that there is an unexpected tradeoff relationship, possibly shaped through developmental mechanisms during cortex formation.

Poster C24

Generalized and differential return of fear – the role of anxiety and stressful life events

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Current treatments for anxiety disorders are effective but the high frequency of clinical relapse remains a major problem. Individual difference factors contributing to relapse risk remain however elusive in humans. In rodents, stressful life events (SLE) have been shown to increase the likelihood for fear relapse, rendering SLEs an interesting candidate for studies in humans. To investigate the role of SLEs in humans, participants (N=84), selected based on their personal history of recent SLEs, underwent a two day classical fear conditioning, extinction and reinstatement paradigm, while functional magnetic resonance imaging (fMRI), skin conductance responses (SCR) and subjective ratings were acquired. We observed consistent differences between both groups in SCRs as well as activation of the anterior insula (AI), a region critically implicated in fear learning and expression. The SLE+ group showed a generalized reinstatement effect (i.e. response enhancement to all CSs) in SCRs and the neural activation of the AI, while reinstatement in SCRs and neural activation of the AI, was differential (i.e. more pronounced responses enhancement for the CS+) in participants without recent SLEs. The same dissociation was observed in individuals characterized by high or low state anxiety in a second study. These results indicate that recent SLEs have the power to affect the processing of aversive stimuli, possibly mediated by state anxiety, at a later time and should therefore be considered in the context of clinical treatment. Particularly, the relapse risk after successful cognitive-behavioral treatment of anxiety might be affected by recently experienced SLEs.

Poster C25**Effects of interpersonal motivation and social context on electrophysiological measures of performance monitoring.**

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Learning from the outcomes of one's own actions is elementary for the guidance of goal-directed behaviour. The ability to internally monitor cues and evaluate external reinforcers determines the adjustment of behavioral patterns towards the most favorable outcome. Importantly, as a product of human interaction, individuals rely on other people's experience and participation when performing daily tasks in an efficient manner. To date, however, the effects individual differences in the degree to which motivationally salient events are evaluated in a social context have often been neglected. This study examined the effects of interpersonal motivation on scalp-recorded midfrontal electrophysiological activity (midfrontal theta) following performance errors (error-related negativity; ERN) and negative feedback (feedback-related negativity; FRN) during social interaction. Participants performed an appetitive task in cooperation or in competition with a virtual participant. ERN amplitudes were greater in the competition group. In contrast, in the cooperation group only achievement motivated participants elicited enhanced ERN amplitudes, whereas low achievement motivation was associated with decreased amplitudes. FRN was most negative following unpredicted negative feedback, when the second actor committed an error. Further, participant's social motivation significantly affected the magnitude of the FRN. High social motivation was associated with enhanced amplitudes following unpredicted negative feedback. Results indicate that subjects evaluate information regarding own and other's performance depending on their social disposition and contextual embedding. The present study highlights the importance of individual differences in performance evaluation and elucidates the complex dynamic interaction between individuals' motivation and social context.

Poster C26**Execution of facial tic-like movements in Tourette patients is not decelerated by incompatible visual stimuli**

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Tics can be triggered in Tourette patients by watching tics of other patients, or single voluntary movements. This automatic imitation of movements is termed "echopraxia" and has been ascribed to a failure to inhibit normal imitation tendencies. The aim of this study was apply the imitation-inhibition paradigm to facial tics in Tourette patients in order to investigate whether Tourette patients fail to inhibit automatic imitation tendencies when tics are concerned.

The present study investigated 16 GTS patients and 21 healthy controls, using an adapted version of the imitation-inhibition paradigm. Patients were asked to respond to two different auditory tones with either a facial movement that was part of their tic repertoire (tic-like movements), or a facial movement that was not (non-tic movement). At the same time, patients were presented with behaviourally irrelevant videos of the two same facial movements, which were either compatible or incompatible with the movement executed by the patient. Movements in healthy controls were matched to patients.

Healthy participants responded faster in compatible than in incompatible trials. GTS patients showed the same effect for non-tic movements. However, their responses were equally fast in incompatible and compatible trials, when the movement they were asked to execute was a tic-like movement. Error rates did not differ between the groups.

The results suggest that tic-like movements are highly overlearned responses that can be triggered without interference by external, incompatible, visual movement stimuli. However, imitation - inhibition processes appear to remain intact in Tourette patients.

Poster C27**Gay men mimic happy faces more expressively than heterosexual men**

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Sexual orientation seemingly affects empathy, with gay men self-describing as more empathic than heterosexual men. Whether such effects are restricted to self-report, or extend to psychophysiological correlates of empathy is currently unknown. The present study thus aimed to investigate the effects of sexual orientation on facial mimicry, which is considered a correlate of empathic processes. Pictures of happy and sad facial expressions of men and women, taken from the Karolinska Directed Emotional Faces Database, were presented to 20 gay and 20 heterosexual men, as well as 20 lesbian and 20 heterosexual women for a duration of 6000 ms. Facial muscle activity was recorded via facial electromyography from the zygomaticus major and orbicularis oculi muscle regions, indicating smiling, and the corrugator supercilii, indicating frowning.

Gay men compared to heterosexual men showed stronger responses to happy faces, reflected in both zygomaticus and orbicularis activity. This effect was observable in response to male (zygomaticus: $p = .002$, orbicularis: $p = .027$) as well as female faces (zygomaticus: $p < .001$, orbicularis: $p < .001$). No effects of sexual orientation were found in women.

The current study demonstrates that gay men show more intense facial mimicry than heterosexual men, particularly in response to happy faces. These results are discussed with regard to evolutionary theories of homosexuality, predicting relatively higher empathic skills and pronounced affiliative motives in homosexual individuals. The study was kindly supported by the DFG (PA937/11-1, LU1905/2-1).

Poster C28**Event-related potentials reveal developmental trajectory of auditory rule learning from infancy to adulthood**

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The acquisition of human grammar crucially involves

the detection of complex patterns in spoken language input. For example, sentences such as “The boy who smiles is called Tim” cannot be understood without the ability to relate non-adjacent linguistic elements to each other. While behavioural studies provide evidence of non-adjacent dependency learning starting from the second year of life, electrophysiological studies antedate this ability to the first half year of life. Yet, it has been shown that adults have difficulties learning non-adjacent dependencies from mere exposure to structured input. Thus, a systematic investigation of the developmental time-course of this ability is needed to understand how basic language-learning mechanisms change across the lifespan. We will present a series of auditory artificial grammar learning experiments with 3-month olds, 2-year olds, 4-year olds and young adults using electroencephalography (EEG). We adapted the classic oddball-design to test non-adjacent dependency learning between syllables. Results evidence that infants possess the ability to automatically detect non-adjacent dependencies between syllables from early on and that this ability changes from an automatic signal-driven learning mechanism in young infants towards attention-based learning in young adults. In conclusion, the ability to detect complex dependencies in the auditory input is argued to be one of the foundations of grammar acquisition, providing the concrete pattern onto which abstract syntactic functions can be mapped later on in development.

Poster C29**Psychophysiologische Korrelate der Herzratenreaktion beim Kaltwasserstresstest**Bachmann, Petra¹; Larra, Mauro F.²; Schilling, Thomas M.²; Best, Daniel²; Schächinger, Hartmut²¹Institut für Psychobiologie, Universität Trier, ²Universität Trier

Der Kaltwassertest („cold pressor test“, CPT) gewinnt in der psychobiologischen Forschung als gut zu standardisierender Stresstest zunehmend an Bedeutung. Er führt zu autonomen und endokrinen Reaktionen, einem deutlichen Blutdruckanstieg sowie einer zwar statistisch signifikanten, zumeist jedoch nur moderaten Erhöhung der Herzfrequenz. Umso erstaunlicher ist es, dass frühere Studien gerade einen Zusammenhang der Herzratenreaktion mit ZNS-vermittelten Stresseffekten (z.B. einer begünstigten Gedächtniskonsolidierung) zeigen konnten.

In der vorliegenden Studie wurde untersucht, inwieweit

die Herzratenreaktion beim Kaltwasserstresstest mit der Selbstwahrnehmung von Erregungs- und Stresserleben korreliert. Insgesamt unterzogen sich 70 Probanden einer Kaltwasser- oder Kontrollprozedur, bei der beide Füße für drei Minuten in eiskaltes (n=35) oder auf 30 Grad erwärmtes (n=35) Wasser eingetaucht wurden. Unmittelbar vor sowie 30 bzw. 150 Sekunden nach dem Eintauchen wurden systolischer und diastolischer Blutdruck, mittlerer arterieller Blutdruck und die Herzfrequenz gemessen. Außerdem erfolgten weitere Baseline-Messungen der physiologischen Parameter vor und nach dem Test sowie subjektive prae- und post-Ratings von Stress, Angst und Erregung und retrospektiv die Selbsteinschätzung von Schmerz und Anspannung.

Kaltwasserstress führte zu signifikanten Erhöhungen der physiologischen und psychologischen Parameter. Nur die Herzfrequenzreaktionen korrelierten signifikant mit subjektiven Stress- und Erregungsbewertungen. Dies galt nicht für die Blutdruckreaktionen. Unsere Ergebnisse belegen einen exklusiven Zusammenhang von Herzratenreaktion und explizit zugänglichen, ZNS-basierten Erregungsprozessen beim Kaltwasserstresstest.

