P-1-1 The computational development of reinforcement learning during adolescence.

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Learning and decision-making do not rely on a unitary system, but instead require the coordination of different building blocks in the form of dissociable computational modules. Here, we aimed to trace the developmental time course of the computational modules responsible for learning from reward or punishment, and learning from counterfactual feedback. Adolescents and adults carried out a novel reinforcement-learning paradigm in which participants learned the association between cues and probabilistic outcomes, where the outcomes differed in valence (reward versus punishment) and feedback was either partial or complete (either only the outcome of the selected option or both the outcomes of the selected and unselected option were displayed). Unlike adult performance, adolescent performance did not benefit from complete information. In addition, while adults learned symmetrically from both reward and punishment, adolescents learned from reward but were less likely to learn from punishment. Computational strategies changed during development: whereas adolescents' behaviour was better explained by a basic reinforcement-learning algorithm, adults' behaviour integrated increasingly complex computational features, namely a counterfactual learning module (to account for the higher performance in the complete feedback context) and a value contextualization module (to account for symmetrical reward and punishment learning). This tendency to rely on rewards and not to consider alternative consequences of actions might contribute to an explanation of risky decision-making.

P-2-2 Connectivity stability in children: associations with externalizing symptoms

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The convergence between Neuroscience and Psychiatry has led to a new paradigm of mental disorders as brain disorders, with main focus on abnormal brain connectivity. However, most studies focus on the identification of intrinsic functional connectivity, assumed to be "static" in time, i.e., without considering possible time-varying properties in the range of seconds. In other words, the temporal dynamic of brain connectivity is often neglected and unexplored. In this study, we investigate time-varying connectivity in resting state fMRI data using graph theory. Our main concern is the temporal stability of control and default-mode networks. Our main hypotheses are two: the networks increases its stability through age and also, that delayed maturation of the networks lead to psychopathological manifestations. We considered resting stage fMRI data of 654 children and adolescents (from 7-15 years old) from the Brazilian 'High Risk Cohort Study for Psychiatric Disorders''. Our psychiatric assessment tool was the Child Behavior Checklist filled by the parents. We built a network maturity index based on time-varying graph measures based on functional connectivity and support vector regression. As expected, we found that time-varying eigenvector centrality is more stable when the children get older. Moreover,

immaturity of the networks was also found to be associated with general psychopathology mainly with externalizing dimensions. We conclude that network maturation during neurodevelopment is a crucial element in understanding the neural substrates of mental disorders.

P-1-3 A longitudinal analysis of developmental change in neural activity for feedback learning

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Learning from feedback is an important ability that develops rapidly in childhood and early adolescence, and has been associated with the development of the fronto-parietal and frontal-striatal learning network. This study tested developmental changes in brain activity during feedback learning using a longitudinal design in which 211 participants between ages 8 and 27 were tested twice across 2 years. Participants performed a learning task where stimuli had to be sorted in one of three locations without knowing the correct rules beforehand. Participants used negative and positive feedback to detect the correct rules (learning phase), and applied these rules in a subsequent application phase. Dorsolateral prefrontal cortex (DLPFC), pre-supplementary motor area (pre-SMA)/anterior cingulate cortex (ACC), superior parietal cortex (SPC) and caudate were recruited more during learning than application, and more during learning from negative than positive feedback. Mixed linear models were used to test linear vs. nonlinear patterns of neurodevelopmental change. In addition, neural activity was used to predict future school performance, highlighting the importance of these findings for school settings.

P-2-4 Appraising and reappraising social ambiguity in adolescence: Individual differences in social anxiety and the recruitment of emotion regulation networks

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(Re)appraising social ambiguity is important for efficient social cognition, emotion regulation and mental health. From a developmental perspective, extending our understanding of the neural circuits involved in (re)appraising social ambiguity may be of particular interest in adolescents. As a period of increased salience of social cues and protracted maturation of underlying social-affective neural circuits but also an at-risk period for the development of social anxiety, adolescence may constitute an optimal time for interventive efforts aiming to train adaptive appraisal of social cues. Using a novel task, female adolescents aged 16-17 were presented with ambiguous social scenes half of which were manipulated to be self-relevant by containing a picture of the participant; control scenes contained a picture of an age-matched unknown female. After interpreting the scene, participants were prompted to reappraise the scene in a positive manner, followed by an affect rating. Individual difference measures and training sessions were administered pre-fMRI session. When comparing appraise trials relative to reappraise trials, regions associated with affective ambiguity processing in adults such as the ventromedial prefrontal cortex (vmPFC) where significantly more active. Reappraisal trials relative to appraise trials activated regions implicated in conflict monitoring and cognitive control including the dorsal anterior

cingulate cortex (dACC). Data collection is ongoing. These preliminary data point to the potential effectiveness of positive reappraisal in adolescence.

P-1-5 Longitudinal changes in social brain development: Playing for self and best friends

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

P-2-6 Examining Incentive Responding in the Nucleus Accumbens in Adolescent Substance Users

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Adolescence is a period of increased participation in risky behaviors, including substance use, and brain regions related to processing incentives are undergoing important developmental changes during this time. The relationship between neural incentive-responding and substance use in adolescents is not well understood, and previous research on the topic has been complicated by the high rates of adolescent polysubstance use. We therefore sought to examine incentive-elicited brain activation in the context of three common substances of abuse (cannabis, tobacco, and alcohol). Given the crucial role of the nucleus accumbens (NAcc) in both development and incentive processing, we compared NAcc activation during anticipation of reward and loss avoidance using an fMRI-based Monetary Incentive Delay (MID) task. Youth (ages 14-18; 66% male) were matched on age, gender and frequency of use of common substances within six distinct groups: cannabis-only (n=14), tobacco-only (n=34), alcohol-only (n=12), cannabis+tobacco (n=17), cannabis+tobacco+alcohol (n=17), and non-using controls (n=38). All groups

showed comparable behavioral performance on the task. The tobacco-only group demonstrated lower nucleus accumbens (NAcc) activation during reward anticipation compared to the alcohol-only group, the control group, and both polysubstance groups. Interestingly, no activation differences emerged between the cannabis-only group and any other group. These results indicate that adolescents who tend to use only tobacco may have neurobiological traits that meaningfully distinguish them from both

P-1-7 Development of Kana reading in Japanese -four developmental stages revealed by eye tracking-

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Preschoolers develop oral language and pre-literacy abilities and thereafter become readers. In Japanese, preschoolers learn to read Kana symbols first. Unlike Kanji symbols, Kana symbols represent only phonetic information of syllables. The aim of this cross-sectional study was to elucidate the developmental processes of Kana reading. We used two sentences of Kana (33 characters and 38 characters) and investigated how preschoolers develop their reading skills. We presented the sentence on a PC monitor, and measured eye-scanning patterns using an eye tracker (Tobii x60). We also measured the reading time and asked two questions regarding to the meaning for each sentence. In total 66 Japanese preschoolers and some first-grade pupils (3 to 7 years) participated in this study. Here we propose four developmental stages. At the first and most primitive stage (average 4.4 years), they fixated and pronounced each character one by one and they failed to understand the meaning of the sentence. At the second stage (average 4.2 years), they still read each character one by one but start to understand the meaning of the sentence. At the third stage (average 5.7 years), they skipped about one-fifth of the characters probably because they start to recognize words (chunks of characters) and therefore their reading became fluent. At the final stage (average 5.9 years), they only fixated about half of the characters and looked at few characters ahead of the character they pronounced. For two subjects, we conducted a longitudinal study and basically confirmed these stages.

P-2-8 Dynamics of Knowledge Effects on Memory During Child development and Intensive Learning

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Memory performance increases dramatically during childhood and adolescence. One important reason for this is an increase in knowledge. Prior knowledge is assumed to provide the learner with a schema that helps to incorporate new information into existing neocortical networks, which facilitates binding processes in the hippocampus. An increase in knowledge, e.g., due to formal education, should lead to an enhanced memory for schema-related information, and decreased hippocampus (HC) recruitment for memory encoding. We tested these hypotheses in two real-world educational settings. Study 1 investigated medical students who prepared for the state examination using a web-based learning

platform, which gave us detailed information about their knowledge increase. The candidates underwent fMRI three months prior to and shortly after their exam during encoding of schema-related or schema-unrelated face-word pairs. The selective enhancement in memory for schema-related information was paralleled by a decrease in HC activation for successful memory formation, and increased connectivity with semantic processing areas. Furthermore, individual differences in knowledge increase predicted the HC decrease. Study 2 compared children with one year of school experience with kindergarten children of similar age on an object-scene memory task. Objects were either congruent or incongruent to the scenes. Compared to the kindergarten children, school children showed a stronger tendency to remember the congruent objects better than the incongruent ones. Corresponding fMRI data will be presented.

P-1-9 Pathways to psychopathology: gene-brain-behavior relationships in social dysfunction

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Research on impaired social development has mainly focused on autism spectrum disorder (ASD), as it is characterized by social dysfunction. Studying children with sex chromosome aneuploidies such as Klinefelter syndrome (47,XXY), may aid in determining developmental risks for social dysfunction. Social development is often compromised in 47,XXY and their genetic profile is known, which benefits the search for neurobiological markers of social dysfunction. We used neuroimaging to map brain structure and function (using VBM, DTI, task & resting state fMRI) in boys with 47,XXY compared with typically developing boys, and boys with idiopathic ASD. Our results suggest that boys with 47,XXY show deviations in brain structure and function associated with higher order cognitive functions, social information processing, and language processing. Additionally, while boys with 47,XXY show considerable overlap with boys with idiopathic ASD in autism symptoms, there are clear differences in the underlying neural mechanisms that revolve around the frontal lobes and insular cortices. This may impact the selection of mental health care strategies, and may give direction to studies focused on the development of new interventions, such as real time fMRI neurofeedback. As our sample consisted of children/adolescents, our results also suggest that differences in brain development between behaviorally similar groups are already present during childhood. Interventions aimed at preventing or ameliorating social dysfunction may therefore be most effective when implemented prior to adolescence.

P-2-10 Association between amygdala and hippocampal volumes and condom use for adolescent girls

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Adolescence marks the initiation of new socio-emotional and physical behaviors, including sexual intercourse. Numerous factors influence how and when youth decide to engage in sex and what

protective measures to take in this context. Further, evidence suggests that patterns of brain and socio-emotional development differ by gender in this age group. Thus, we sought to determine how brain volumes correlated with safer sexual behaviors, and how those relationships compared by gender. Specifically, we posited that protected sex (defined as condom use) would correlate with regional brain volumes implicated in social and emotional functioning (e.g., amygdala, hippocampus, ventral striatum), and that these relationships would differ between female and male youth. We used Freesurfer to extract cortical and subcortical volumes among an ethnically-diverse sample of 134 high-risk, sexually-experienced youth (M age 16.03 years (SD 1.18) range = 14-17; 28.8% female). We conducted multiple linear regressions using frequency of condom use as the dependent measure (regional volumes), followed by an examination of interactions with gender. We found significant volumeXgender interactions, with follow up analyses indicating frequent condom use was related to smaller volumes across the bilateral amygdala, left hippocampus, and right globus pallidus in females. No relationship between regional brain volume and protected sex emerged for males. These data highlight the potential relevance of limbic and striatal structures in decisions about safer sex behavior for adolescent females.

P-1-11 Differential effects of socioeconomic status on declarative and procedural memory systems

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While prior research has shown a strong relationship between socioeconomic status (SES) and declarative (explicit) memory, the relation between SES and procedural (implicit) memory remains unknown. Convergent research in both animals and humans has revealed a fundamental dissociation, both behaviorally and neurally, between a declarative memory system that depends on medial temporal-lobe structures and the dorsal-lateral prefrontal cortex (DLPFC) and a procedural memory system that depends on the basal ganglia. Due to the dissociation of declarative memory and procedural memory in the brain, there is reason to believe that SES may not affect these two systems equally. Here, we measured performance in 58 adolescents (mean age 14.4) from higher (n = 35) and lower (n = 23) SES backgrounds on tests of declarative memory (complex working memory span) and procedural memory (probabilistic classification) and their hippocampal, DLPFC, and caudate volumes. Lower-SES adolescents had worse declarative memory performance ($W = 571$, $p < 0.01$, $r = 0.39$) and reduced hippocampal (Right: $t(55) = 2.57$, $p = 0.01$, $r2 = .19$; Left: $t(55) = 2.64$, $p = 0.01$, $r2 = .22$) and DLPFC volumes (Right: $t(55) = 3.80$, $p < 0.001$, $r2 = .48$; Left: $t(55) = 2.15$, $p = 0.04$, $r2 = .33$), but there were no significant differences between the low-SES and high-SES groups on learning on the procedural memory task or caudate volumes (all $p > .6$) These findings suggest that SES may have a selective influence on hippocampal-prefrontal dependent declarative memory and little influence on striatal-dependent procedural memory.