Poster C30

DIE AFFEKTIVE MODULATION VON AKUSTISCH UND TAKTIL AUSGELÖSTEN SCHRECKREAKTIONEN

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Die Schreckreaktion wird durch Bilder mit positiver Valenz abgeschwächt und durch Bilder mit negativer Valenz verstärkt. Während dieses Muster für die akustisch ausgelöste Schreckreaktion vielfach gezeigt werden konnte, bleibt unklar, ob es gleichermaßen für die taktil ausgelöste Schreckreaktion gilt. Ziel der vorliegenden Studie war daher, die affektive Modulation der akustischen mit der affektiven Modulation der taktilen Schreckreaktionen in einem Within-Subjects Design zu vergleichen.

42 Probanden (21 Frauen) wurden 12 positive, 12 negative und 12 neutrale Bilder je 3-mal präsentiert, während entweder akustische (105 dB(A), 50 ms, binaural, weißes Rauschen) oder taktile (10 PSI, 50 ms, bitemporal) oder keine Schreckreize appliziert wurden. Als Indikator für die Schreckreaktion wurde die EMG-Reaktion des Orbi-

cularis Oculi Muskels verwendet.

Es zeigte sich eine Interaktion zwischen der Modalität des Schreckreizes und der Valenz der Bilder: Während sich bei der akustischen Schreckreaktion alle drei Valenzen unterschieden, fand sich bei der taktilen Schreckreaktion kein Unterschied zwischen neutralen und negativen Bildern.

Die Ergebnisse zeigen, dass die affektive Modulation der Schreckreaktion zumindest teilweise von der Modalität des Schreckreizes abhängt. Dies spricht dafür, dass Studien zur affektiven Modulation der Schreckreaktion, die Schreckreize in unterschiedlicher Modalität verwenden, nicht ohne weiteres vergleichbar sind.

Poster C31

How does noninvasive brain stimulation during nocturnal slow wave sleep effect EEG- activity and performance in a visual memory task in healthy older adults?

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Evidences for a beneficial effect of induced weak transcranial slow oscillatory direct current (tSOS; 0.75Hz) on slow wave sleep (SWS), and specifically verbal memory emerged mainly from young healthy adults. Improvements might be modulated by neurophysiological activity related to consolidation (slow oscillations). However, with increasing age sleep is substantial modified and it remains unclear, whether tSOS applied during early nocturnal sleep can enhance endogenous brain activity and improve performance in a non-verbal memory task in older adults. 21 healthy older subjects were tested in a randomized, counterbalanced cross-over design in two consecutive nights comprising either five blocks (5min each) of tSOS (STIM) or no (SHAM) stimulation during the first nonREM phase disrupted by 1-min artifact- and stimulation-free intervals. Before and after nocturnal sleep subjects were asked to memorize as many of 38 pictures and its location as possible. EEG-power spectra were determined for slow oscillations (<1Hz), slow (8-12Hz) and fast (12-15Hz) spindle band of each 1-min interstimulation-interval and 30 and 60min post-stimulation, log transformed and analysed by a rmANOVA. Results indicated impaired overnight visual memory performance after tSOS compared to sham, but no effect for location memory. No effect of tSOS on EEG-

power spectra were found during 1-min interstimulation-intervals, but a delayed impact (60min post stimulation) on frontal slow spindle activity was observed. Results are discussed in the context of altered sleep characteristics during aging and its impact on application of standard tSOS protocol in healthy older adults.

Poster C32

Somatoviszzerale Aktivierung durch Bedrohungsreize

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Ebenso wie für die Emotion Furcht wird für Ekel eine starke motivationale Komponente zur Vermeidung von Bedrohungen postuliert. Es wird angenommen, dass Furcht den Organismus auf Flucht vorbereitet und dass Ekel für die Abwehr von Mikroorganismen mobilisiert. Allerdings sind die Befunde zur Physiologie unter Ekel von den verwendeten Ekelreizen abhängig (Kreibig, 2010). Zudem überlappen sich Ekelreize aus dem Verletzungs- und Kleintierbereich mit Furchtauslösern. Ziel der Studie war es, mit nicht überlappenden Ekel- und Furchtreizen (z.B. Körperausscheidungen, Dunkelheit) zu prüfen, ob die beiden Emotionen trotz der von beiden ausgelösten Vermeidungstendenz differenzierbar sind. Bei N = 114 Studentinnen wurden ein emotionsneutraler Zustand und Ekel oder Furcht anhand von Filmclips und Imaginationskripten induziert. Als abhängige Variablen wurden die selbstberichtete Befindlichkeit sowie 24 somatoviszzerale Variablen erfasst. Die Befunde der Studie werden vorgestellt und diskutiert. Zum Ersten wird eine Replikation der publizierten Physiologie beider Emotionen im Vergleich zu einem emotionsneutralen Zustand erwartet: Eine erhöhte sympathisch-adrenerge Aktivierung unter Furcht sowie eine sympathisch-adrenerg – vagal-cholinerge Koaktivierung unter Ekel. Zum Zweiten wird für die Physiologie unter Ekel sowohl eine breite Vermeidungstendenz als auch ein spezifisches, von Furcht abgrenzbares Aktivierungsmuster erwartet.

Poster C33

Attribution of intent and conduct disorder: functional imaging of the hostile attribution bias in children and adolescents

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The role of the interpretation of social cues is well recognized in the social adjustment process. Specifically with regard to aggressive behavior, studies have consistently reported a correlation between a tendency to interpret hostile intent in others and aggressive behavior patterns. This hostile attribution bias (HAB) has been argued to play a role in the development and maintenance of aggressive responding. To date, however, extremely little is known about the neurological underpinnings of HAB, and very few studies have investigated the neural pathways associated with this bias in children and youth with clinically relevant levels of aggressive and antisocial behavior. The current study therefore seeks to investigate HAB among children and youth with a clinical diagnosis of conduct disorder, with low as well as high levels of callous-unemotional traits, compared to nonaggressive children using functional magnetic resonance imaging (fMRI). Studies investigating the correlates of conduct disorder and aggression have reported differences between individuals with high versus low levels of callous-unemotional traits on behavioral, physiological and neural levels. Therefore, we expect that unique pathways are related to HAB in children and youth with conduct disorder and high callous-unemotional traits compared to those with low callous-unemotional traits and nonaggressive children. Preliminary results show higher levels of HAB among male participants with and without conduct disorder than among female participants. Region of interest analyses will focus on dorsolateral prefrontal cortex, superior temporal sulcus and anterior insula, areas known to be activated in distinguishing between intentional versus accidental harm and during mentalizing tasks.

Poster C34

Neuroplasticity-based training modulated oscillatory dynamics in first-episode schizophrenia patients.

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 Universität Konstanz

Similar cognitive and brain abnormalities in first-episode and chronic schizophrenia patients indicate early onset of psychopathology/pathophysiology, and (all too) frequent functional decline advocates early interventions. Beneficial effects of cognitive remediation have been reported for first-episode patients, while evidence on training effects on brain abnormalities are still limited. The present study examined cognitive test performance (MCCB) and electromagnetic alpha (8-.. Hz) oscillations in an auditory paired-stimulus task in 35 first-episode patients (FE) before and after either 4 weeks neuroplasticity-based training targeting auditory-verbal discrimination, learning and memory (Brain Fitness Program, Posit Science, SF, USA) or treatment-as-usual (TAU). Induced alpha power decrease (considered as signature of neural network readiness for information sampling) around S2 was smaller in FE prior to training than in healthy comparison subjects. This alpha power decrease was larger after BFP, but not after TAU. Three month after training, larger alpha power decrease was still evident in the majority of BFP patients (n = 17), available for follow-up assessment. Cognitive test performance improved similarly in both groups and prevailed over a 3-months follow-up period. Correlations/relationship between change in alpha power and test performance measures did not reach significance. Results emphasize reorganization potential and beneficial effects of cognitive training in FE advocating targeted, neuroplasticity-based training early in the course of illness.

Poster C35

Akuter Stress, HPA-Achse und kognitive Funktionen: Der Einfluss von Aufgabenschwierigkeit auf die Performanz unter psychophysisozialem Stress.

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Der Einfluss von akutem Stress auf kognitive Funktionen wird seit einigen Jahren sehr kontrovers diskutiert und hat

durch die anhaltende öffentliche Debatte auch großen Bezug zum täglichen Arbeitsleben. Unklar ist, unter welchen Bedingungen und bei welchen Aufgaben akuter Stress einen dämpfenden respektive leistungssteigernden Effekt hat. Ein entscheidender Faktor für Richtung und Stärke dieses Effektes könnte die Aufgabenschwierigkeit sein.

In der vorliegenden Studie wurden N= 47 männliche Versuchspersonen dem Socially Evaluated Cold Pressor Test (Schwabe et al., 2008; SECPT) unterzogen und sowohl vor als auch nach dem Stressor mit zwei verschiedenen kognitiven Aufgaben konfrontiert: Das Frankfurter Aufmerksamkeitsinventar (Moosbrugger & Oehlschlägel, 2011; FAIR-2) und die Subskalen „Figurenauswahl“ und „Matrizen“ des Intelligenz-Struktur-Test (Liepmann et al., 2006; IST-2000-R).

Auf den SECPT reagierten n= 18 Probanden („responder“) mit einem signifikanten Anstieg des Cortisolspiegels, während n= 29 Probanden („non-responder“) hormonell nicht auf das Treatment reagierten. Auf Verhaltenzebene zeigte sich für die Leistung im FAIR ein signifikanter Unterschied zwischen den Gruppen ($F_{1,45} = 7.681$, $p = .008$, $\eta^2 = .146$) in der Richtung, dass die Gruppe der responder sich verbesserte, während die non-responder keine Leistungsänderung zwischen den Messzeitpunkten zeigte. In den kognitiv anspruchsvolleren Subtests des IST-2000-R unterschied sich die Leistungsänderung der Gruppen weder für die Figurenauswahl ($F_{1,45} = 3.679$, $p < .061$) noch für die Matrizen ($F_{1,45} = .243$, $p = .625$).

Die vorliegenden Daten legen den Schluss nahe, dass der Einfluss von akutem Stress auf die kognitive Leistung vom Schwierigkeitsgrad der Aufgabe abhängt und dass eine reagible HPA-Achse sich förderlich auf die Aufmerksamkeit auswirkt.

Poster C36

The stimulus onset asynchrony between a startling acoustic stimulus and a visual target decisively modulates the ‘StartReact’ effect

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Simple manual reactions to visual stimuli are faster when the appearance of the imperative target (IT) collides with the presentation of a startling acoustic stimulus (SAS) - a phenomenon called ‘StartReact’ effect. However, so far

only little is known on the impact of the stimulus onset asynchrony (SOA) between IT and SAS regarding response acceleration. Here, we tested the impact of the SOA between IT and SAS in two independent experiments.

In experiment I (n = 35) the SOA between IT and SAS varied from -200 ms (SAS before IT) to +200 ms (IT before SAS) in intervals of 50 ms. In Experiment II (n = 25) the SOA varied from -800 ms (SAS before IT) to 0 ms (simultaneous presentation of SAS and IT) in intervals of 100 ms. IT and SAS only trials served as control conditions. Startle magnitude was assessed using electromyography measures of the orbicularis oculi muscle.

Results experiment I: responses were fastest when the SAS appeared shortly before or simultaneously with the IT (SOA -200 to 0). Response time increased in a linear fashion with increasing SOA when the SAS was presented after the IT (SOA +50 to +200). Results experiment II: response time decreased with decreasing SOA between SAS and IT up to SOA -200, where maximal response acceleration was observed.

Our results indicate that the SOA between IT and SAS decisively modulates the 'StartReact' effect. SAS presented shortly before or simultaneously with the IT may lead to fastest response times.

Poster C37

Effekte falscher Informationen auf die Psychophysiologie im Tatwissentest

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Der verfälschende Einfluss nachträglicher Informationen auf die Erinnerungsleistung wird seit nunmehr knapp 40 Jahren beforscht und gilt als gut belegt. Dennoch gibt es bislang wenig Erkenntnis bezüglich physiologischer Korrelate dieses Phänomens. Ziel der vorliegenden Studie ist es, den Falschinformationseffekt unter Verwendung randomisierten Videomaterials zu replizieren und zu überprüfen, ob sich verfälschte Erinnerungen von echten mittels peripher-physiologischer Maße unterscheiden lassen. Im Rahmen der Studie (N=41) wurde den Versuchspersonen ein Video gezeigt, in dem ein Diebstahl zu beobachten war. Nach Ablauf einer Woche erhielten die Teilnehmer einen Text, der das Video zusammenfasste, dabei jedoch zur Hälfte der tatrelevanten Objekte verfälschende Information enthielt. Im Anschluss sollte das durch den Film

erworbene Wissen verheimlicht werden, während in einem Concealed Information Test (CIT; Lykken, 1959) die physiologischen Reaktionen auf die tatsächlich gesehenen und die verfälschenden Objekte sowie auf irrelevante Vergleichsobjekte erfasst wurden. Gemessen wurden Hautleitfähigkeit, Herzrate, Atemexkursionen und Fingerpuls sowie die Reaktionszeiten. Zur Überprüfung der Erinnerungsleistung folgte eine dreiteilige Erinnerungsabfrage. Die Verhaltensdaten zeigen, dass eine Replikation des Falschinformationseffekts gelungen ist: Verfälschende Objekte wurden subjektiv häufiger erinnert als irrelevante, und die Erinnerungsrate tatsächlich gesehener Objekte wurde durch Falschinformation abgeschwächt.

Neben der Überprüfung der CIT-typischen Reaktionsdifferenzen werden die physiologischen Ergebnisse hier hauptsächlich unter zwei Gesichtspunkten diskutiert: 1. In welchem Ausmaß korrelieren explizites Erinnern und physiologische Reaktion? 2. Inwieweit liefern physiologische Daten inkrementelle Information über die Erinnerungsleistung?

Poster C38

Affective Consequences of Visual Exposure to Exterior Architecture Design Cues

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Exterior architectural arrangements influence the subjective report of aesthetic comfort, pleasantness, and quality of life in residential neighborhood. However, it remains unknown whether such cues are capable to impact emotion on a physiological processing level. This study focused on the well validated "affective startle modulation" model. It was expected that visual foreground stimuli (pictures of exterior architectural arrangements) enhance or reduce somatic (eye blink) responses to binaural background acoustic startle probes (105 dB) according to the pictures' affective content. Pictures were carefully matched to show attractive and unattractive architectural arrangements of similar geographical areas. Thirty-three participants were instructed to imagine either to live in the neighborhood of the depicted scenes ("residential"), or to travel through. A mixed design, two-factorial ANOVA revealed startle enhancement by unattractive exterior arrangements only in

“residential” subjects. The presented data indicate that, depending on cognitive context, visual exterior design cues are capable to induce aversive affective psychobiological consequences.

Poster C39

Working Memory Load Dependent Modulation of Lateralized Alpha Oscillations

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Lateralized presentation of visual stimuli is known to elicit hemisphere-specific brain responses. Related changes in the time-frequency domain are most commonly found in the form of lateralized alpha band activity (7 – 13 Hz; van Dijk et al., 2010). In accordance with the suggested role of alpha oscillations in inhibition (Jensen & Mazaheri, 2010), alpha power is found to be lower in regions contralateral to a relevant stimulus than in regions ipsilateral to a relevant stimulus during task performance.

The present MEG study aimed to further explore the relationship between visual working memory and alpha power by employing a lateralized Sternberg-task. Participants (N = 15) were asked to remember a lateralized stimulus array of variable size for comparison with a probe stimulus. Consistent with the idea that alpha power is central to resource allocation, increasing demands on working memory were hypothesized to amplify patterns of lateralized alpha activity.

For statistical analysis, alpha power values of a priori selected sensor clusters were fed into a repeated measures ANOVA. A three-way interaction of stimulus position x hemisphere x load revealed that alpha lateralization was indeed more pronounced during higher task loads.

The magnitude of alpha lateralization is sensitive to the demands of a task (e.g. working memory load), supporting the hypothesized role of alpha lateralization as a relevant indicator of resource allocation.

Poster C40

A behavioral and electrophysiological investigation of the influence of fMRI scanner noise on visual attention processes

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Cognitive functions like visual attention are affected by exogenous factors like stress, motivation, neuroactive substances or noise. Since studies combining EEG and fMRI methods are increasingly applied to investigate cognitive processes in neuroscientific research, it remains unclear to what extent the experimental environment changes cognitive performance. To test effects of scanner noise on visual attention we applied a well-established change detection task that has been used in combination with both EEG and fMRI methods in the past and that is able to distinguish between different processes of selective visual attention. While the EEG was recorded, 24 subjects completed two blocks of the change detection task in which changes in luminance in a fast sequence of visual frames had to be detected. The subjects wore headphones throughout the whole experiment and undertook one block of the task under silence and the other block under simulated fMRI scanner noise. The order of the blocks was alternated across subjects. Noise not only lowered the rate of correct responses in general but also in particular for targets presented on the right display side. Moreover, response times decreased in the second block only if the first block was completed under silence but not under noise. Differences between noise and silence were also reflected in event-related potentials of the EEG. In sum, these findings indicated that fMRI scanner noise is able to affect perceptual learning and visual attention processes.

Poster C41

Visuelle Blockade durch hypnotische Suggestion

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Hypnotherapie nutzt Trance und Suggestion im therapeutischen Kontext erfolgreich und mit empirisch belegter Wirksamkeit, z.B. zur Therapie von Süchten, Belastungs-

störungen und Schmerzen. Allerdings existieren kaum experimentell gesicherte Erkenntnisse über die neurobiologischen Mechanismen des Trancezustandes. Noch weniger ist bekannt, wie Suggestion die Informationsverarbeitung externer Reize so verändert, dass sie eine andere Qualität erhalten. Während erste Studien die neurobiologischen Mechanismen von hypnotischer Analgesie untersucht haben, ist bisher kaum etwas über andere Sinnesmodalitäten bekannt. Die hier präsentierte Studie behandelt den Einfluss von hypnotisch suggerierter visueller Blockade auf die visuelle Wahrnehmung. Versuchspersonen wurden mittels Harvard Group Scale of Hypnotic Susceptibility und Stanford Hypnotic Susceptibility Scale auf ihre hypnotische Suggestibilität getestet. 19 hochsuggestible Personen (Jena) bzw. 12 Versuchspersonen (Trier: 4 niedrig-, 4 mittel-, 4 hochsuggestible) bearbeiteten zwei Mal einen visuellen 3 Stimulus Oddball, einmal mit und einmal ohne hypnotische Trance und hypnotischer Suggestion in ausbalancierter Reihenfolge. Für die hypnotische Suggestion wurden die Probanden zunächst in eine Entspannungstrance gesprochen; anschließend wurde ihnen suggeriert, dass ein Brett ihre Sicht auf den Monitor blockiert. Die Ergebnisse zeigen, dass hochsuggestible Personen unter hypnotischer Trance mit suggerierter visueller Blockade weniger Zielreize zählten. Damit übereinstimmend, zeigen die ereigniskorrelierten Potentiale der Hochsuggestiblen eine deutliche Reduktion der parietalen P3 auf den Zielreiz. Somit beeinflusste die hypnotische Suggestion unter Trance nicht die sensorische Wahrnehmung der Reize, sondern veränderte spezifisch die Aufmerksamkeit und Bewertung des Zielreizes. Diese Replikationsstudien geben einen ersten Hinweis über die Wirkungsweise und neuronale Mechanismen der Hypnose und Suggestion und ihre Wechselwirkung mit Suggestibilität, einem stabilen Persönlichkeitskonstrukt.