P-2-12 A comparison of default-mode connectivity in children with ADHD, dysthymic disorder and typically developing children

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Pediatric attention-deficit/hyperactivity disorder (ADHD) and depression have both been associated with a failure to adequately suppress default-mode network (DMN) activity. The present study aimed to determine whether there are differences in DMN connectivity among children with ADHD, dysthymic disorder (DD) and typically developing children (TDC). 20 children with a diagnosis of ADHD, 20 children with a diagnosis of DD and 20 TDC aged 9.7-16.8 years underwent a 6 min resting-state scan. Preprocessing and statistical analyses were performed using CONN a functional connectivity toolbox compatible with SPM12. 6 DMN ROIs (PCC (posterior cingulate cortex), MPFC (medial prefrontal cortex), right and left IPL (inferior parietal lobe), right and left PFC) served as seed regions. Compared to TDC the clinical group (combined ADHD + DD) showed increased functional connectivity of the 6 seed regions and several cortical clusters. Only the right IPL showed heightened connectivity with the right frontal pole in TDC compared to the clinical group. Comparisons of ADHD and DD groups revealed increased connectivity between PCC and right lateral occipital cortex, between left IPL and right fusiform cortex, between left PFC and right postcentral gyrus in children with ADHD. DD children showed increased functional connectivity between MPFC and left frontal pole compared to ADHD children. The results suggest differential functional connectivity of DMN regions in children with ADHD, DD and TDC. This may help delineating the underlying pathophysiology between these two diagnostic disorders.

P-1-13 How to regulate infant stress signals? Neural correlates of maternal affect regulation in adolescent and adult mothers

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Children of adolescent mothers present a high-risk group for child neglect and maltreatment, especially if other stressors are present. Their cognitive and emotional development is often disturbed, and they display more externalizing and aggressive behaviors than children of adult mothers. One explanation for the reduced maternal sensitivity in adolescent mothers is that they are less able to regulate their own stress in the face of infant distress and have therefore more difficulties to offer a sensitive response that, in turn, shapes the emotional development of the infant. Previous neuroimaging studies have shown that maternal sensitivity is associated with activations in prefrontal and limbic brain areas. The main aim of the present project was to investigate maternal affect regulation in response to infant stress signals in adolescent mothers (< 21 years) and adult mothers (>25 years) using functional magnetic resonance imaging (fMRI). Participants were subjected to an infant cry paradigm using self-distraction as emotion regulation strategy to down-regulate emotional intensity. Preliminary findings reveal limbic activations (e.g. insula, amygdala) in response to infant cry. In the self-distraction condition subjective emotional intensity was downregulated and activations in the bilateral amygdala were decreased. Differences between adolescent and adult mothers will be presented and clinical implications will be discussed.

P-2-14 The role of inhibitory control in adolescent scientific and mathematical reasoning

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Science and maths reasoning requires the integration of new evidence about the world into one's existing theories. This necessitates revising previously held theories or developing new theories through a process called conceptual change. While the traditional view holds that naïve theories are revised in the face of new evidence, neuroimaging research with adults suggests that old theories are still present even when new ones are learnt. Inhibitory control plays an important role, as the processing of counterintuitive material requires the inhibition of underlying beliefs and perceptual biases. When solving counterintuitive scientific problems, experts recruit areas of the brain associated with conflict monitoring, error detection and inhibitory control: lateral prefrontal cortex, and anterior cingulate cortex. The current project investigates the relationship between reasoning and inhibitory control, and how this changes through adolescence. The task battery includes measures of semantic inhibition, response inhibition, and a novel test of science and maths reasoning. Eleven- to 15-year-olds observe pictures, sentences or equations representing intuitive or counterintuitive science or maths statements, and judge whether they are correct. Analyses will focus on the relationships between these measures, and the results will inform future neuroimaging work to investigate the neural bases of these mechanisms in adolescence. This work has important implications for education, as it may suggest that inhibitory control training should be a focus in maths and science curricula.

P-1-15 The grit of nucleus accumbens ? a neural mechanism of successful learning in children

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The question of what makes children successful at learning or training has been discussed for decades in terms of motivation, cognitive abilities and personality. "Grit" is defined as an individual trait that quantifies a person's ability to persist with an activity despite setbacks, and to pursue long-term goals (Duckworth, 2007, Journal of personality and social psychology).Recently, grit has been shown to predict drop-out rate in college, learning in the work-place, and success in spelling competitions (Duckworth, 2007, Journal of personality and social psychology; Eskreis-Winkler, 2014, Frontiers in Psychology; Duckworth, 2009, Journal of personality assessment). Although these evidences from real-world learning situations, the effect of grit in an experimental training setting for children is unknown. The neural basis of grit is also unknown. Here we show that measures of grit in a sample (N = 55) of 6 year old children predict the cognitive improvement during 8-weeks of working memory training. The same measure of grit was associated with the shape and volume of the nucleus accumbens (measured in a subsample of the same children, N = 27). This structure is central for motivation and regulation of the effort during goal-directed actions (Salamone, 1991, Psychopharmacology; Denk, 2005, Psychopharmacology; Salamone, 2012, Neuron). These results indicate that successful learning in children is dependent on individual differences in grit, which is in turn related to the nucleus accumbens.

P-2-16 Rethinking my baby's needs - a functional emotion regulation strategy? Neural correlates of maternal affect regulation in response to infant stress signals.

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Early maternal care plays a crucial role in the child's development. Mothers, who react sensitive to their infant's needs, support the development of adaptive emotion regulation skills, which constitute an important basis of stress reactivity and resilience. Previous studies indicate that depressive mothers show less sensitivity and reduced neural activity in parental brain regions in face of infant distress. The reduced sensitivity in caregiving behavior of depressive mothers seems to be, in turn, imprinted in the offspring's neurobiology. Therefore, children of depressive mothers present a high-risk group for the development of psychopathology in later life. We investigated this critical period of brain development by comparing primiparous mothers with and without postpartum symptoms of depression and their 6-to-8 month old infants. The main aim of the current project was to expand previous research on maternal affect regulation in response to infant stress signals using functional magnetic resonance imaging (fMRI, N=62). In particular, we investigated whether depressive versus healthy mothers were able to up or down regulate their affect and neural response to infant cry stimuli by using emotion regulation strategies (cognitive reappraisal, self-distraction). Preliminary findings replicate typical activations in parental fronto-limbic emotion regulation networks and show, moreover, different activation patterns in brain regions associated with deliberate top-down modulation of negative emotions. Differences between depressive and healthy mothers will be discussed.

P-1-17 The detection of intentionality in early psychosis

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Paranoid delusions may arise from an overattribution of malevolent intentions to others' actions. To date evidence for this has been found in chronic but not early psychosis (EP). We investigated whether EP patients overattribute intentionality in a simple paradigm and whether this is associated with paranoia. 38 adolescents with EP and 93 controls watched films of two moving shapes. In the: 1) animate contingent condition one shape moved when it 'saw' the other; 2) animate non-contingent condition one shape moved independently of the other; 3) mechanistic contingent condition one shape's movement was launched by the other's; and 4) mechanistic non-contingent condition one shape passed by the other without touching. Participants rated the relationship strength between the shapes' movements. Paranoia was assessed with the Positive and Negative Syndrome Scale. Participants perceived a stronger relationship between the shapes' movements in the mechanistic contingent than non-contingent condition, but little difference between animate contingent and non-contingent movements. In the animate condition there was a trend for EP to perceive the relationship between the

shapes weaker than controls (p = 0.08). A similar trend was present in the mechanistic contingent condition (p = 0.09). EP's paranoia was not related to ratings of relationship strength. The results show an intact perception of intentionality in EP. This contradicts research in chronic psychosis and suggests that EP presents a window of opportunity for interventions that prevent a biased perception of intentionality.

P-2-18 Control your Anger! The neural basis of aggression regulation following social rejection

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Social rejection is very distressing, particularly during the transition from childhood to adolescence. In some individuals, rejection can lead to aggression. Prior studies have investigated the neural basis of social rejection, but the relation with aggressive behavior has remained unknown. This study examined the relation between social rejection and aggression in a new social evaluation fMRI paradigm. The paradigm was first tested in an adult sample (N=30, 50% male). During the experiment, participants viewed pictures of peers with their reaction to the participants' profile (accept, neutral or reject). Participants were requested to react to the peer feedback by pressing a button, producing a loud noise. The noise blast duration was used as an index of aggression. Rejection led to more aggression (longer noise blast). Social evaluation, being accepted or rejected versus neutral responses, resulted in neural activation in a network of insula, medial prefrontal cortex (mPFC) and striatum. Specifically, being accepted resulted in higher activation in the mPFC and striatum, whereas activation in the bilateral insula was related to being rejected. In addition, more activation in the right dorsal lateral PFC (DLPFC) during rejection versus neutral feedback resulted in more aggression regulation (shorter noise blast). These data fit with cognitive control models suggesting that DLPFC exerts top down control over affective impulsive actions. We are currently testing this paradigm in a developmental sample (aged 7-13), to investigate the development of aggression regulation.

P-1-19 Brain Activation upon Ideal-Body Media Exposure Followed by Peer Feedback in Late Adolescents

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Media content matters in social contexts, especially for adolescents who socialize largely with their peers in media(ted) environments (e.g., Facebook). This is well exemplified by the development of body image, in which media's prevailing thin body-ideal and peer influences play vital roles. However, how these influences interact in impacting adolescents' body affect is not well understood. Studies have demonstrated the involvement of the dorsal anterior cingulate cortex (dACC) and bilateral insula in response to peer feedback that deviates from expectations or social norms. Given that media set social norms, especially for heavy media consumers like adolescents, examining peer feedback allows testing direct effects of deviating body-ideals. Hence, we investigated influences of peer feedback following

ideal-body media images on brain activity by using fMRI. Girls (18-19 years-old, N=24) were exposed to 60 media models (30 thin; 30 average-sized) while in an MRI-scanner. They rated each model as 'too thin' or 'normal', followed by either congruent or incongruent peer feedback. Results showed increased activity in the dACC and insula in incongruent situations (e.g., the participant rated the model as 'normal-weight' while feedback indicated the model as 'too thin'), especially for those with low self-esteem. The increased activity corresponds to previous findings that these brain centers become active in uncertain situations (e.g., when social norms are exceeded). These first results reveal that media-based feedback has direct influence on brain responses to deviating norms.

P-2-20 The neural correlates of prosocial behavior during observed exclusion in females

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Humans show prosocial behavior to help others and reduce their distress. Prior studies have shown that after observing social exclusion, people tend to help excluded individuals by donating money to them or by including them in subsequent interactions. While observing social exclusion, areas in the brain associated with social pain (bilateral insula, dorsal anterior cingulate cortex) and mentalizing (medial prefrontal cortex and temporo-parietal junction) are active, but it is not yet known if these regions are also engaged when showing prosocial compensating behavior. The current study aimed to investigate whether people compensate for social exclusion during the observation of social exclusion, and whether brain areas involved in social pain and mentalizing are active during this prosocial behavior. We measured prosocial behavior with the Prosocial Cyberball Game, a four-player adaptation of Cyberball, in a sample of 23 healthy females (18-19 years). During the ball tossing game one player is excluded by the other players, and the participant can compensate by tossing the ball more often to the excluded player. We found that participants compensated for exclusion by tossing more balls to the excluded player than to excluding players. During tosses to the excluded player compared to tosses to the excluding players, we found increased activity in the left TPJ and bilateral insula. This indicates that people show prosocial behavior by compensating for observed exclusion, and that brain areas associated with social pain and mentalizing are involved in this process.