Poster C42

Statistical context and sensory stimulus properties dynamically interact during feature-based attentional control

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Selecting relevant from among competing information is

a fundamental operation of the brain. Sensory properties as well as stimulus relevance influence this process. Here we investigate the interaction of these two factors in three different versions of a feature-based attention task (each performed by n=20 subjects). The color of a target stimulus was cued perceptually, verbally, or semantically. The percentage of cue validity (%CV, i.e., the probability that the cue indicates the target's color correctly) changed unpredictably between 50, 70 and 90%. Reaction times (RTs) for valid and invalid trials in each %CV condition were recorded and analyzed with analyses of variance. The results showed that probabilities significantly affected attention, with higher RT costs for invalid cueing associated with higher %CV. Importantly, this modulation depended upon the sensory cue properties and the time on task: while a strong impact of %CV was found for semantic cueing in both halves of the experiment, the effect solely emerged in the second half of the experiment for perceptual and verbal cueing. Our data suggest that adding a top-down guided attentional modulation by probabilities is more difficult with more automatic cue processing. However, with more observations and exposure to volatile contingencies, these probability-dependent effects can still be initiated. These results demonstrate that feature-based attentional mechanisms cannot be ascribed to purely sensory or top-down influences. Instead, our data suggest that the impact of top-down and bottom-up factors in attentional control is flexible and is dynamically concerted with statistical regularities in the environment.

Poster C43

Separable mechanisms for reward-guided learning

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An organism's ability to learn from behavioural outcomes is central to its evolutionary success. Important progress has been made in understanding the computations underlying reinforcement learning, but these models begin with a fundamental assumption - that organisms can attribute each outcome to the behaviour that caused it. Results of recent lesions studies have challenged this assumption, suggesting that learning is possible even when this simplest assumption is not met, and that these non-contingent

mechanisms dominate behaviour when lesions are made to the lateral orbitofrontal cortex (LOFC).

We used novel reward-guided learning paradigms in two functional magnetic resonance imaging studies to show that humans deploy separable learning mechanisms that operate in parallel. While behaviour was dominated by contingent learning, it also revealed hallmarks of non-contingent learning strategies. The latter consisted of i) a non-contingent attribution to proximal choices (PROX), ii) a smooth spread of effect to both ii) the recent history of choices (SoEc) and iii) the recent history of rewards (SoEr).

A network of brain regions centred on LOFC mediated the balance between these individual learning mechanisms. LOFC supported contingent learning by encoding contingent associations between outcomes and their causal choices. In contrast, amygdala responding to non-contingent rewards prevented non-contingent learning via either PROX, SoEc and SoEr. Finally, learning from PROX was driven by timing-dependent reward responses in dorsolateral striatum, a region classically associated with model-free learning. These results point to the existence of several, independent mechanisms for reward-guided learning, of which only one indeed relies on contingent associations.

Poster C44

Mindfulness Meditation Facilitates the Formation of Expert Networks: A Steady State Visually Evoked Potential Study

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Mindfulness meditation increases performance on attention-related tasks and has wide-ranging benefits for physiological and psychological well-being. However, some of these effects might be explained by general stress reduction rather than improvements that are specific to mindfulness practice. To address this question we investigated whether enhanced sustained visuospatial attention is unique to mindfulness meditation or can also be accomplished by stress-reducing relaxation training. Furthermore, we were interested in the neural mechanisms by which a more efficient use of attention resources can be achieved. Specifically, we hypothesized functional neural changes resulting in an optimized distribution of atten-

tional resources through regular practice of mindfulness meditation. We measured the behavioral performance of 41 subjects during an multiple object tracking task while simultaneously recording EEG, in particular the steady state visually evoked potential (SSVEP) elicited by the flickering moving objects. After the first testing sessions participants either engaged in an eight-week mindfulness meditation training or took part in a progressive muscle relaxation program. After the training the meditation group scored higher on the behavioral attention measure than the control group while exhibiting reduced SSVEP amplitudes. The reduction of the SSVEP after training in mindfulness meditation suggests the formation of specific expert networks, which enable more efficient use of attentional resources.

Poster C45

Neuronale Korrelate emotionaler Ablenkung auf kognitive Leistung bei der Posttraumatischen Belastungsstörung und Trauma-Kontrollen

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Hintergrund: Die Posttraumatische Belastungsstörung (PTBS) ist einerseits durch eine erhöhte Reaktivität und Sensitivität gegenüber emotionalen Stimuli und andererseits durch eine beeinträchtigte Kontrolle diese Reize zu inhibieren charakterisiert. Einige Studien weisen auf ein dysfunktionales Netzwerk bei der Verarbeitung emotionaler Stimuli hin, welches durch eine Hypoaktivität präfrontaler Bereiche und einer Hyperaktivität limbischer Regionen gekennzeichnet ist. Ziel der vorliegenden Studie ist es die Auswirkung emotionaler Ablenkung auf kognitive Funktionen bei PTBS-Patientinnen im Vergleich zu traumatisierten, aber gesunden Kontrollprobandinnen zu untersuchen und die entsprechenden neurofunktionellen Korrelate zu vergleichen.

Methode: Bisher wurden 28 weibliche Personen mit interpersoneller Traumatisierung vor dem 18. Lebensjahr, die eine PTBS entwickelten eingeschlossen und 20 Probandinnen, die in Folge des Traumas keine psychische Störung zeigten. Um die emotionale Ablenkbarkeit zu untersuchen, wurde eine klassische und emotionale Stroop-Aufgabe mit Trauma-, negativen-, neutralen- und

Farbwörtern während der funktionellen Magnetresonanztomographie durchgeführt.

Ergebnisse: Erste Ergebnisse zeigen, dass PTBS-Patienten im Vergleich zu Trauma-Kontrollen eine erhöhte Interferenz (längere Reaktionszeiten, mehr Fehler) bezüglich Trauma-Wörtern verglichen mit den anderen Bedingungen aufweisen. Neuronal zeigte sich eine verminderte Aktivierung in präfrontalen Arealen (Medialer Frontaler Gyrus) und eine differentiell erhöhte Aktivierung in emotionsverarbeitenden (dorsaler Anteriorer Cingulärer Cortex, Insula) Arealen bei der Verarbeitung Trauma-assoziiierter Wörter.

Schlussfolgerung: Insgesamt scheint die Diagnose einer PTBS sowohl auf behavioraler als auf neuronaler Ebene mit einer erhöhten Interferenz für Trauma-relevante Stimuli einherzugehen. Mögliche Veränderungen dieses Musters durch Psychotherapie werden diskutiert.

Poster C46

Impaired executive control in patients with obsessive-compulsive disorder: further evidence from an affective antisaccade task

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Deficient performance in the antisaccade task has repeatedly been observed in patients with obsessive compulsive disorder (OCD), indicating deficits in executive control. Furthermore, anxious subjects are known to exhibit heightened biases towards fear-related stimuli, resulting in impaired performance when such stimuli are employed in cognitive control tasks. Building on these findings, the present study aims to investigate whether OCD patients' deficits in executive control become more pronounced when emotional stimuli are presented. Pro- and antisaccade performance of 22 OCD patients and 35 healthy control subjects was assessed using facial stimuli displaying fear, disgust, and neutral expressions as peripheral targets. Cases and controls were matched for age, gender, education and verbal intelligence. In line with previous research, OCD patients showed increased antisaccade error rates as compared to control subjects. Groups did not differ with respect to pro- and antisaccade latencies. Notably, neither cases' nor controls' antisaccade performance was signifi-

cantly modulated by the emotional content of the stimuli. While these preliminary results do not provide support for an increased processing of affective stimuli in OCD, larger samples will allow to parse the phenotypic heterogeneity of OCD, and to examine whether an affective modulation of saccade measures is present in OCD subgroups. On the whole, the results of the present study add to the growing evidence suggesting an impairment of frontostriatal functioning in OCD patients.