P-1-21 Specificity of connectivity-based sub-regions of the intraparietal sulcus for working memory, nonverbal reasoning, and mathematics

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Working memory (WM), nonverbal reasoning, and mathematics are tightly linked cognitive abilities, which have all been associated with structure and function of the intraparietal sulcus (IPS). One outstanding question is whether the strong associations between those cognitive abilities are observed because WM, nonverbal reasoning and mathematics are all associated with common IPS sub-regions, or whether these cognitive abilities are associated with different IPS sub-regions. However, given the large

individual variation in IPS anatomy, results are inconclusive regarding the specificity of IPS sub-regions in those cognitive abilities. Here, we individually defined 3 IPS sub-regions in left and right hemisphere based on patterns of structural connectivity with frontal cortex, inferior parietal lobe (IPL), and occipital cortex. 66 participants, aged 6-25, who were scanned 1-3 times at a 2-year interval were included in the analysis. Results showed that cortical thickness (CT) in the left IPS sub-region connected with IPL was commonly associated with WM, nonverbal reasoning, and mathematics. Specifically, CT in the right IPS region connected with frontal cortex was only associated with mathematics. Together, these results indicate that there are both commonalities and specificity in the associations between CT in individually defined IPS sub-regions, and working memory, nonverbal reasoning, and mathematics.

P-2-22 Is adolescence a sensitive period for learning numerosity discrimination?

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Areas of the brain underlying cognitive skills such as the manipulation of working memory, decision making and numerical skills undergo significant development during human adolescence. Due to the protracted development of these brain regions it has been suggested that adolescence is an ideal time to acquire and strengthen skills such as processing numerosity. The current study investigated whether adolescence is a sensitive period for learning. Participants (n=448, age 11-33 years) were divided into three training groups, who underwent between 10 and 20 days of online training in numerosity discrimination, relational reasoning, or face processing; the latter two served as active control group. Participants were tested before training, after completing training and again six months after that. Effects of the three training programmes on numerosity discrimination performance were measured and compared between age groups (children, young adolescents, mid-adolescents, adults). It was hypothesised that during adolescence, training effects on the numerosity discrimination task would be maximal in the numerosity discrimination training group compared with other training groups. This study provides a better insight into sensitive periods in adolescence. Implications for education will be discussed.

P-1-23 Developmental fMRI of speech and voice perception: effects of task, age and phonological skills

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Learning to recognize human voices and speech is a crucial skill for verbal communication. Development typically leads to optimized neural mechanisms, enabling efficient voice/speech analysis in adults with high adaptability to behavioral goals. Here we investigated how this adaptive processing reaches its mature efficiency. We measured fMRI responses while children (8-9 yrs) adolescents (14-15 yrs) and adults (~24 yrs) listened to vowels (/a/, /i/, /u/) spoken by different speakers (boy, girl, man) and performed a delayed-match-to-sample task on either vowel or speaker identity. Across age groups,

similar behavioral performance was shown and speech sounds evoked comparable fMRI responses in superior temporal and medial frontal cortex. Task modulations of these responses showed an incremental specialization for voice processing with age in the right superior temporal cortex, especially when analyzed across individually determined voice selective regions. An age-related decrease was found in the recruitment of the supramarginal gyrus and posterior cingulate, possibly related to decreasing working memory and/or attention demands. Beyond age-related changes, individual differences in phonological skills significantly scaled with the strength of speech-evoked activity in left posterior and right middle superior temporal regions. Together, these findings suggest a prolonged period of functional specialization throughout childhood and adolescence during which changes in attention and language specific learning contribute to the shaping of relevant cortical brain circuitry.

P-2-24 Neural activations during fairness decisions in response to emotions in boys with aggressive conduct disorder

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Individuals with conduct disorder (CD) persistently violate the rights of others or major age-appropriate social norms, and are marked by impairments in social processing. Although many studies found that youths with CD have difficulties in processing the affective reactions of others, not much is known about how they make social decisions in response to emotional expressions of others during social interactions. In the current study, we therefore investigated the neural mechanisms underlying fairness decisions in response to communicated emotions of others in aggressive boys with CD (N = 32) recruited from forensic settings, and typically developing (TD) boys (N = 33), aged 15-19 years. Participants received written emotional responses (angry, disappointed or happy) from peers in response to a previous offer and then had to make fairness decisions in a version of the dictator game. Behavioural results showed that the CD boys did not differentiate between the different emotions that were communicated by others, whereas the TD boys reacted relatively less fair in response to happy reactions than the CD boys. Whole-brain neuroimaging results ($p < .05$ cluster-corrected) revealed that when receiving happy versus disappointed and angry reactions, the CD boys showed less activation than the TD boys in the temporoparietal junction (TPJ), an important region for social cognitive abilities such as perspective taking and empathy. These results suggest that boys with CD have difficulties with processing explicit emotional cues from others on behavioural and neural levels.

P-1-25 Neural mechanisms underlying individual differences in temporal discounting of money and candy in adolescents

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Adolescents often engage in impulsive behaviors. Temporal discounting (TD) tasks, which consist of choices between an immediate reward (e.g., ?2 today) and a larger, delayed reward (e.g., 10 in 30 days) are frequently used to study impulsivity. Adolescents show a stronger preference for immediate rewards in TD tasks than adults, although there is large variation in adolescents' preferences. Further, primary rewards, such as candy, are discounted more steeply than monetary rewards. The goal of the present study was to compare the neural mechanisms involved in the discounting of money and candy in adolescents, and to examine the neural correlates of individual differences in TD. A TD task with monetary and candy rewards was administered in an fMRI scanner to 58 adolescents (31 girls) aged 12-16 years. The OFC, DLPFC and parietal cortex were involved in TD of both monetary and candy rewards. TD of candy further activated the insula and VLPFC. Adolescents who showed a relatively strong preference for immediate rewards, showed more activity during delayed choices in emotional salience and cognitive control regions, including the caudate, OFC, VLPFC, insula and dorsal ACC. Adolescents who showed a strong preference for delayed rewards, activated the parahippocampal gyrus, which is implicated in episodic memory, to a greater extent during delayed choices. We are currently performing a mixed-model analysis to examine the role of reward and delay sensitivity in these individual differences in TD. Further, a longitudinal follow-up of these participants has just been completed.

P-2-26 Neural responses to social exclusion in adolescents: the influence of social status

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Social exclusion elicits distress and activation of brain areas involved in the processing and regulation of this distress in adolescents. Popular adolescents frequently exclude their peers, and they are central and influential in the peer group. Accepted adolescents also have a high social status, but they are well-liked and pro-social. The aim of the present study was to examine whether neural responses to social exclusion and inclusion are influenced by the popularity of the excluders, and by adolescents' own popularity and acceptance. Two Cyberball games were administered in an fMRI scanner to 52 adolescents (27 girls) aged 12-16 years: one with a team of highly popular players, and one with a team of average popular players. The players' popularity was manipulated by descriptions of their hobbies, number of Facebook friends and classmates' ratings. Peer nominations were used to assess participants' own popularity and acceptance. We found an increased response in the dorsal and rostral ACC to inclusion by average popular peers, who were also rated as more likeable, compared to highly popular peers. Participants' peer acceptance was positively associated with their IFG response to exclusion by popular peers. These findings indicate that being well-liked by peers influences neural responses to social inclusion and exclusion.

P-1-27 Using a cursive font reduces executive cost in reading

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First attempts to read often reveal letters (or words) reversals errors. According to the neuronal recycling hypothesis, these are due to the mirror generalization (MG) property of secondary visual areas, whose neuronal network is partly shared or "recycled" to process letters. But if a tiger is a tiger regardless of the side from where it attacks, a 'b' is not to be confused with a 'd'. In a previous study, we demonstrated that expert readers have not completely "unlearned" MG for typographic mirror letters for which the figural similarity of the mirror images is strong, and that they need to inhibit MG to avoid confusions (Borst et al., 2015). In the present study, we investigated whether expert readers also need to inhibit the MG process for uppercase or cursive letters, for which the figural similarity of the mirror images is weak. Expert readers performed a negative priming task in which they had to decide on the prime whether two letters were identical and on the probe whether two animals presented facing opposite direction were identical. Participants took more time to determine that the two animals were identical (a situation in which they had to activate the MG process) when presented after mirror letters than non-mirror letters (e.g., 'f/t') but only for typographic letters. Thus, inhibition of the MG process is needed only when the mirror images share the same figural properties. Our results have clear implication for education: using cursive or uppercase letters to teach children to read would likely help them avoid mirror errors.

P-2-28 Brain Development of Irritability: fNIRS Investigations of Emotion and Executive Function in Preschool Children

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Irritability is a dimensional construct that that is normally distributed within the preschool population, but, at the high end, is a risk factor for the development of psychiatric disorders. Little is known about the neural mechanisms which underlie irritability and predict associated clinical outcomes. The preschool age is also a period of accelerated executive function growth, raising the possibility that normative executive function might separate those irritable children who will go on to develop psychiatric disorders from those will mature normally. We used functional near infrared spectroscopy (fNIRS) to examine emotion regulation and three domains of executive function (working memory, inhibitory control, and cognitive flexibility) in the prefrontal cortex of 91 typically-developing preschoolers (age 3-5) and a separate sample of children diagnosed for clinical disorders. Using child-friendly computer games developed by our laboratory, children responded using a touch screen computer while changes in oxygenated and deoxygenated hemoglobin were monitored. We found significant positive correlation between parent reported irritable temperament and all four emotion/executive function tasks in the LPFC in typically developing children, which may underlie their normative behavioral functioning. The clinical group, however, displayed decreased LPFC activation during emotion/executive function, which correlated with clinical symptoms. This study fits into a growing research program mapping the neural circuitry of irritable temperament using multi-modal imaging.

P-1-29 Neural correlates of delay aversion in ADHD

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Background: For individuals with attention-deficit/hyperactivity disorder (ADHD) delay is an extremely aversive experience. The delay aversion model emphasizes that escaping delay is particularly rewarding for ADHD individuals. Since it allows them to avoid the negative emotional reaction which waiting elicits. However, neurobiological evidence is lacking. Methods: Thirty adolescents with ADHD and 31 matched controls performed a reaction time task under three conditions: On No Escape Delay trials a post-response delay of 2, 6, or 14 seconds occurred irrespective of response speed. On Escape Delay trials, responses were punished by the imposition of post-response delay if participants responded too late, and on No Delay trials, no delay was imposed regardless of response speed. Different types of visual cues signaled the three conditions (and delay levels) of the task. fMRI BOLD responses were acquired to compare anticipatory brain activation following the different cue types. In addition, response speed and subjective ratings were examined. Results: A delay dose-response relationship was found in the ADHD group, but not in the control group. The imposition of delay activated the emotional centers to greater extent in ADHD compared to controls. The perspective of the possibility to escape delay resulted in a hyperactivation of the reward-related structures in ADHD compared to controls. Conclusions: The prospect of escaping delay seems to be a powerful reinforcer for adolescents with ADHD. This is in line with the hypothesis that waiting is aversive for ADHD adolescents.

P-2-30 Mapping cerebral networks of inhibition and working memory during development: an fMRI meta-analysis of 1073 children and 1903 adolescents.

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Cognitive success of children and adolescent at school is supported by executive functions, including inhibition (resisting habits, temptations, or distractions) and working memory (mentally holding and using information or instructions). A key question within the field is the way the networks supporting inhibition and working memory develop during childhood and adolescence and the degree to which their development are similar. This meta-analysis investigates for the first time functional Magnetic Resonance Imaging (fMRI) studies involving more than 1000 children and 1900 adolescents performing inhibition or working memory tasks. We ran Activation Likelihood Estimation (ALE) meta-analyses with Family Wise Error (FWE) correction for multiple testing to identify regions of reliable activity across tasks and ages. Inhibition tasks were associated with activation of a prefrontal network, with an hemispheric switch with age, children activating the left superior frontal gyrus and adolescent the right Inferior Frontal Gyrus (rIFG). Working memory tasks elicited a diffuse fronto-parietal network in children while adolescents activated a more focal prefrontal network. Interestingly, conjunction analysis in adolescents revealed an activation overlap between the inhibition and working memory tasks on the rIFG. These

findings provide reliable evidence of specific and age-dependent networks underlying inhibition and working memory functions.

P-1-31 Rejection in Bargaining Situations: An Event-Related Potential Study in Adolescents and Adults

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Rejection is a common experience when bargaining, however the neural correlates of bargaining rejection are not yet well understood. We measured the neural reaction to rejection or acceptance of monetary offers with event-related potentials (ERPs) in the period of emerging and early adulthood when individuals develop social relationships with expectations of reciprocity. Adults (n=18, age 20.6) and adolescents (n=16, age 15.2) played multiple rounds of the Ultimatum Game as proposers. Participants divided coins between themselves and a second player (responder) by making a choice between an unfair distribution (7 coins for proposer and 3 for responder; 7/3) and one of two alternatives: a fair distribution (5/5) or a hyperfair distribution (3/7). Participants mostly made fair offers when the alternative was unfair, but often made unfair offers when the alternative was hyperfair. Strikingly, when participants´ fair offers were rejected this was associated with a larger MFN compared to acceptance of fair offers and rejection of unfair offers. Also, the MFN was smaller after acceptance of unfair offers compared to rejection. These neural responses did not differ between adults and adolescents, suggesting that the MFN reacts as a neural alarm system to violation of social expectancies which is already prevalent during adolescence. Currently, we are investigating the role of social status on sensitivity to rejection in a bargaining situation, using the same paradigm measuring ERPs in three age groups (9-11 yrs; 14-15 yrs; 18-21 yrs).

P-2-32 Discovering the neural underpinnings of social touch in infancy : a fNIRS study

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It is known that pleasant touch is mediated by C-Tactile(CT) fibers and that CT targeted touch leads to broad cortical activations including posterior STS, a key region of the social brain. Our goal is to discover if a similar pattern of activation can be observed in young infants, or whether the development of this cortical specialization results from extensive postnatal experience. In order to measure the brain response to touch we use functional Near InfraRed Spectroscopy(fNIRS). Our overall design involves comparing social to non-social touch in blocked trials; we have explored three different stimulus contrasts. Across the studies the social touch stimulus is always a gentle caress (3-10cm/s) performed by the experimenter on the baby's arm. In the first study we contrasted the human caress to a caress performed with a spoon, both at the same speed, hypothesising that a difference in temperature and texture would be sufficient to elicit different activations. In the second study we changed the non-social stimulation and used tapping of a hand instead. In these studies we found broad cortical activation to

touch (social and non-social) versus baseline, but the contrast between social and non-social touch was not consistently differentiated across infants. In our third study we are stroking the baby's arm with an electric toothbrush, hypothesising that the features of this stimulation are so different from those of a human caress that it will not activate CT fibers, leading to a clearer distinction between the conditions. We will report results from this third experiment.

P-1-33 Functional Specialization of the Right Temporo-Parietal Junction in Early Childhood

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Situated within the default mode network and at the boundary of other networks, the right temporo-parietal junction (rTPJ) is a nexus region that has been implicated in an array of processes such as attention, social perception, and social cognition. In middle childhood, the rTPJ displays functional specialization for mental state representation yet little is known about its functional organization in early childhood. However, early childhood is a key time to study change in rTPJ organization given the pronounced advances in social cognitive abilities during this age. The lack of studies in early childhood is due to the challenge of acquiring artifact-free MRI data in young children. The current study utilized a novel passive-viewing functional connectivity approach to examine regional rTPJ specialization in 4 (N = 31) and 6 (N= 36) year olds, and adults (N = 22), resulting in high success rates (4s: 71, 81%; 6s: 83, 86%). Participants watched screensaver-like abstract patterns and a clip of an engaging movie, both of which served to hold attention and decrease movement. We used a two-step principal component analysis to uncover local temporal and subsequent global spatial patterns that account for > 5% within-region time series variance. Our results indicate that the adult rTPJ is organized into anterior and posterior eigenimages within the default mode network whereas the corresponding eigenimages in children are more diffuse and distributed into bordering networks. These results provide insight into the progressive functional specialization of this heterogeneous region.

P-2-34 Behavioral and fMRI measures of risky decision making in adolescents with Neurofibromatosis type 1 (NF1)

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Neurofibromatosis type 1 (NF1) is one of the most common single-gene disorders affecting cognitive function. About 1/3 of children with NF1 meet diagnostic criteria for ADHD, and the cognitive phenotype is characterized by impairment in prefrontally-mediated functions. Mouse models of NF1 show irregularities in dopaminergic metabolism in the striatum. Here we investigated neural activity during a task of risky decision-making, reliant on orbitofrontal-striatal activity, in NF1 vs. controls. Youth with NF1 (N=14) and controls (N=9), age 7-18, were administered a developmentally sensitive gambling task (Van Leijenhorst et al., 2008), in which they chose between low-risk gambles with a high probability of

obtaining a small reward, and high-risk gambles with a low probability of obtaining a large reward. Primary analyses included assessing risk-taking across potential reward values, and neural activity when making risky decisions. NF1 patients did not differ from controls in propensity to make risky decisions. However, older NF1 patients were less risky than younger patients; this pattern was not observed in controls. fMRI analyses revealed neural activity in low reward conditions, constrained to occipital regions, whereas striatal activity was observed in high reward conditions. Dorsal striatal activity was greater in younger participants, across diagnostic groups. These results indicate that NF1 patients and controls show age-related differences in risky decision-making. Future analyses will investigate the unique neural signature of risk-taking in NF1 relative to controls.

P-1-35 ERPs and EEG oscillations reveal age differences and similarities in memory formation and retrieval of contextual details as well as increasing cognitive control

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It is difficult to dissociate memory development from generalized cognitive control abilities contributing to reliable memory judgments based exclusively on behavioral outcome. However, the cognitive processes supporting memory encoding and retrieval in developmental populations are still largely unknown, despite huge potential implications for educational settings. Notably, patterns of behavioral performance and neuronal activation do not necessarily correspond closely, as similar performance can be achieved via different routes and similar neurocognitive mechanisms can underlie various levels of performance. Electrophysiological data allow real-time tracking of cognitive processes and hence the examination of brain-behavior interactions. Here, I will present highlights from a larger study assessing cognitive processes supporting episodic memory and cognitive control in 7- and 10-year old children and young adults, including a two-year follow-up. The ability to recollect perceptual details to distinguish between identical and conceptual item repetitions and cognitive control abilities were assessed along with electrophysiological data during incidental and intentional memory formation and retrieval as well as during a task-switch paradigm. Methodological challenges in interpreting age-related similarities and differences in cognitive processing given concurrent morphological differences between age groups will be discussed, and how recognition memory and cognitive control change along with brain maturation between middle childhood and young adulthood.

P-2-36 The development of brain network architecture

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Brain connectivity shows protracted development during childhood and adolescence, and the topology of brain networks changes during this period. However, the timing of these changes varies and has not yet been well described. We explored developmental changes in brain connectivity and network topology during childhood and adolescence. We acquired two sets of DWI-scans and anatomical T1-

weighted scans. The first dataset included 85 typically developing individuals (53 males; 32 females), aged between 7 and 23 years and was acquired on a 1.5 Tesla scanner. We reconstructed whole brain networks using the FACT algorithm (fiber assignment by continuous tracking). We operationalised fiber tract development as differences in mean diffusivity (MD) with age. Most fibers showed decreases in MD throughout childhood and adolescence, reflecting increasing white matter integrity. The strongest late developmental changes during adolescent were observed in short association fibers within and between the frontal and parietal lobes. Furthermore, there was a simultaneous decrease in average path length and an increase in network clustering, reflecting fine tuning of topological organization. These results suggest a multistep maturational model where connections between single modal regions strengthen in childhood, followed by connections from these single modal regions to association regions, and finally by the strengthening of connections between association regions within the frontal en parietal cortex.

P-1-37 Cognitive and socio-emotional factors in relation to school performance: a network approach

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In most children, the cognitive control system and the socio-emotional system get into balance during adolescence. That is, during development, adolescents 'make greater use of cognitive control skills to modify attention, emotion and behavior in service of long-term 'adult' goals' (cf. Crone & Dahl, 2012). We hypothesized that adolescents with greater imbalance between the cognitive and socio-emotional systems have more difficulty in school. To get insight into this hypothesis, we took a network approach. This allowed us to identify key variables related to school performance and identify children with different levels of imbalance. 392 adolescents (Mean age at T1: 13.3 years, SD=.8) performed experimental tasks measuring cognitive control and risk taking propensity. In addition, we indexed school performance, and collected survey data on a.o., pubertal status, need for arousal, need for social support, and resistance to peer influence. Results indicate substantial individual differences between children who are delayed in their school careers and children who are on-track. Need for arousal is the most central node in both groups; it is however more central in the delayed group. The network in the delayed group is also more complex than in the on track group: there are more connections related to socio-emotional function. Community analysis shows there are more children in the delayed group where the 'balance' tips to the socio-emotional side. This suggests that in the delayed group, the cognitive/socio-emotional balance is more precarious than in the on-track group.

P-2-38 Developmental differences in the factors that regulate belief updating in dynamic environments

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To make optimal decisions in dynamic environments, we have to flexibly adjust the degree to which new information is used for belief updating. Such adaptive processes rely on a prefrontal monitoring system that is subject to substantial developmental changes. In this study we a used a predictive inference task to investigate developmental differences in the ability to adjust learning rates in dynamic environments. Using Bayesian modeling and regression analyses, we dissociated three factors, surprise, uncertainty and reward that affect learning rates in children, adolescents and adults. Overall, we found lower learning rates in children compared to the other groups, indicating that they tend to underestimate the rate of change in the environment. This effect was particularly pronounced for small prediction errors whereas for surprising outcomes children showed strong learning rate adjustments. We found no developmental differences in uncertainty-driven learning, indicating that age groups were comparable in their ability to use outcome information to reduce uncertainty. Finally, all age groups showed enhanced learning rates after obtaining reward, even though rewards were non-predictive of future outcomes. This bias was most pronounced in adolescents, which is consistent with findings pointing to enhanced reward sensitivity in this group. To conclude, our results indicate substantial developmental differences in the factors that govern adaptive learning. Future work will focus on providing a normative neuro-computational theory to explain these age-related changes.

P-1-39 Risk-taking, perceived risks, and perceived benefits across adolescence: A domain-specific risk-return approach

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Risk taking behaviors such as risky driving and unsafe sex peak during late adolescence, compared to childhood and adulthood. Such behaviors--although partly considered normative--can be associated with substantial individual and societal costs. Despite strong research interest, relatively little is known about contextual factors and underlying mechanism leading to this inverted-U pattern across transitions into and out of adolescence. We used the newly developed adolescent version of the Domain-Specific Risk-Taking (DOSPERT) scale to investigate apparent risk taking, perceived risks, perceived benefits, and their tradeoff in a sample of 213 12-25-year-olds. Using mixed-effects models, we found mainly curvilinear age effects with a peak in risk taking in mid-late adolescence in the ethical, health/safety, recreational, and social domains, with similar curvilinear patterns in perceived benefits in ethical and health/safety domains. Perceived risks showed less age differences. Perceived risks and benefits were significant predictors of risk taking in all domains, with benefits typically showing stronger effects than risks. Mediation analyses suggested that observed age differences can be explained by age differences in perceived risks and benefits. Our results replicate the developmental inverted-U in risk taking observed in real-life--rarely observed in the lab with risky choice tasks--with age and domain differences prominent in apparent risk taking and perceived benefits, identifying promising entry points for possible intervention and prevention efforts.

P-2-40 Evidence for delayed fear extinction learning in the adolescent brain

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In anxiety disorders, defensive responses are exaggerated and sustained to cues that no longer signal threat, suggesting impaired fear extinction. Importantly, anxiety disorder onset is frequently reported to start during adolescence. Previous research in rodents and humans points to an evolutionarily conserved profile of blunted fear extinction during this developmental period. We sought to examine the effects of age in 55 participants (M age = 17.75yrs, SD age = 3.65yrs, range = 12-28yrs; 35 females & 20 males) upon the function of fear extinction circuitry using functional magnetic resonance imaging of aversive associative learning. We found greater activity in the amygdala and hippocampus to threat versus safety cues across extinction for adolescents, compared to adults. In addition, we found less dorsal medial prefrontal cortex activity to threat versus safety cues during early extinction for adolescents, compared to adults. These neural findings are in line with previous behavioural research in rodents and humans showing a developmentally distinct profile of blunted fear extinction learning during the period of adolescence. The implication of these findings to the development of anxiety disorders will be discussed.

P-1-41 The neural correlates of risky and ambiguous decision making during choice and feedback

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Adolescence is a period of marked developmental changes in cognitive and socio-emotional brain circuits, that have been related to changes in risky choice behavior. Typically, risky choice is studied with paradigms that involve gambles with known probabilities. However, real-life risky choice often presents probabilities that are unknown, or ambiguous. We administered a two-option choice task presenting a gamble versus a safe option to a young adult sample (N=30, ages 18-28) with both risky (known probabilities) and ambiguous (unknown probabilities) choices, followed by feedback presenting the outcome (gain or no gain after risk or ambiguity). During choice we observed greater lateral prefrontal cortex (PFC) activity in risk than in ambiguity conditions. During feedback the striatum was more activated after gain than no gain, but this differentiation was more pronounced in ambiguity than in risk conditions. Our data thus reveal differential activation for choice and outcome processing under risk versus ambiguity, particularly in the lateral PFC and striatum. Currently we are acquiring data from a developmental sample (12-27 years). These results will lead to novel insights on risk and ambiguity in the developing brain, and new interpretations of adolescent risk-taking.