Poster C47

Neural correlates of maintaining constructed objects in visual working memory

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How are visual objects that have been constructed from object features through mental imagery maintained in working memory (WM)? Here, we compared two conditions of WM maintenance that only differed in how the WM contents were created. Participants maintained objects in visual WM that they either had to create out of single features or that were presented to them as complete objects. The complexity of the objects varied parametrically between two and four features. Upon a button press, the object should subsequently be matched to a comparison object. We analyzed EEG phase coupling as a measure of cortical connectivity in a 1s interval before the comparison object appeared, because during this interval both groups maintained essentially the same objects in visual WM, but with the maintenance of the constructed objects possibly requiring increased neural coupling. Increased coupling between (predominantly left) frontal and occipital cortical sources was found for the maintenance of constructed in comparison with presented objects in the theta, alpha, beta, and gamma frequency bands. Furthermore, in the higher frequency bands beta and gamma, increased frontal coupling was observed for increased stimulus complexity. We interpret these findings as a stronger communication of frontal executive areas with the visual cortex that is required when objects have to be maintained in visual WM that have been constructed from object parts through mental imagery.

Poster C48**Electrophysiological differences between confident and not-confident responses in a spatial working memory task**

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Behavioral studies suggest that the analysis of response accuracy combined with confidence ratings (correct/confident, correct/not-confident, incorrect/confident, incorrect/not-confident responses) allows one to dissociate working memory encoding and maintenance processes in the delayed response task. To further test this hypothesis, we used electroencephalography in healthy participants and investigated neural activity during working memory encoding and maintenance in relation to these four response types in a spatial delayed response task. Participants were presented with a sample array of three bars and asked to remember their orientations. After a retention interval, one of the three bars appeared again and participants indicated whether the bar was rotated clockwise or counter-clockwise relative to the sample presentation. After their decision, participants rated their confidence level for their response, separately for each trial. During the encoding phase, event-related potential components associated with the perceptual processing of the stimuli (N1 and N2pc) showed reduced amplitudes during not-confident vs. confident trials. This was found for correct and incorrect trials. During the retention interval, the contralateral-delay activity was reduced for correct/not-confident compared to correct/confident responses, providing a neural indicator of guessing. These preliminary findings suggest that the quality of encoding and maintenance processes determines subjectively rated response confidence. Our findings thus help to better understand the processes that contribute to different responses in working memory tasks. Combining performance data with confidence ratings may be a useful behavioral approach to dissociate the component processes of working memory that are otherwise difficult to separate in behavioral studies.

Poster C49**EEG alpha-band resting-state connectivity encodes stable preference for social outcomes in humans**

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Johann Wolfgang Goethe Universität

Humans display individual differences in cooperative behaviour. While an ever-growing body of research has investigated the neural correlates of task-specific cooperation, the mechanisms by which situation-independent, trait-related differences in cooperation render behavior consistent across a wide range of situations remain elusive. Addressing this issue, we show that the individual tendency to behave in a prosocial or individualistic manner when sharing resources – commonly termed Social Value Orientation (SVO) – can be predicted from human resting-state connectivity measured using Electroencephalography (EEG).

Specifically, we were able to predict SVO with high accuracy based on EEG brain-electrical resting-state connectivity in 58 healthy adults (26 individualists; 32 prosocials) using a linear Gaussian Process Classifier in a leave-one-out framework. We show that brain electrical connectivity in the alpha frequency range drives classification.

Using eLORETA source localization, we additionally identify brain networks encoding SVO and compare the results to recent studies using fMRI.

Our results shed light on the neural mechanisms underlying individualists' and prosocials' habitual social decision-makings by identifying temporal and anatomical characteristics of resting-state dynamics encoding stable cooperative behavior.

Poster C50**Large Scale Sleep EEG Data Analysis of Slow-Waves and its Cross Frequency Coupling with Memory-Related Oscillations**

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Universität Zürich

Sleep is a crucial state of the human condition. And although we spend about a third of our lives in this passive state of reduced consciousness, there is still debate about

the core function of it. Retention of memory is one process that has been identified to benefit strongly from sleep. Especially slow-wave sleep (SWS) has been shown to facilitate memory consolidation. Conversely, learning leads to an increase in slow-wave activity (SWA). The co-occurrence of spindle activity with slow-waves is proposed to be a crucial mechanism for memory consolidation, which is mechanistically not fully understood yet.

This research focuses on the analysis of slow-waves recorded with EEG during sleep in a large dataset (938) of healthy young subjects. Typically SWA is reported as activity in the delta (0.5-4.5Hz) frequency band. Here, the actual slow-waves in the EEG signal are detected and analyzed. Additionally we look at their cross-frequency coupling to supposedly memory-related oscillations, such as slow and fast spindles and theta activity.

These findings will be related to the results of a pictorial memory task. Additionally gender and age differences, as well as changes of slow-wave properties over the course of the night will be shown.

Understanding the properties of slow-waves and their relation to higher frequency oscillatory events will lead to important insights into the mechanisms of memory consolidation during sleep.

Poster C51

Beschreibung der Fehlernegativität durch Gammafunktionen: Prüfung ereigniskorrelierter Potentiale jenseits von Peak- und Flächenparametern

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In der Forschung zu Ereigniskorrelierten Potentialen (EKP) werden zur Hypothesenprüfung oft die lokalen Maxima oder Minima von EKP-Komponenten (Peaks) der untersuchten Probanden genutzt, um verschiedenen experimentellen Bedingungen gegeneinander auf Signifikanz zu testen.

Da die Höhe der Peaks einer Komponente von verschiedenen Aspekten abhängig ist (z.B. vom Peak der unmittelbar vorangehenden Komponente) werden auch peak-to-peak Analysen oder Flächenbestimmungen (area-under-the-curve) als weitere Indikatoren in der Hypothesentestung eingesetzt.

Die summierte neuronale Aktivität eines spezifischen

funktionalen Areal des Neocortex ist für die Entstehung einer EKP-Komponente verantwortlich. Sowohl die Anzahl der aktivierten Neuronen als auch die Dauer ihrer Aktivierung kann, in Abhängigkeit der experimentellen Bedingungen, unterschiedlich sein. Dies kann sich nicht nur auf die Höhe der Peaks, sondern auch auf die Form und den Aktivierungsanstieg der Komponente auswirken. Diese spezifischen Informationen gehen sowohl bei Analysen klassischer EKP-Parameter als auch bei Independent-Component-Analysen verloren.

In unseren Untersuchungen prüften wir, an Daten aus einer Kraftproduktionsaufgabe (N=52) und einer klassischen Flanker-Aufgabe (N = 84), den Einsatz von Gammafunktionen zur Beschreibung der Form der medialfrontalen Aktivität (z.B. Fehlernegativität). Hierfür wird eine Gammafunktion mithilfe einer grid-und-simplex-search Funktion an die EKP -Komponente angepasst. Nach der Anpassung ergeben sich für jeden Probanden drei individuell optimierte Parameter der Gammafunktion (Rate, Shape, Skalierung). Diese Parameter können anschließend statistisch geprüft werden. Die Möglichkeiten (z.B. Test von spezifischen Annahmen neuronaler Modelle) und Grenzen dieser ergänzenden Methode zur EKP-Analyse werden vorgestellt und diskutiert.

Poster C52

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

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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. On this poster, 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 du-

ring action cascading and leads to faster responses when two actions are 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 80 mg of synthetic GABA or 80 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 causal role of the GABA-ergic system in modulating performance in action cascading.

Poster C53

Oscillatory signatures of crossmodal congruence effects: An EEG investigation employing a visuotactile pattern matching paradigm

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Coherent percepts emerge from the accurate combination of inputs from the different sensory systems. There is an ongoing debate about the neurophysiological mechanisms of crossmodal interactions in the brain, and it has been proposed that transient synchronization of neurons might be of central importance. Oscillatory activity in lower frequency ranges (< 30 Hz) has been implicated in mediating long-range communication as typically studied in multi-sensory research. In the current study, we recorded high-density electroencephalograms while human participants were engaged in a visuotactile pattern matching paradigm and analyzed oscillatory power in the theta- (4-7 Hz), alpha- (8-13 Hz) and beta-band (13-30 Hz). Employing the same physical stimuli, separate tasks of the experiment either required the detection of predefined targets in visual and tactile modalities or the explicit evaluation of cross-modal stimulus congruence. Analysis of the behavioral data showed benefits for congruent visuotactile stimulus combinations. Differences in oscillatory dynamics related to crossmodal congruence within the two tasks were observed in the beta-band for crossmodal target detection, as well as in the theta-band for congruence evaluation. Contrasting ongoing activity preceding visuotactile stimulation between the two tasks revealed differences in the alpha- and beta-band. Source reconstruction of between-

task and within-task differences showed prominent involvement of premotor cortex, supplementary motor area, somatosensory association cortex and the supramarginal gyrus. These results add to the increasing evidence that low frequency oscillations are functionally relevant for integration in distributed brain networks, as demonstrated for crossmodal interactions in visuotactile pattern matching in the current study.

Poster C54

Veränderungen neuronaler Korrelate der Emotionsregulation durch Distraction bei Dialektisch-Behavioraler Therapie der Borderline-Persönlichkeitsstörung

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Hintergrund: Dialektisch-Behaviorale Therapie (DBT) gilt als eine State-of-the-Art Psychotherapie für Patienten mit Borderline-Persönlichkeitsstörung (BPS). Sie fokussiert unter Anderem auf den Erwerb von Emotionsregulationsfähigkeiten. Mögliche Fertigkeiten für den Umgang mit intensiven Gefühlszuständen sind die kognitive und die sensorische Distraction. Bisher wurde jedoch noch nicht untersucht, ob sich nach DBT die neuronalen Korrelate der Fähigkeit, sich von aversiven Reizen ablenken zu können, verändern.