P-2-42 Behavioral and neural correlates of delay and effort discounting in adolescents with ADHD

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Children and adolescents with ADHD prefer smaller immediate rewards over larger delayed rewards, as reflected in steep discounting during delay discounting (DD) tasks. An important theory proposes that the mechanism underlying this impulsive behavior is delay aversion. Decreased sensitivity to reward

may, however, also play a role in preferences for small immediate rewards. This study aimed to compare behavioral and BOLD responses during DD and effort discounting (ED) between adolescents with ADHD and controls, in order to examine whether steep discounting in ADHD is specific for delayed rewards, or whether it represents a general motivational deficit. Thirty-one adolescents with ADHD and 31 controls (12-17 years) were scanned while performing a DD/ED task. In the DD task participants were presented with a series of choices between a small reward (2-8 cents) delivered immediately and a larger reward (10 cents) that was delivered after 5-25s. In the ED task participants were presented with choices between a small reward that was delivered after exerting 15% of their maximal hand grip strength and a larger reward delivered after exerting 30-90% of their maximal strength. In line with the delay aversion theory, adolescents with ADHD showed steeper discounting than controls in the DD task, but not in the ED task, which appeared to be due to a ceiling effect in both groups. BOLD responses during DD and ED choices will be presented as well. An imbalance in the neural circuit underlying DD is expected in ADHD. No group differences in the neural system underlying ED are expected.

P-1-43 The development of observational learning: An ERP approach

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Observational learning is an important mechanism for cognitive and social development. The underlying neurophysiological mechanisms are, however, still not well understood. In two developmental EEG studies we adapted a probabilistic reward-based observational learning paradigm to compare ERPs of observational and individual reinforcement learning. We investigated how (study 1) children's similarity in age to the observed person (peer vs. adult) and (study 2) the age of the observer (children vs. adults) affects the integration of observed information. In study 1 (Rodriguez Buritica et al., in press) children's feedback-related negativity to observed outcomes (oFRN) showed a similar distinction between outcome valences, as did the FRN for own outcomes. Moreover, children imitated the choices of similar others (peers) more than those of dissimilar others (adults) and the oFRN showed a trend of being larger observing similar compared to dissimilar others. Preliminary results of study 2 showed that both age groups benefit from social information during learning. Children's oFRN and adult's P3 response to observed outcomes (oP3) reflected the learning rate from social information. Thus, children seem to be more sensitive to outcome information, whereas adults seem to rely more on context updating mechanisms. Our results suggest that the oFRN serves as a measure of observational learning in children and varies with the model-observer similarity. Children and adults benefit from social information during learning. However, ERP results point to age-specific learning mechanisms.

P-2-44 Training the creative adolescent brain: an fMRI training study on divergent thinking

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Prior research suggests that adolescence is a time of enhanced sensitivity for practice and learning. In this study (N=32) we tested the neural correlates of divergent thinking (DT) training in 15-16-year-olds relative to an age-matched active control group. Recent studies indicate involvement of a network including supramarginal gyrus (SMG), angular gyrus and middle temporal gyrus (MTG) during DT. Performances have been related to lateral prefrontal cortex (lPFC) regions which develop during adolescence. All participants performed an alternative uses task, a valid DT test, while fMRI images were acquired before and after a two-weeks-training- program.The experimental group completed 8 sessions of divergent thinking training and the control group completed 8 sessions of task switching training. Performance did not change significantly across groups. But a group x time interaction demonstrated better training outcomes for the experimental group relative to the control group. Generating alternative uses (experimental task condition) relative to generating object characteristics (control task condition) was associated with increased activation in the SMG,AG and MTG. Test-retest analyses showed that within-individuals-activation in these regions was relatively stable over time in both groups. Changes in superior lPFC activation from pre- to post-training were positively associated with changes in alternative uses fluency. Together, the results are consistent with the hypothesis that divergent thinking training outcome in adolescence is associated with lPFC activations.

P-1-45 How motivation colours interference control in ADHD

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It is widely accepted that interference control processes are modulated by motivation. Recent theories propose that ADHD symptoms arise from deviant cognitive control-motivation interplay. However, empirical studies are limited: The majority focus on reward to improve performance, but how reward associations lead to distraction and its neural mechanisms are scarcely studied, despite relevance for ADHD. Therefore, this fMRI study investigated motivation effects on interference in ADHD. We expected that ADHD subjects, relative to controls, would show: 1.improved interference control during reward, 2.increased distraction by reward-associated distracters, 3.both effects related to altered fronto-striatal responses. Adolescents with ADHD(n=25) and controls(n=34) performed a motivational Stroop task in the fMRI scanner. Interference was associated with more activity in frontal and parietal regions. Reward improved performance and increased ventral striatal activation. Reward-associated distracters did not lead to increased distraction in either group. ADHD subjects performed overall worse than controls and showed less right inferior frontal gyrus activation, negatively related to errors, suggesting deficient inhibition. This study contributes to knowledge of ADHD by showing that atypical neural processes may not be evident in absence of behavioral group differences. Unexpectedly, findings indicate no aberrant modulation of motivation on interference control in adolescents with ADHD. Instead, a crucial role of inefficient inhibition and reduced processing speed is highlighted.

P-2-46 Comparing the use of assumption-free and HRF models in the analysis of infant fNIRS data

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In recent years, functional Near-Infrared Spectroscopy (fNIRS) has become more widely used as a method to study infant brain activation through the measurement of hemodynamic signals during a variety of experiments. For fMRI research, powerful statistical methods, mostly based on the General Linear Model (GLM) have been developed. Although GLM-based analysis methods employing the canonical hemodynamic response function have been validated in adults (e.g. Plichta et al., 2007), hemodynamic responses in infants have been reported as more variable, often delayed and sometimes negative (Minagawa-Kawai et al., 2010; Kotilahti et al., 2010). Consequently, models employing the canonical hrf might not be suitable for the analysis of infant fNIRS data. Furthermore, fNIRS measures both oxy- and deoxy-hemoglobin concentrations, where the deoxy-hemoglobin response does not follow the shape of the canonical hrf. In the present study, we employed fNIRS (using NIRx NIRScout, 8 sources and 8 detectors, S-D distance of 2 cm) to assess temporal and parietal cortex activation in 5-7 month-old infants in response to dynamic social compared to dynamic non-social stimuli (Lloyd-Fox et al., 2009). Statistical analysis of the fNIRS data was done using models with (hrf, hrf with temporal- and dispersion derivatives) and without (finite impulse response, averaging) a-priori assumptions about the shape of the hemodynamic response. Finally, these methods were evaluated in terms of statistical power and their ability the account for the variability in the shape of the infant hemodynamic response.

P-1-47 Breaking the link between target detection and response initiation during adolescence

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Attaining an independent role in society marks the end of the adolescence. Thus, development of self-regulated decision-making is critical for the transition into adulthood. We measured 51 participants between 13 and 24 years using a visual oddball paradigm, including rare targets and frequent non-targets. We used electrophysiological measures, providing adequate temporal resolution for studying target detection. Our analysis focused on the P3 component (elicited during target detection) and its time-frequency characteristics in the delta (1-3 Hz) and theta (4-7 Hz) band. The stimulus-locked P3 amplitude did not vary with age, but intertrial consistency of delta and theta oscillations increased. The response-locked P3 had a posterior maximum up to 15 years, similar amplitudes at anterior and posterior regions around 17 years and a restored posterior maximum with, however, a general elevated level of anterior activation during young adulthood. The theta amplitude induced by targets and non-targets was more similar around 17 years than for younger or older participants. The results imply improved involvement of frontal resources and increased consistency of the stimulus-locked brain response with increasing age, possibly indicating decreased linking of target detection with response initiation. The similarity of theta amplitudes elicited by targets and non-targets during late adolescence might reflect similar focused attention on both events. This developmental stage might be important for improvements in self-regulated decision-making with the transition into adulthood.

P-2-48 The effect of symbolic and non-symbolic formats

on arithmetic in children: an fMRI study

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An intriguing question with clear educational relevance deals with revealing the neural mechanisms that underlie number processing in children. Evidence suggests that children's ability to process numbers in different formats (digits, dot patterns) is associated with their mathematics achievement (De Smedt et al., 2013 for a review). It remains, however, unclear if and how presentation format during calculation affects brain activity. We therefore aimed to investigate this issue in the current study. We conducted an fMRI study in 23 typically developing children aged 9 to 12. Children had to subtract numbers up to ten and compare the result to a reference number (four or five). Numbers were presented as dot patterns, Arabic digits and number words. Our findings suggest that the same brain networks are recruited during calculation with symbolic magnitudes (digits and number words). On the other hand, there are clear differences between calculating with symbolic and non-symbolic formats. Specifically, calculating in symbolic formats showed increased activity in angular gyrus and superior temporal gyrus. On the other hand, calculating in the non-symbolic format showed increased activity in middle occipital and superior parietal lobes, as well as in superior frontal gyrus and insula. These differences might be explained by differences in strategies used to solve these calculation problems. We are currently using this same paradigm in a study in children with learning disorders, in order to compare their activated brain networks with those of their typically developing peers.

P-1-49 Peer Influence on Prosocial Behavior in Adolescence: Using Adolescent Actors as Peers in an Experimental fMRI Study

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Adolescence is a time of increased sensitivity to peer influence, which creates vulnerabilities but also opportunities. This fMRI-study examined peer effects on prosocial behavior in adolescence, using an adapted public goods game. Participants (12-16 years; N = 61) made decisions in anonymous groups about the allocation of tokens between themselves and the group. Two fictitious spectator groups of peers (adolescent actors) were online during some of the decisions. We used a within-subjects design with three conditions: (1) Alone: no spectators present, (2) Spectators: spectators were present, no feedback displayed, (3) Feedback: spectators provided feedback with likes. Prosocial behavior was analyzed with a 3-factor (Condition: Alone, Spectators, Feedback) RM ANOVA. Results indicate a main effect of condition, $F(2,118) = 50.08$, $p < .001$, and age-group, $F(1,59) = 6.21$, $p = .016$. Prosocial behavior increased in the presence of peers and even more after feedback from peers. The 12-13 year olds showed more prosocial behavior in all conditions than the 15-16 year olds. At the neural level, whole brain analyses for the contrasts spectator > alone and feedback > alone at the onset of the decision screen showed activation in the social brain network, including the mPFC, TPJ and precuneus. We found developmental differences in the mPFC, suggesting that the mPFC differentiates more

between peer effects in 12-13 year olds than 15-16 year olds. These findings suggest that peer presence and feedback increase prosocial behavior, associated with elevated activity in the social brain.

P-2-50 Neonatal MRI is associated with future cognition and academic abilities in preterm children

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Early identification of preterm children at risk of future impairments utilising brain markers might assist in referral for early intervention. We examined the use of neonatal MRI measures derived from automated methods (Jacobian maps from deformation based morphometry, DBM; fractional anisotropy, FA, maps from diffusion tensor images, DTI) to predict skills important for mathematics (working memory, early math) at 5 and 7 years in preterm children using univariable and multivariable models (general linear model, GLM; support vector regression, SVR). Subjects were born <30 weeks' gestation or <1250g birthweight at the Royal Women's Hospital, Melbourne from July 2001 to December 2003 recruited into a prospective longitudinal cohort study. At term-equivalent age infants underwent MRI. Working memory and early math were tested at 5 (n=195) and 7 (n=197) years. Results identified localised regions around the insula and putamen in the Jacobian map positively associated with early math at 5 and 7 years (both $p<.05$) even after covarying for clinical factors using GLM but not SVR. The Jacobian map showed the same trend for association with working memory at 7 years. FA was positively associated with working memory and early math at 5 years (both $p<.001$) even after covarying for clinical factors using SVR but not GLM. In summary, we identified regions around the insult and putamen using neonatal DBM, and brain microstructural organisation using neonatal DTI, associated with skills important for mathematics. Results contribute to the evidence for clinical utility of neonatal MRI.