Methode: BPS-Patientinnen sahen zu Beginn und Ende einer 12-wöchigen DBT-Behandlung während funktionseller Kernspintomographie negative und neutrale Bilder und führten in der Hälfte der Durchgänge gleichzeitig eine Arbeitsgedächtnisaufgabe durch oder wurden durch einen Hitzereiz abgelenkt. Als Kontrollgruppe nahmen gesunde Kontrollprobandinnen und BPS-Patientinnen, die nicht in DBT-Behandlung waren, im gleichen zeitlichen Abstand teil.

Diskussion und Ergebnisse: Die Patientinnen zeigten nach DBT im Vergleich zu Patientinnen ohne DBT sowie zu gesunden Kontrollprobandinnen Veränderungen im supramarginalen Gyrus, der mit emotionaler Wortverarbeitung assoziiert ist. Hier zeigte sich unter kognitiver Ablenkung eine Reduktion der Aktivität auf negative im Vergleich zu neutralen Bildern. Bei sensorischer Distraction nor-

malisierte sich bei BPS-Patientinnen nach DBT die neuronale Aktivität in der Amygdala. Die Ergebnisse deuten darauf hin, dass die DBT bei BPS mit einer Veränderung der neuronalen Korrelate des negativen Gefühlslebens einhergeht.

Poster C55

Personality traits and strategy adaptation in action cascading

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Every day, we need to apply different action control strategies to successfully interact with ever-changing environments. In situations requiring several responses, we often have to cascade different actions. Though the strategies used to accomplish this have been investigated frequently, it has remained rather unclear if these strategies are dependent on personality traits and to what degree these strategies are adapted while performing a task. Furthermore, we do not know if such adaptations are subject to differential effects depending on an individual's preferred initial strategy to cope with multiple-demand situations. Participants completed the NEO-FFI and performed an experimental (stop-change) paradigm assessing action cascading. The results show that the initial strategy used is selectively affected by conscientiousness, which should hence be seen as a major personality dimension modulating action cascading strategies. Highly conscientious people showed a more effective, step-by-step processing strategy. Using Bayesian analyses, we were able to show that even though the applied strategy is subject to slight modulations over the course of an action cascading task, this shift is equally strong for all subjects, irrespective of their general action cascading strategy.

Poster C56

Stress beeinträchtigt die visuelle Wahrnehmung von Landschaften, nicht aber von Gesichtern.

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In den letzten Jahren häufen sich die Hinweise darauf, dass der mediale Temporallappen (MTL) nicht ausschließlich

für das Langzeitgedächtnis verantwortlich ist, sondern auch an visueller Wahrnehmung beteiligt ist. Befunde zeigen, dass der MTL insbesondere dann involviert ist, wenn die Wahrnehmung eine hohe Komplexität aufweist. Innerhalb des MTL wird eine funktionelle Gliederung zwischen dem Hippocampus, der an der Wahrnehmung von räumlichen Szenen beteiligt ist, und dem perirhinalen Cortex angenommen, der an der Wahrnehmung von Gesichtern und Objekten beteiligt ist.

Aufgrund einer hohen Dichte an Mineralo- und Glucocorticoidrezeptoren im Hippocampus sind hippocampusabhängige kognitive Funktionen anfällig für den Einfluss des Stresshormons Cortisol. Während dieser Einfluss auf Gedächtnis und andere Funktionen gut belegt ist, sind keine Befunde zum Einfluss auf hippocampusabhängige Wahrnehmungsprozesse bekannt. Wir erwarten, dass die Wahrnehmung von Landschaften, insbesondere mit hoher Komplexität, beeinträchtigt wird, während Gesichter unbeeinträchtigt bleiben.

Es wurden fünfzig männliche Probanden getestet, die entweder dem stressvollen sozial evaluierten Kaltwassertest (SECPT) oder einer Kontrollbedingung ausgesetzt wurden. Die Wirksamkeit des Stressors wurde anhand der Analyse von Speichelcortisol zu vier Zeitpunkten geprüft. Im Anschluss daran sollten die Probanden in einer visuellen Diskriminationsaufgabe mit einer schwierigen und einer leichten Bedingung aus jeweils drei Gesichtern oder Landschaften den Reiz auswählen, der sich von den anderen beiden unterscheidet. Es konnte gezeigt werden, dass sich Stress negativ auf die Wahrnehmung von Landschaften der schwierigen Bedingung auswirkt, die leichte Bedingung und Gesichtern bleiben davon jedoch unbeeinträchtigt.

Die Ergebnisse der Studie können erstmalig zeigen, dass Stress neben dem Einfluss auf Gedächtnisfunktionen auch reizspezifische Beeinträchtigungen hippocampusabhängiger Wahrnehmung zur Folge hat.

Poster C57

Der Einfluss von frühen Gewalterfahrungen der Mutter auf die Mutter-Kind-Interaktion und assoziierte neuronale Korrelate

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Einleitung: Gewalterfahrungen in der Kindheit können tiefgreifende und langanhaltende psychische und biologische Folgen haben und sich so auf die spätere Mutter-Kind-Interaktion auswirken. Hierbei spielen eine verringerte Sensitivität traumatisierter Mütter gegenüber Emotionen ihres Kindes und eine reduzierte Fähigkeit zur Regulation von Emotionen eine wichtige Rolle. Dies könnte mit einer veränderten Aktivität in fronto-limbischen Hirnregionen zusammenhängen.

Methode: Mütter mit (n=24) und ohne (n=25) körperliche oder sexuelle Gewalterfahrungen in der eigenen Kindheit und ihre Kinder (6-12 Jahre) nahmen an der Studie teil. In einem funktionellen Magnetresonanztomographie-Experiment bestand die Aufgabe der Mütter in der Imagination von schwierigen und angenehmen Interaktionen mit dem eigenen und mit einem fremden Kind. Darüber hinaus wurde die Mutter-Kind-Interaktion in einer echten, standardisierten Situation erfasst. Zusätzlich wurden Cortisol- und Oxytocin-Werte erhoben.

Ergebnisse: Bisherige Ergebnisse zeigen eine reduzierte mütterliche Sensitivität und erhöhte Feindseligkeit in der Mutter-Kind-Interaktion bei Müttern mit frühen Gewalterfahrungen, die sich neurobiologisch in einer veränderten Aktivität in fronto-limbischen Hirnregionen widerspiegelt. Die Ergebnisse werden zudem mit Cortisol und Oxytocin in Zusammenhang gebracht.

Poster C58

Angstsensitivität, ein Endophänotyp der Reaktivität im „Human Open Field Test“?

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Hohe Angstsensitivität wird derzeit als potenzieller Endophänotyp, d.h. als genetisch verankerte Vulnerabilität für die Entwicklung von Angststörungen, diskutiert. Studien zur Exposition bei Agoraphobie deuten auf Zusammen-

hänge zwischen hoher Angstsensitivität und angststypischem Vermeidungsverhalten hin.

Um zu untersuchen ob hohe Angstsensitivität ein prä-morbider Risikofaktor für agoraphobische Tendenzen ist, wurden N=18 Versuchspersonen ohne psychische Störungen mit hohen (n = 10) vs. niedrigen Werten (n = 8) auf dem Angstsensitivitätsindex (ASI) identifiziert und mit einer agoraphobischen Bedingungen konfrontiert (Aufenthalt im offenen Feld). Gemessen wurden Verhalten (Wegwahl), Physiologie (Hautleitfähigkeit) und Kognition (Angst- und Arousalratings) zur Baseline, während einer Antizipationsphase am Rand des offenen Feldes und während der Exposition in der Mitte des Feldes.

Im Vergleich zur Baseline wurden vermehrt Hautleitfähigkeitsreaktionen (nSCR) in den ersten 30 Sekunden der Antizipation bei allen Probanden gefunden. Im tonischen Maß (Ledalab: CDA.tonic) hatten die Versuchspersonen mit hohem ASI-Wert zudem erhöhte Werte. Im Gegensatz dazu wurde die Angst nur während der Exposition als erhöht beurteilt. In einem retrospektiven Rating bewerteten die Versuchspersonen mit hohem ASI ihre Angst in dieser Phase zudem signifikant höher als die Probanden mit niedrigem ASI. Im Verhalten zeigten sich keine Gruppenunterschiede.

Die Ergebnisse zeigen sympathische Hyperreaktivität in der Antizipation sowie kognitive Verzerrungen in der retrospektiven Bewertung der anschließenden (physiologisch nicht unauffälligen) Expositionssituation bei Probanden mit hohen ASI-Werten. Bedenkt man aktuelle Erkenntnisse zu genetischen Korrelaten der Angstsensitivität, stützen diese Befunde, dass hohe Angstsensitivität einen Endophänotyp für die Entwicklung agoraphobischer Angst darstellt. Der ASI erscheint zur Identifikation von Personen mit einem erhöhten Risiko für agoraphobische Tendenzen geeignet.

Poster C59

Differentielle Effekte in ERPs für bedrohliche Gesichtszüge.

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Gesichter spielen in der alltäglichen sozialen Interaktion eine bedeutende Rolle. Als neurophysiologische Marker für die kognitive Verarbeitung von Gesichtern haben sich dabei verschiedene Ereigniskorrelierte Potentiale etabliert,

wie die N170, die EPN, oder die LPP. Des Weiteren konnte schon mehrfach gezeigt werden, dass diese EKPs sowohl durch den emotionalen Gesichtsausdruck, als auch durch kontextuelle Faktoren moduliert werden. Zu einem sehr wichtigen Faktor, der individuellen Ängstlichkeit, und ihren Einfluss auf die Verarbeitung von wütenden Gesichtern ist die Befundlage jedoch ziemlich spärlich und die Ergebnisse recht widersprüchlich.

Deswegen untersuchten wir, wie sich Angst als Eigenschaft oder Zustand auf die neuronale Verarbeitung struktureller Gesichtsinformationen (N170) und emotionaler Gesichtsinformationen (EPN & LPP) auswirkt. Dazu wurden an 168 Versuchspersonen EEG Messungen vorgenommen während sie eine Gender Discrimination Task bearbeiteten, bei der ihnen wütende und neutrale Gesichter präsentiert wurden. Zudem wurde der Hälfte der Probanden mitgeteilt, dass sie am Ende des Versuchs eine freie Rede halten sollten, was nachweislich zu einer Erhöhung ihrer Zustandsangst führte. Die Eigenschaftsangst der Versuchspersonen wurde mittels Fragebögen erfasst.

Dabei konnten wir weder für die N170 noch für die LPP eine Modulation durch die Eigenschaft- oder Zustandsangst der Probanden nachweisen. Lediglich die EPN wurde durch die individuelle Ängstlichkeit der Probanden moduliert, die dabei gefundenen Effekte zeigten sich jedoch nur schwach und unabhängig von dem wahrgenommenen Gesichtsausdruck. Aufgrund der großen Stichprobengröße können wir so belegen, dass die neuronale Verarbeitung wütender Gesichtsausdrücke weitgehend unabhängig von der interindividuellen Ängstlichkeit erfolgt.

Poster C60

Brain activation to threat-related visual scenes in Generalized Anxiety Disorder

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Generalized anxiety disorder (GAD) is characterized by chronic, excessive and uncontrollable worry about a variety of topics. Patients report greater perceived intensity of emotional experiences, state to feel more threatened by, and less in control of emotions and experience difficulties in recovering from a negative mood state. Although GAD is one of the most frequent anxiety disorders, it is

still poorly understood from a neurobiological point of view how patients perceive complex daily-life scenes. To keep the ecological stimulus validity as high as possible, we chose threat-related and neutral complex scenes from the International Affective Picture System (IAPS) and implemented these in an emotion-irrelevant detection task using functional magnetic resonance imaging (fMRI). GAD patients experienced both aversive and neutral scenes as more arousing and particularly aversive scenes as more anxiety-provoking than healthy controls (HC). FMRI results reflect the rating data, in that GAD patients versus HC exhibited a limbic hyperactivity in the left insula, and increased activation in dorsolateral prefrontal cortex (dlPFC) to aversive versus neutral scenes. The insula is generally involved in anxiety, and the dlPFC has been proposed to play a central role in emotion processing and regulation. With an emotion-irrelevant detection task, we show crucial involvement of the insula and dlPFC in the processing of complex visual scenes in GAD.

Poster C61

Interaction between emotion and higher cognition in subclinical schizotypy: an fMRI investigation

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Introduction: Dysfunctional emotion-cognition-interactions play a crucial role in various mental disorders, such as schizophrenia. However, the functional cerebral basis remains poorly understood. We established a new (event-related) fMRI task exploring the interplay between emotion recognition and executive functions. Based on the Wisconsin-Card-Sorting-Test (WCST), we developed an adaption by replacing forms with identity and color by emotional expressions (Emotional-Card-Sorting-Test, ECST). A third control task included neutral faces instead (Facial-Card-Sorting-Test, FCST).

Methods: Based on a screening of N=679 male students, we formed three groups with extremely high (n=20), medium (n=29) and low (n=20) schizotypy values (Five-Factor-Schizotypal-Inventory). All tasks required the matching of a target card to one of four reference cards according to an unknown criterion (ECST/FCST: number, identity, emotion/hair-color). Individual contrast images

containing the parameter estimates of the six different conditions (correct, false in each task) were entered into a second-level repeated-measures-analysis of variance with random effects (GLMflex).

Results and conclusion: No performance differences were found between groups. At a neural level, in addition to the WCST-typical fronto-parietal network, the ECST recruited core regions of facial processing (fusiform gyrus) and social cognition (superior temporal gyrus). Regarding group effects, high schizotypy individuals revealed decreased activation in "cold-cognitive" brain regions (dorsolateral prefrontal cortex) leading to the conclusion that they might devote more cognitive resources to achieve the same performance as low- and medium-scoring. The present work might form the basis for future research applying the ECST in schizophrenia patients as well as psychosis-prone high-risk samples.

Poster C62

Das Neuropeptid Oxytocin moduliert Annäherungs- und Vermeidungsverhalten sozial ängstlicher Männer und Frauen

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Das Neuropeptid Oxytocin beeinflusst die Wahrnehmung und Verarbeitung sozialer Informationen. Bisherige Studien weisen auf anxiolytische, vertrauensfördernde Effekte von Oxytocin hin, welche insgesamt Annäherungs- gegenüber Vermeidungstendenzen zu begünstigen scheinen. Ziel der doppelblinden Placebo kontrollierten Studie war es, den Einfluss von Oxytocin (24 IE, intranasal) auf das Annäherungs- und Vermeidungsverhalten von sozial hoch (N=60) und wenig (N=60) ängstlichen Frauen und Männern zu untersuchen. In dieser fMRT-Aufgabe wurden die Teilnehmer(innen) intruiert, auf fröhliche und ärgerliche Gesichter einen Joystick zu sich heran zuziehen (Annäherung) oder von sich weg zu drücken (Vermeidung). In der Placebobedingung zeigten sozial wenig ängstliche Personen den bereits bekannten „Kongruenzeffekt“: Sie waren schneller in automatisierten Verhaltenstendenzen, d.h. im Annähern auf fröhliche Gesichter (sozial-appetitive Reize) und im Vermeiden ärgerlicher Gesichter (sozial-aversive Reize) und langsamer in Bedingungen, die ein Überwinden dieser automatischen Tendenzen erforderten

(z.B. Annähern auf ärgerliche Gesichter). Bei sozial hoch ängstlichen Personen war dieser Kongruenzeffekt in der Placebobedingung reduziert, während sich sozial hoch ängstliche Personen in der Oxytocinbedingung nicht von den wenig ängstlichen Personen unterschieden (Gruppe x Substanz x Kongruenz-Interaktion $p=.066$). Die Ergebnisse deuten darauf hin, dass Oxytocin zu einer Normalisierung von Annäherungs- und Vermeidungstendenzen bei sozial hoch ängstlichen Personen beitragen könnte. Zum ersten Mal können in der vorliegenden Studie systematisch Geschlechtsunterschiede analysiert werden und gemeinsam mit neuronalen Korrelaten des Verhaltenseffekts während der Überwindung automatischer Verhaltenstendenzen durch Oxytocin diskutiert werden. Die Ergebnisse der vorliegenden Studie könnten nicht nur das Verständnis sozialer Angst verbessern, sondern auch Implikationen für die (pharmako-)therapeutische Behandlung sozialer Phobien haben.

Poster C63

Online Processing of Moral Transgressions: ERP Evidence for Spontaneous Evaluation.

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Experimental studies using fictional moral dilemmas indicate that both automatic emotional processes and controlled cognitive processes contribute to moral judgments. However, not much is known about how people process socio-normative violations that are more common to their everyday life, nor the time-course of these processes. Thus, we recorded participants' electrical brain activity while they were reading vignettes that either contained morally acceptable versus unacceptable information, or text materials that contained information which was either consistent or inconsistent with their general world knowledge. For the latter text materials, knowledge-inconsistent words triggered a larger centroparietal ERP negativity about 300 ms after critical word onset (N400), indicating an influence on meaning construction. By contrast, a larger ERP positivity, starting already at about 250 ms after critical word onset, was elicited by morally unacceptable compared to acceptable words. We take this early ERP positivity to reflect an implicit evaluative (good-bad)

categorization process that is engaged during the online processing of moral transgressions.

Poster C64

Zentralnervöse Verarbeitung von Körpersignalen bei Anorexia nervosa

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Hintergrund: Anorexia nervosa (AN) ist gekennzeichnet durch strenges Fasten und tiefgreifende Veränderungen des Körperbildes. Es wurde mehrfach diskutiert, ob AN mit Veränderungen in der Wahrnehmung und Interpretation von Körpersignalen (z.B. Hunger, Sättigung) und Emotionen einhergeht. Unklar ist bislang, ob Unterschiede zwischen Patienten mit AN und Gesunden bezüglich Interozeption auf veränderte periphere Aktivierung oder veränderte Aufmerksamkeit auf Körperprozesse zurückgehen.

Methodik: Zur Klärung dieser Frage wurden Herzschlag-evozierte Hirnpotenziale (HEP) bei 20 Patientinnen mit AN und 20 gesunden Kontrollpersonen unter zwei Bedingungen erfasst: im Ruhezustand und während einer Herzschlagzähltaufgabe. HEPs gelten als Indikatoren für die kortikale Repräsentation afferenter Signale aus dem kardiovaskulären System.