P-1-51 Adolescents show reduced cognitive interference in response to unpredictable cues

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The current study aimed to test whether children, adolescents, and adults are differentially impacted by temporal uncertainty, as measured by cognitive performance and activity of brain systems critical to detecting and resolving uncertainty. N=109 healthy participants aged 9-22 completed an fMRI task that involved making judgments about negative and neutral pictures preceded by either a predictable, chronological countdown or an unpredictable, random countdown. Consistent with our prior work, reaction times were significantly more slowed to images following unpredictable cues as compared to predictable cues, which suggests that temporal uncertainty leads to cognitive interference. Findings indicated that the slowing effect of unpredictability vs. predictability varied significantly by age. A quadratic age analysis showed that adolescents exhibited less uncertainty-based interference than children and adults. To explore the neurodevelopmental changes that could contribute to this

behavioral effect, we examined the relationship between task performance and neural activation in the amygdala. Adolescents showed an overall blunting of amygdala activation compared to children and adults. Moreover, the magnitude of amygdala response to unpredictable vs. predictable images correlated with behavioral slowing, such that individuals with reduced amygdala responses to unpredictable images showed less slowing in task performance. Given that adolescence is an important developmental period for establishing independence, it may be adaptive to be less perturbed by unexpected cues.

P-2-52 Safety signal learning as a novel mechanism for fear reduction during development

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Translational studies in mice and humans demonstrate a period of diminished cued fear extinction during adolescence, suggesting adolescents may benefit from novel mechanisms of fear reduction that bypass prefrontally-mediated extinction processes. Rodent studies show that safety cues effectively reduce anxiety to threat and prevent the onset of new fears. However, safety signal learning remains largely unexplored in humans, especially during development when anxiety peaks. Because the safety cue provides a context for the conditioned stimulus (CS), safety learning may rely on hippocampal projections to frontoamygdala circuitry and thus be especially useful for adolescents. We adapted a conditioned inhibition paradigm to examine the safety signal learning across childhood and adolescence during fMRI (6-17 years). Children and adolescents showed evidence of safety cue learning, as demonstrated by faster reaction times to the CS paired with the safety cue, relative to the CS with a novel stimulus. Moreover, hippocampal activation was greater to the CS with the safety cue, relative to the CS with a novel stimulus, suggesting the involvement of the hippocampus in safety learning during development. Participants with higher hippocampal activation to the safety signal were also quicker to approach the CS in the context of the safety cue. Our findings suggest that safety signals may be a powerful way to reduce fear during this developmental window and have important implications for optimizing treatments for youth anxiety based on the biological state of the developing brain.

P-1-53 The behavioral and neurobiological effects of meeting adolescents' expectations

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The social landscape changes significantly during adolescence. During this developmental window, individuals are tasked with learning about and predicting the dynamic social world. Research on non-social learning has demonstrated that prediction error signals help individuals learn from unexpected outcomes, a phenomenon that is neurobiologically stronger in the adolescent versus adult mesolimbic system (Cohen et al 2010). However, how the adolescent brain represents expected and unexpected social outcomes remains elusive. To address this question, we developed a novel social prediction error

task. Target participants were asked to predict how a friend would rate certain characteristics about them. We then manipulated the friend's responses to be worse than, equal to, and better than what the target expected. We presented expectations and outcomes to the target while they received an fMRI scan. We found a significant difference in response times, such that adolescents were fastest to respond when their expectations were met, compared to when they were missed or exceeded. They also reported feeling more positive when their expectations were met compared to when they were exceeded. Neurobiologically, we found enhanced engagement of mesolimbic circuitry when expectations were met relative to when they were worse than or better than expected. These data suggest adolescents may experience fulfilled expectations as more rewarding than incorrect expectations, even when those incorrect expectations are better than expected.

P-2-54 Positive emotions eliminate framing susceptibility in children

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According to dual process theories, the framing effect (Tversky & Kahneman, 1981) could stem from an affective heuristic. This bias conducts to a shift of preferences according to the formulation of the options (intuitive behavior), thereby violating the invariance principle (analytic behavior; De Martino et al., 2006). Previous studies have provided evidence in support of this assumption in adults, showing that framing susceptibility can be influenced by emotions and in particular by positive emotional context (Cassotti, et al., 2012). In developmental research, it has been shown that children are less sensitive to this bias than adults (Reyna et al., 2015), but little is known about the influence of an emotional context on their framing susceptibility. In this study, we examined the influence of a positive emotional context on framing susceptibility in 10 year-old children and in adults. In each trial, participants received an initial amount of money, and pictures of happy faces were presented to them (from the NimStim face Simulus set). Finally, participants chose between a sure option and a gamble option of equally expected value in a gain or loss frame. The results revealed a framing effect in children and adults, however, framing susceptibility was lower in children. Besides, the emotional context modulated framing susceptibility in both children and adults: it reduced framing susceptibility in adults and lead to a suppression of the framing effect in children. These results confirm that emotions play a key role in framing susceptibility starting from childhood.

P-1-55 Fixation effect in creative idea generation: Opposite impacts of example in children and adults

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Recent research with adults has shown that exposure to examples does not systematically constrain creativity and can, on the contrary, have a stimulating effect. In the present study, we examined the potential influence of examples on the generation of creative ideas in school-age children and adults.

We utilized the egg task, in which participants design a method to drop a hen's egg from a height of 10 m to ensure that it does not break. First, we conducted a pilot study to confirm that the nature of the fixation effect in the egg task differs between children and adults, and we then explored the potential influence of examples on creative idea generation in a second study. The results revealed that exposure to the same example during a creative task has two opposite effects: adults were constrained in their ability to propose solutions, whereas this ability was enhanced in children. We explain this differing effect by noting that the same example can be within fixation for adults and outside fixation for children. The positive effect of examples allowed children to exhibit performance that was comparable to that of adults with regard to fluency and flexibility.

P-2-56 Development of the neural correlates of emotional interference in a verbal working memory task

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Various aspects of executive functions continue to mature during adolescence. Working memory, the ability to maintain, manipulate and update information in a mental workspace, shows increase in capacity until mid-adolescence, associated with increased frontoparietal cortex activation. The present study investigated developmental differences in the impact of affective distractors during a working memory task. Twenty three adult (22-33 years old) and 28 adolescent (12-14 years old) female participants were scanned while performing a numerical n-back task (0-back and 2-back) with either no distractor, or with distracting happy or fearful faces presented either side of the stimulus. Results showed greater activation in adults than adolescents in 2-back vs. 0-back blocks in the parietal cortex and superior frontal cortex bilaterally, and greater activation in adolescents than adults in the presence of distractors in the occipital cortex and left fusiform gyrus. Region of interest analyses further indicated that across groups, the left orbitofrontal and right inferior frontal/precental cortex were more sensitive to the presence of distractors in 0-back than 2-back blocks, while the right amygdala showed greater activation in the presence of distractors in adolescents compared to adults. This study therefore provides further evidence of protracted neural development of the executive control system during adolescence, showing that adolescents are less able to limit neural responses to distracting affective stimuli.

P-1-57 Testing domain-generality of inhibition through an inter-tasks positive priming paradigm in school children and young adults

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Piaget postulates in its classical model of cognitive development that intelligence develops linearly by successive stages. However, discoveries of early logical abilities in infants and late reasoning errors in adults suggest that the cognitive ontogenesis is not as linear as assumed by Piaget. Neo-Piagetian

authors postulate that cognitive development does not only rely on the acquisition of new knowledge, but also on the ability to inhibit previously acquired knowledge. However, it remains largely unknown whether this inhibition relies on processes shared across various cognitive domains (domain-general) or on more domain-specific processes. To determine the development of the generality or specificity of such inhibition, 9-year-old children and 22-years-old adults were asked to perform an inter-tasks priming paradigm in which they responded to Stroop items on the primes and Piaget number-conservation items on the probes. While children were more efficient to inhibit a misleading length-equals-number heuristic in the number-conservation task if they had successfully inhibited a previous prepotent reading heuristic in the Stroop task, this facilitation effect was not observed in young adults. These results provide evidence that the inhibitory control ability of school children generalizes to two distinct cognitive domains (i.e., verbal for the Stroop task and logico-mathematical for Piaget's number-conservation task) but also suggest that inhibition might become progressively more domain specific with age.

P-2-58 Resting-state changes after sub-acute pediatric arterial ischemic stroke: a descriptive case study

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Aims: Compared to adults, data on reorganizational patterns in resting-state activity of children who suffered an arterial ischemic stroke (AIS) is rare. We therefore examined changes in resting-state activity 1 month and 4 months after an acute AIS. Methods: One boy (7 years) who recently suffered a right sided periventricular AIS was examined. Magnet resonance (MR) images were acquired using a 3T scanner. High-resolution T1-weighted MR structural images were recorded using a magnetization prepared rapid gradient-echo 3D sequence, functional imaging was performed using a multiband echo planar imaging sequence. Conn toolbox 14 was used to descriptively compare resting-state activity in different brain regions. Results: 1 month post-stroke, an activity shift to the contra-lesional hemisphere resulting in bilateral activation is visible in different regions, such as the primary motor cortex, the inferior frontal cortex pars triangularis, the somatosensory cortex and the primary visual cortex. In those areas, interhemispheric balance is reattained 4 months post-stroke. Conclusions: The results suggest that in the child's brain, dynamic reorganization processes in resting-state activity over time might happen. The hemispheric shift to the contra-lesional side 1 month and the rebalance 4 months post-stroke in different brain areas suggest a global character of functional reorganization patterns. The present results may serve as an important indicator for dynamic changes in the pediatric brain connectivity after stroke. Further analyses including more children are necessary.

P-1-59 Maturational trajectories of subcortical grey matter microstructure: A longitudinal study

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Cross-sectional diffusion imaging studies have reported age-related increases in fractional anisotropy (FA) and decreases in mean diffusivity (MD) in subcortical grey matter structures during childhood and adolescence. Some white matter tracts appear to develop earlier in girls than boys, and in boys the development may continue into adulthood. It is unknown whether the sexes also differ in their maturational trajectories of subcortical grey matter microstructure. Here we examined the maturational trajectories of FA and MD of subcortical structures using a large longitudinal dataset. Eighty-eight children and adolescents aged 7-19 years underwent MRI 2-11 times (713 scans) on a 3T MR-scanner. Mean amygdala, hippocampus, accumbens, caudate, putamen and thalamus FA and MD values were extracted. Age-related changes over time in ROI MD or FA for boys and girls were estimated using generalized additive mixed models with smoothing splines. FA increased linearly or almost linearly with age in both sexes in all ROIs (ps<.048), except for the putamen in boys (p=.26). MD decreased with age in all ROIs in both sexes (ps<.0001). In girls, the MD trajectories were non-linear and reached a plateau at the age of 12-13 years in all ROIs, except amygdala. Interestingly, this is the average age at which females reach sexual maturity. In boys, MD decreased linearly throughout the studied age range. While unknown, the observed apparent difference between sexes in the maturational trajectories of subcortical MD may be mediated by differences in sex hormones and/or when the sexes enter puberty.

P-2-60 Neuroimaging and outcome of symptomatic neonatal arterial ischemic stroke in Switzerland

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Background and Objectives: Neonatal ischemic stroke is known to be associated with cerebral palsy, epilepsy and cognitive impairment. Involvement of the corticospinal tract is known to be predictive for poor motor outcome. The aim of the study is to test the prognostic value of early neuroimaging data regarding cerebral palsy (CP) symptoms and cognitive functions after 2 years. Methods: We included 79 children (31 female) with a mean age of 2.9 days (range from 1 - 26 days) at manifestation. MRI was performed within the first 28 days of life. The predictive value of the infarct localization regarding CP and cognitive functions at 2 years was calculated by using a logistic regression. Results: Of all children, 30 (38%) had CP. The infarct was bilateral in 21.5%, right sided in 16.5%, and left sided in 62% of the children. 30.4% had multiple infarctions and 27.8% had a hemorrhagic transformation. The most important predictor for CP manifestation 2 years post-stroke was an infarction located in the thalamus (OR = 5.19, p = .012). Moreover, there is a tendency for infarction in the capsula interna (OR = 2.85, p = .086) and the temporal cortex (OR = 2.89, p = .066) to be predictive for CP. For cognitive functions we found no predictive infarct localization. Conclusion: Early MRI in children with neonatal ischemic stroke has a prognostic value for motor development. Interestingly, involvement of the thalamus was more

predictive for CP than the capsula interna. Moreover, temporal cortex involvement showed a notable association with the development of CP.