Ergebnisse: Personen mit AN wiesen in beiden Bedingungen signifikant höhere HEP-Amplituden auf, als Kontrollpersonen. In der Herzschlagzähltaufgabe zeigte sich eine Tendenz zu besserer Herzschlagwahrnehmung bei Patientinnen. Es bestanden keine signifikanten Gruppenunterschiede in Herzrate oder Herzratenvariabilität (HRV). HEP-Amplituden korrelierten positiv mit Essstörungssymptomen sowie mit der Behandlungsdauer.

Diskussion: Die Ergebnisse implizieren eine stärkere kortikale Repräsentation afferenter Körpersignale bei AN. Dieser Effekt lässt sich nicht durch stärkere periphere Aktivierung (z.B. Herzrate, HRV) erklären. Dies steht im Gegensatz zu früheren Befunden einer verschlechterten Herzschlagwahrnehmung bei AN. Es eröffnet sich die Frage, ob verbesserte Interozeption bei Patientinnen als Symptom der Störung zu sehen ist oder als Zeichen der Genesung im Rahmen der stationären Behandlung.

Poster C65

fMRI study of automatized action schemata in nicotine addiction.

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During the course of addiction habitual mechanisms which reflect robust stimulus-response associations gain the control over drug-taking. It has been suggested that the performance of habitual behavior is guided by automatized action schemata, a constellation of stimuli-bound specific skills which ensure the efficient initiation and execution of drug-using behavior. We employed functional magnetic resonance imaging (fMRI) while smokers performed an orientation affordance task which measures automatized reactions by comparing the compatibility between the side of the behavioral response and the orientation of the stimulus. Compatibility between hand and orientation of the graspable part of smoking-related but not control objects activated brain regions involved in habitual learning (striatum) as well as areas implicated in action knowledge and motor planning (premotor cortex, inferior parietal lobule, inferior temporal cortex and fusiform cortex). This demonstrates that smoking-related habits are encoded by subcortical as well as cortical sensorimotor brain regions. In the next phase of this study, a comparison with non-smokers will test our results for group-specific neural activations.

Poster C66

Predicting inter-individual differences in planning performance from transcallosal signal transduction between left and right mid-dlPFC – a TMS-EEG study

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Bilateral mid-dorsolateral prefrontal cortex (mid-dlPFC) is known to subserve higher-order cognitive functions such as planning ability. The strength of structural connectivity between the mid-dlPFC homologs has recently been shown to predict inter-individual differences in planning performance, but the role of mid-dlPFC functional

connectivity in terms of the underlying neurophysiological signal transduction is yet unknown. Here, we assessed transcallosal signal transduction by single-pulse TMS over mid-dlPFC homologs with concurrent EEG recording in a sample of 37 healthy subjects ($M \pm SD$ age 21.7 ± 2.1 years, 22 females). Based on the TMS-evoked EEG potentials in ipsi- and contralateral mid-dlPFC, the area under the rectified curve (AUC, $\mu V \cdot ms$) was used to compute indices of transcallosal inhibition ($AUC_{[contralateral]} / AUC_{[ipsilateral]} * 100$) and lateralization ($(AUC_{[ipsi]} - AUC_{[contra]}) / (AUC_{[ipsi]} + AUC_{[contra]})$). Regression analysis revealed significant associations between planning accuracy (measured Tower of London task) and mean inhibition as well as lateralization indices for right mid-dlPFC stimulation (inhibition: $\beta = .415$, $p = .011$; lateralization: $\beta = .396$, $p = .015$), but not for left mid-dlPFC stimulation (inhibition: $\beta = .128$, $p = .451$; lateralization: $\beta = .234$, $p = .147$). Thus, stronger lateralization/inhibition of signal transduction from right to left mid-dlPFC, but not from left to right mid-dlPFC, was predictive of better planning performance. Therefore, functional segregation in terms of less inter-hemispheric cross-talk, especially from left to right mid-dlPFC, appears to be an important determinant of inter-individual differences in planning performance. The data further corroborate recent assumptions of dissociable contributions of left and right mid-dlPFC in planning and higher-order cognition.

Poster C67

Improved recall in an object-location memory task after 26-week supplementation with long-chain omega3 fatty acids (LC-n3-FA) in healthy older adults

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Object-location memory is critical in every-day life and known to deteriorate early in the course of neurodegenerative disease like Alzheimer (AD). As the process of AD begins years, if not decades, before the diagnosis of clinical dementia, searching for new prevention strategies is of major economic and medical importance. Although basic researches suggest a beneficial effect of LC-n3-FA on learning and memory, evidence from randomized

controlled trials in non-demented subjects is limited. 44 healthy, non-demented subjects (20 female) aged between 50-75 years were included in this double-blind randomized placebo-controlled study. Subjects were randomly assigned to LC-n3-FA (2200mg/day) or placebo capsules intake for 26 weeks. Before and after intervention memory performance in an object-location memory task (learning and recall) was assessed (primary), as well as performance in further standardized cognitive tests, dietary habits, and serum parameters. Successfully supplementation of LC-n3-FA was monitored by the omega3 index. Intervention resulted in a significant increase in omega-3 index in the LC-n3-FA group, as well as improved recall of object locations after LC-n3-FA compared to placebo ($p < .05$). Learning and performance in the secondary cognitive outcome parameters were not significantly affected by supplementation with LC-n3-FA. This study experimentally supports beneficial effects of LC-n3-FA on memory functions. Results encourage further long-term trials that assess whether supplementation may delay cognitive decline in healthy adults as well as individuals with higher risk for AD (Mild cognitive impairment).

Poster C68

Friend or foe: Baseline activation of the right TPJ and individual differences in implicit intergroup bias

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Why are some people more biased than others in their implicit evaluations during social interaction? The dispositional determinants of individual differences in implicit intergroup bias are barely understood. Here, we explored whether heterogeneity might be explained by stable neural traits. For that purpose, the source-localized resting electroencephalograms of 83 participants were correlated with their bias in an in-/outgroup implicit association test. We observed that participants revealing higher baseline activation of the right temporo-parietal junction (TPJ; indicated by low levels of slow-wave oscillations) demonstrated stronger implicit intergroup bias. High baseline activation of a brain region is believed to indicate efficient capacities to mediate specific cognitive processes. Our results thus suggest that individuals with an efficiently-working

right TPJ possess capacities that predispose them towards stronger implicit intergroup bias. As the human species has evolved living in distinct social groups, the capacity to quickly differentiate friend from foe became highly adaptive and thus might constitute an essential part of human nature.

Poster C69

Gaze behavior during the imagination and perception of emotional facial expressions

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When socially anxious individuals look at emotional facial expressions they exhibit attentional biases and hyper-scanning behavior. However, less is known whether these phenomena occur in response to specific facial features or whether they are driven by top-down processes. The present study examined gaze behavior during imagination and perception of emotional facial expressions. Neutral faces served as cues while participants (N=29) were instructed via headphones to imagine the person in emotional states (e.g., happy, angry). As a control task, non-emotional facial features (e.g., eye color, beard) were to be imagined. Then, the face cue was replaced with a blank mask, in which participants had to imagine the person according to the instruction. Lastly, participants viewed emotional expressions. Eye movements during imagery and free viewing were recorded. Scanpath lengths and fixation durations served as indicators of hyperscanning and avoidance. Results revealed longer scanpaths and reduced fixation durations in free viewing compared to imagery condition. Social anxiety correlated positively with scanpath lengths of all emotions during imagery, however, only fear and happy faces in the free viewing condition. Furthermore, social anxiety inversely correlated with fixation durations of all imagined and perceived emotions, even after controlling for trait anxiety. Given that facial expressions are potential source of threat for socially anxious individuals, similarities in threat related gaze behavior when emotional expressions are imagined and viewed, indicate a top down-process in attentional biases. The present paradigm constitutes a new approach to understanding biased information processing in perception and imagination of facial expressions.

Poster C70

Specific and non-specific brain predictors of heart rate and skin conductance responses to social threat

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Stressful situations provoke autonomic nervous system (ANS) activity that has its roots in the fight-flight-response to threat. Heart rate (HR) and skin conductance (GSR) are both measure of autonomic nervous system activity and therefore reactive to stressful events. However, HR and GSR are innervated differentially by the sympathetic and parasympathetic nervous system. These overlapping but yet different pathways of regulation should also be reflected in functional brain activity. This study investigated overlapping and specific brain activity that is predictive for HR and GSR, using machine learning methods. Functional MRI data and psychophysiological data were recorded in 18 participants during a social threat task. Ideographic training (within participants) revealed strong correlations between a HR trained and a GSR trained brain pattern with the actual HR and GSR response ($r_{GSR} = .65$ and $r_{HR} = .59$). Cross-prediction correlations were rather low ($r_{HR \rightarrow GSR} = .21$ and $r_{GSR \rightarrow HR} = .22$), indicating partial specificity of those pattern for each of the two measures. The predictive pattern for the prediction of HR includes mainly the vmPFC as well as some additional areas as the inferior temporal gyrus, the related pattern for the prediction of GSR includes medial frontal gyrus and vmPFC. Difference maps reveal the main pattern differences for the parts of the ACC, whereas according to a searchlight analysis PAG and vmPFC are predictive for both, HR and GSR. The specificity of those brain patterns across different types of stress-provoking situations has yet to be investigated.

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