P-1-61 The Importance of Affective Contexts on the Role of the Anterior Insula during Adolescent Risk-Taking

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Current neurobiological models of adolescent decision-making suggest that heightened risk taking during adolescence is a result of the asynchronous development of neural regions underlying cognitive control (lPFC) and reward processing (striatum), particularly during periods of heightened social and affective arousal. Despite the emphasis on cognitive-emotional interactions during adolescence, the developmental literature has largely overlooked the potential importance of the anterior insula (AIC), a region known for its role as a cognitive-emotional hub. The current study examines the role of AIC engagement in adolescents' risky decision-making and the impacts of affective arousal on AIC recruitment. In an fMRI paradigm, 40 adolescents completed a gambling task either in the presence of a virtual, anonymous peer or alone. Connectivity analyses demonstrated that AIC activation precedes activation of the lPFC and striatum during decision-making. Across the sample, greater activation of the AIC during decision-making was associated with less risk-taking across the task, suggesting a role in risk aversion. However, when affective arousal was high (peer observation) higher AIC engagement during decision-making was related to greater risk taking. In fact, AIC activation fully mediated the effects of peer observation on task behavior. Together these findings support our notion that the AIC plays a dynamic role in the decision-making process, engaging during both risk-taking and risk-averse behaviors, a role that is dependent on the affective context in which the decision is made.

P-2-62 Is adolescence a sensitive period for face processing?

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Face processing is an aspect of social cognition that undergoes particularly extended development during adolescence with some studies reporting a dip corresponding to the onset of puberty. This development is thought to be largely driven by environmental input, which might make adolescence a sensitive period for face processing. To investigate the role of environmental input on social cognitive development, a systematic investigation of age differences in the acquisition of face information was carried out. Participants (n=448, age 11-33 years) were divided into three training groups, who underwent between 10 and 20 days of online training in face processing, relational reasoning or numerosity discrimination; the latter two served as active control groups. Participants were tested before training, after completing training and again six months after that. Effects of the three training programmes on face processing performance were measured and compared between age groups

(children, young adolescents, mid-adolescents, adults). We predicted non-linear patterns of plasticity between child- and adulthood with participants in mid-adolescence showing less improvement after face-processing training, as compared to control training, than the other age groups. This study provides a better understanding of plasticity of face processing in adolescence and well-controlled data for the effectiveness of computerized socio-cognitive training.

P-1-63 Is adolescence a sensitive period for relational reasoning?

Lisa Knoll[1], Delia Furhmann[1], Ashok Sakhardande[1], M Speekenbrink[1], Sarah-Jayne Blakemore[1]

[1]University College London

Relational reasoning is the ability to identify relationships across multiple mental dimensions. It is linked to logical thinking and problem solving and is known to undergo protracted development during childhood and adolescence. In this study, we investigated the impact of relational reasoning training during adolescence, and specifically whether adolescents benefit more from relational reasoning training than other age groups. Participants (n=448, age 11-33 years) were divided into three training groups, who underwent between 10 and 20 days of online training in relational reasoning, numerosity discrimination or face processing; the latter two served as active control groups. Participants were tested before training, after completing training and again six months after that. Effects of the three training programmes on relational reasoning performance were measured and compared between age groups (children, young adolescents, mid-adolescents, adults). All age groups improved their relational reasoning performance after training in relational reasoning. However, mid-adolescents and adults benefited more from training compared with young adolescents and children. The study provides a better understanding of the effectiveness of online training on relational reasoning in adolescence and may have implications for education.

P-2-64 Does experience shape the brain? The effect of cataract on development of visual segmentation

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Environmental input plays a crucial role in the development of visual perception. The role of visual input can be studied in patients treated for congenital cataract, who received no visual input early in life, but typical visual input after cataract was treated. However, some visual processes remain impaired after treatment. The current study investigated remaining impairments in visual segmentation, a basic visual process that is necessary to process individual objects. Twelve children (average 11 years) that recovered from cataract before the age of 5 years, and 34 control children participated in the study. Each child performed two visual tasks. In a neurocognitive texture segregation task, the difference in Event-Related Potential (ERP) response to homogeneous (no segmentation) and checkered stimuli

(segmentation) was investigated. In addition, behavioral performance on contour integration, related to segmentation, was measured. Results showed decreased performance of the cataract group on contour integration, but not on ERP reflections of segmentation. However, ERP reflections of processing of the separate line elements were delayed in the cataract compared to the control group. These findings imply that specific aspects of segmentation are impaired after cataract, and that visual experience is necessary for the typical development of processing of line elements and for behavioral segmentation. These results, as well as the different findings in ERP versus behavioural measurements, are discussed in terms of feedforward and recurrent connectivity in the visual cortex.

P-1-65 The influence of mindset on math-related post-error adjustments in adolescents

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Students' implicit beliefs ("mindsets") about the malleability of their abilities have major impact on school success. Students with an "entity" mindset believe that their abilities are fixed and cannot be improved much by effort, those with an "incremental" mindset believe that they can increase with effort. Their mindset shapes their responses to academic challenge; an entity mindset often produces a less adaptive response to failure. We investigated the impact of 15-year-old students' mindset on how they deal with making mistakes. We assessed default mindset using a questionnaire, and manipulated mindset by presenting information about brain stability vs. plasticity (prime). Next, they performed a math-shifting task in which they solved equations while the mathematical rule changed occasionally. Students with an incremental mindset were faster and more accurate on the math task. Post-error analysis indicated that students with an entity mindset slowed down after mistakes more, and improved less in accuracy, than those with an incremental mindset. Priming effects were nonsignificant on any task measure. In contrast, the brain plasticity prime produced a significantly stronger incremental self-report mindset score. These results demonstrate that mindset influences how adolescents learn from making math mistakes. The discrepancy between the priming effects on the questionnaire vs. on task performance indicates that knowledge about brain plasticity is not necessarily enough to influence on-line learning behaviour.

P-2-66 Developmental Increases in Phase Synchrony Between Human Functional Brain Networks

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Advances in resting state fMRI have revealed the human brain is organized into functional networks, which display a protracted development. However, a neurally based account of these maturational changes remains unclear. Here, we aimed to study the development of resting state functional brain networks using MEG to probe developmental changes in network development using phase synchrony as our measure of connectivity. We hypothesized increased cortical synchrony through adolescence in both alpha and beta frequency bands, mainly driven by between-network interactions, indicating

increased network integration. We collected 5 minutes of resting state MEG data from 49 subjects, ranging in age from 14-31 years. Resting state data was first filtered into frequency bands, ranging from 1-40Hz. Next, for each subject we calculated a phase locking value (PLV) between every cortical ROI pair. We found a significant positive linear relationship between synchrony and age in the alpha band and high beta band across cortical networks. In both alpha and beta bands, this effect was driven by between-network interactions. Significant between-network increases tended to occur between frontal association areas and other brain networks, including the visual and default mode networks. Taken together, enhanced integration of synchronized phase relationships between functional brain networks may be a key factor facilitating maturation from adolescence to adulthood.

P-1-67 Adolescent Risky Decision Making: Differential Strategies and Underlying Neural Substrates

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Human decision making is far from optimal. For example, when asked to choose between a sure and risky option of equal expected value, individuals are more likely to choose the risky option in case options are framed as losses, while they are more likely to choose the sure option in case options are framed as gains. At the neural level, this framing effect has shown to be driven by amygdalae activation. Although conceptualized as a universal phenomenon, previous research has revealed that not all individuals are equally sensitive to the framing effect. We hypothesized that this is due to individual differences in decision strategies, where each strategy is associated with a distinct neural profile. We have tested this hypothesis in a two-phase study. In the first behavioural phase of the study, a large sample of adolescents (N=861) performed on a framing task. Latent Class Analysis supported our hypothesis, in that adolescents employed one of nine decision strategies. Importantly, only adolescents that were classified in certain decision strategy groups were sensitive to the framing effect; others were not. In the second phase of the study, a sub-sample of adolescents from five different decision strategy groups that were, and were not, sensitive to the framing effect (N=93) performed on the framing task in the fMRI scanner. We present results of preliminary analyses to test whether different decision strategies are associated to distinct neural profiles in which amygdalae activation is present, or not.

P-2-68 The development of convergent corticostriatal structural connectivity during adolescence

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Adolescence is a stage of development characterized, in part, by heightened sensation seeking and continued development of cognitive ability. This unique behavioral profile is thought to be driven by relative rates of maturation of corticostriatal functional brain systems and their integration. The striatum contains primary input nuclei for cortical projections into the basal ganglia and serves as a hub of integration for distributed cortical systems. Here we investigate the development of convergent corticostriatal projections from cortical functional brain systems involved in limbic/reward-processing

(cortical limbic system) and cognitive control (fronto-parietal and dorsal attention systems) using diffusion-weighted imaging and deterministic fiber-tracking in a large cross-sectional sample of adolescents and young adults (N = 231; range 10-31). The degree of convergence between the limbic and the dorsal attention and fronto-parietal networks differed as a function of age. In early adolescence, limbic input was proportionally greater than dorsal attention input to bilateral ventral putamen, and proportionally greater than fronto-parietal input in the right anterior putamen. As the dorsal attention and fronto-parietal networks are largely associated with top-down cognitive control function, this pattern of results suggests a greater weighting of limbic vs. control inputs during early adolescence that changes to predominance of control inputs in adulthood. This developmental pattern may contribute to increased sensation seeking behavior early in adolescence and development

P-1-69 Test-retest reliability of infant ERPs evoked by faces

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Social, cognitive, and sensory information processing can be measured with event related potentials (ERPs). With use of this method we gradually gain insight in the development of the brain in the first years of life. An important basic property of ERP measurements is the test-retest reliability. If ERPs are used in longitudinal studies, one needs to know if observed changes are due to developmental changes or to other factors such as participant state or measurement error. The test-retest reliability of ERPs in infants is however unknown. The aim of the current study is to investigate the test-retest reliability of ERPs evoked by emotional faces in 9-10 month-old infants. Infants were presented with neutral, fearful and happy faces that contained mainly global or local visual information while EEG data was recorded. Within two weeks after the first visit, a second visit occurred in which the procedure was repeated. A total of 79 infants participated in the study, of which 32 infants were included in analyses for both visits. 49 infants were excluded from analyses due to technical errors, dropout or insufficient attended and artifact-free trials in one or both of the visits. Preliminary results show that a successful first visit results in a successful second visit in 70% of the time, whereas an unsuccessful first visit results in a successful second visit in only 30% of the time. Test-retest reliability of descriptive measures (e.g. percentage of attended trials and trials without artifacts) and the outcome measures (e.g. amplitude of the N290 ERP peak) will be presented.

P-2-70 When does an adolescent become an adult: The influence of emotion on the development of cognitive control

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For most legal purposes, an individual is considered an adult at the age of eighteen, but variations in the definition of "adult" exist in many legal and social policies. These distinctions between juvenile and adult are often based on political considerations and conventional wisdom rather than empirical evidence. Although developmental neuroscience research has shown that the brain continues to develop into the early twenties, behavioral and neural distinctions between adolescents and adults continue to be delineated. The present study implements a novel behavioral paradigm, with psychophysiology and fMRI, to examine impulsivity under transient and sustained states of positive and negative emotion in 110 individuals. We show that 13 to 21 year olds show similar decrements in performance as compared to adults over age 21 in response to cues of potential threat and under sustained positive emotion (excitement). These behavioral results are paralleled by: 1) decreased activity in dorsolateral prefrontal cortex, implicated in emotion regulation, in teens and young adults relative to adults in response to fear cues; and 2) increased activity in medial prefrontal cortex, implicated in integration of self and affective information in decision-making, in teens and young adults across the excite context. Our findings suggest that, under transient threat and sustained excitement, 18 to 21 year olds may behave more similarly to adolescents than adults due to continued development of prefrontal circuitry. These results may have implications for age-related legal and social policies.

P-1-71 Genetic variation in endocannabinoid signaling impacts frequency of cannabis use

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The endocannabinoid system has been implicated in substance use disorders that emerge in the early teens and peak by late adolescence. A primary regulator of the endocannabinoid signaling is fatty acid amide hydrolase (FAAH), a catabolic enzyme that impacts levels of anandamide (endocannabinoid) in the brain. In humans, a specific SNP of the gene (rs324420) regulates FAAH levels and activity. Human carries of the A-allele (AC and AA genotype) have reduced FAAH protein levels compared to those without the variant allele (CC genotype). Previous research has shown genotypic differences in FAAH within THC dependent samples. However, rarely have studies examined these developmentally. The current study examines FAAH genotypic differences in self-reported use of cannabis and alcohol in healthy adolescents and adults. A sample of 105 healthy volunteers (55 females) ranging in age from 11 to 25 years completed a questionnaire that asked if they had ever tried cannabis or alcohol and if so, at what age and how often. Substance use frequency was coded on a scale from 1 to 10, where 1 was never having tried the substance and 10 was daily use. The results show that A-allele carries (less FAAH, more anandamide) use cannabis less frequently that non A-allele carriers ($F(1, 44) = 6.34$, $p = .01$, controlling for age, gender, race and multiple comparisons). There was no association with alcohol use. These findings suggest that the FAAH polymorphism may impact cannabis use, and may have potential therapeutic relevance (FAAH inhibitors).

P-2-72 The role of magnitude and ordinal information in the formation of novel symbolic numerical representations

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[1]University of Oxford

Most existing research into the acquisition of numerical symbols has focused on the role of approximate non-symbolic representations of number in this process (see Piazza, 2010 for a review). However, children also learn the ordered count sequence and the role this plays in learning has received less consideration. We used an artificial symbol-learning paradigm to contrast learning numerical magnitude, by associating symbols with non-symbolic arrays, with learning the numerical order of the set of symbols. Thirty-two adult participants were randomly assigned to either the order condition, in which they were taught the ordinal sequence of the symbols, analogous to the count sequence, or the magnitude condition, in which they were trained to associate novel abstract symbols with non-symbolic numerical magnitudes. Participants then completed a comparison task with the newly learned symbols while electroencephalographic (EEG) data was recorded. Both reaction times on the comparison tasks and event related potentials (ERPs) were influenced by ratio in a way that resembled findings with comparisons of real numerical symbols in previous research (e.g. Temple & Posner, 1998). Furthermore, there were no significant group differences in these effects, suggesting that similar symbolic representations were formed whether participants were taught order or magnitude. These findings contribute to our understanding of potential mechanisms underlying the acquisition of numerical symbols.

P-1-73 Early high hormone levels in pubertal girls with MDD associated with depressive traits and resting connectivity

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Adolescence is a period during which the prevalence rate of major depressive disorder (MDD) increases sharply, particularly for females. One identified risk factor for MDD in females is the early onset of puberty, as pubertal hormones may have an adverse impact on developing neural systems serving emotion reactivity (ER) and cognitive control (CC). However, the influence of early puberty and hormone levels on the functional connectivity (FC) within and between networks underlying ER and CC is unknown. The current preliminary study evaluated the relationship between age-regressed levels of progesterone - a hormone shown to influence amygdala reactivity - with depressive symptoms and mean FC of ER and CC networks in 9-12 year old MDD and healthy girls. Networks examined were the Salience network - an ER network involved in detecting and orienting to salient stimuli, and a Cognitive Emotion Regulation network previously shown to exhibit altered FC in MDD. In MDD girls, higher progesterone levels were significantly related to increased depression severity, and marginally correlated with stronger average FC within the Salience network - relationships not seen in healthy girls. Both groups showed a negative relationship between progesterone levels and later sadness coping. These findings suggest early high hormone levels influence neural and behavioral MDD traits.

P-2-74 The Relationship between Inhibitory Control and Weight Status in Adolescents: A Pilot Study Incorporating fMRI, Behavioral Measures, and ad libitum Food Intake

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Previous research suggests a relationship between decision-making and weight status, however little work has focused specifically on adolescence. This novel pilot study assesses sensitivity to different types of reward and inhibitory/self-control in 40 adolescents (20 healthy weight, 20 overweight) ages 12-17. To assess neural sensitivity to different reward types, participants completed a modified card-guessing paradigm while undergoing an fMRI scan. Depending on the trial, participants were able to win monetary rewards, food rewards, or no reward by correctly guessing if a computer-generated number would be higher or lower than 5. Participants also completed two behavioral versions of a modified go/no-go task to assess inhibitory control and sensitivity to reward type. A mouse tracking task was used to assess self-control; participants rated 76 common foods based on health, liking, and wanting, and then made a binary choice regarding which food option they would rather eat. Self-control was also measured using the Eating in the Absence of Hunger protocol which assesses snack food intake after consuming a standardized meal. General food intake behavior was measured using a 30 minute ad libitum laboratory test meal. Here, we highlight our preliminary results characterizing the relationship between neural sensitivity to reward, generalizability of reward types, impulsivity/self-control, and actual food-intake behavior in obese versus healthy weight adolescents. We discuss implications for adolescent decision-making in food choice behavior.

P-1-75 The impact of type of examples and analogical reasoning on creativity in adolescents

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The ability to generate creative ideas can sometimes be limited by recently activated knowledge such as the knowledge we have about the usual function of an object. This phenomenon is described as the fixation effect and has to be overcome in order to produce creative ideas, such as a highly original umbrella (Hatchuel et al., 2011). Neuroimaging and behavioral studies conducted in adults have recently demonstrated that the exposure to examples can help the individuals resisting to this bias, when the examples proposed are themselves creatives (Agogué et al., 2011). Besides, it has been proposed that one of the mechanisms enabling to overcome the fixation effect is the use of analogical reasoning (Smith et al., 2010). This research, conducted on adolescents, aimed at (i) exploring the impact of both the frequency and the creativity of the example provided to them and (ii) studying if the use of analogies can help overcoming the fixation effect. Participants were requested to generate alternative uses of conventional everyday objects. Each participant was shown an example of alternative use that could either be frequent and creative, infrequent and creative, frequent and uncreative and infrequent and uncreative. The results demonstrate that frequency and creativity have differential impacts on the production of creative responses in adolescents. Besides, the adolescents report differential levels of analogous responses according to the kind of example that has been provided.

P-2-76 The Effects of Adolescent Cannabis Use on Adult Working Memory

Brenden Tervo-Clemmens[1], Daniel Simmonds[1], Luna Beatriz[1]

[1]University of Pittsburgh

Cannabis has been associated with impairments in working memory (WM), which continues to improve through adolescence. As such, adolescents may be particularly vulnerable to the effects of cannabis on WM. However, the effect of age of onset of cannabis use on brain function supporting specific components of visuospatial working memory is not well understood. During fMRI acquisition, 54 adults with a history of cannabis use completed a Sternberg-type visuospatial working memory task where set size, maintenance duration, and cue validity were manipulated. For behavior analyses, we used linear-mixed-effects modeling to examine interactions between age of onset of cannabis use and the three task factors: set-size (1 or 3 locations), delay length (1.5 or 6s), and cue type (valid or invalid). A fast event-related design was used to distinguish fMRI activation during encoding, maintenance, and response epochs. Only correct trials were included in group analysis. Controlling for total use, there was a negative relationship between cannabis age of onset and reaction time in trials with invalid cues. Age of onset was further associated with an increase in bi-lateral dorsal caudate activation and recruitment of this region significantly mediated the relationship between of age of onset and reaction time in invalid trials. CB1, the primary cannabinoid receptor in the brain, is highly expressed in the caudate nucleus. The present findings highlight a potential pathway through which early cannabis exposure in adolescence may impair adult working memory.

P-1-77 The Effects of Adolescent Cannabis Use on Adult Working Memory

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P-2-78 Different structure-function relationships in very preterm and term born children

Ines Mürner-Lavanchy[1], Maja Steinlin[2], Christian Rummel[2], Regula Everts[2]

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Premature birth may have serious consequences on brain development. Alterations in cortical thickness (CTh) and cortical surface area (CSA) have been detected in very preterm children. These alterations have been suggested to parallel cognitive functioning, which is often at risk in those children. There is a lack of studies on the relationship between CTh, CSA and cognitive functioning in very preterm and term born children. Forty very preterm children (<32 weeks gestational age and/or <1500 gram birth weight) and 30 controls were included in the study. The automated surface reconstruction software FreeSurfer was applied to obtain CTh and CSA measures. Comprehensive neuropsychological testing was administered prior to MRI examination. In preterms, right-hemispheric CTh correlated positively with working memory, visuomotor skills, verbal learning and shifting performance. Left-hemispheric CTh correlated positively with working memory and verbal learning performance. Right- and left-hemispheric CSA correlated positively with inhibition, visuomotor skills and shifting performance in preterms. In controls, no significant structure-function relationships were found. To sum up, better cognitive performance was associated with higher CTh and larger CSA in preterms but not in term born controls. As our earlier publications suggest, preterms might show a slight developmental delay. It is possible that cognitive functions in preterms do not yet rely on highly specialized neurons and thicker cortex and larger cortical surface area is needed to fulfill requested cognitive operations.

P-1-79 Activation of prefrontal cortex during hierarchical rule learning in 8-month-old infants: data from near-infrared spectroscopy

Denise Werchan[1], Anne G. E. Collins[1], Michael Frank[1], Dima Amso[1]

[1]Brown University

Rationale: Adults (Collins & Frank, 2013) and infants (Werchan, Collins, Frank, & Amso, 2015) create and generalize hierarchical rule sets during incidental learning. While this process is thought to be supported by interactions between prefrontal cortex (PFC) and basal ganglia in adults (Collins & Frank, 2013), the neural circuits supporting this form of learning in infants are unknown. Here we tested whether infants recruit PFC during hierarchical rule learning. Methods: Fifteen 8-month-olds were given a violation of expectation hierarchical-rule-learning task that required them to learn spoken object-label pairings across different speaker contexts. We tested whether infants could append a novel object-label to an existing rule set and transfer it back to other speaker contexts associated with that rule set. Transfer was assessed by measuring infants' looking times to speaker-object-label mappings that were consistent versus inconsistent with the rule set structure. Infants' PFC activation was recorded using near-infrared spectroscopy. Results: Infants trended towards looking longer to the inconsistent mapping, $t(14) = 1.88$, $p = .08$, which suggests that they created hierarchical rule sets and used these sets to generalize object-labels across speaker contexts. Infants also had greater PFC activation when the rule sets switched-requiring them to update the current rule set in working memory, $F(1,14) = 8.249$, $p = .012$. Together,

these findings suggest that PFC supports hierarchical rule learning in 8-month-olds, a function previously thought to emerge later in life.

P-2-80 How peer's choices and the information level regarding risk influence adolescent risk-taking engagement?

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Many studies have indicated that adolescents could make advantageous choices when they received explicit information but failed to choose advantageously when they were not explicitly informed regarding risks that could only be gradually learned from feedback. The aim of the present study was to examine whether peers' behavior increases or decreases adolescents' risk-taking in both informed and non-informed situations. 180 adolescents aged from 13 to 15 completed a new adaptation of the BART. Participants were required to cumulate as much points as possible by inflating balloons associated with variable break points. They could save the cumulated points at any moment but if the balloon exploded first, all the cumulated points were lost. In the "informed" condition, the participants received explicit information regarding the balloon resistances (i.e., low-resistance, medium-resistance, and high-resistance), whereas they had to learn to estimate the risk level on the basis of feedback in the "non-informed" condition. In addition, participants also received information about the decision made by three classmates for each balloon. Critically classmates' choices were a design manipulation promoting either risky or cautious behavior. Results showed that cautious peers reduced adolescents' risk-taking only in the non-informed condition leading them to collect more points whereas risky peers had the opposite effect.

P-1-81 Friend versus foe? Neural correlates of fairness related decision-making in interactions with peers

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[1]Leiden University, [2]Radboud University Nijmegen

Studies on social decision-making often focus on interactions with anonymous others, whereas the majority of our interaction partners are people we know. Behavioral differentiation between different types of interaction partners develops across adolescence. We investigated neural networks of fairness-related decision-making in 51 adolescents (M age = 15) and 27 adults (M age = 21). Participants could make equal or unequal distributions of coins between themselves and another player: a friend, a disliked classmate, a neutral classmate, or an unfamiliar peer. Both adults and adolescents choose equal distributions more often for their friends than other interaction partners. Preliminary fMRI analyses show higher activation of the temporoparietal junction when participants of both age groups made inequity choices compared to equity choices, suggesting involvement of mentalizing during inequity choices. Adults also showed higher TPJ activation when interacting with friends than with disliked peers, whereas interactions with disliked peers involved higher ventrolateral prefrontal cortex activation than

interactions with friends. For adults decisions involving costly compared to non-costly prosocial behavior elicited medial prefrontal cortex activation. For adolescents costly equity compared to inequity choices involved higher vlPFC activation, suggesting the role of regulation during these choices. Our findings show differential activation of the social brain depending on the social context in which fairness decisions are made. This differentiation develops across adolescence.

P-2-82 Individual differences in spontaneous attentional processing of objects are related to conceptual development of number in preschoolers

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Humans possess an approximate number system (ANS) for extracting the numerosity of a set of items and a parallel individuation (PI) system for distinguishing between and tracking individual items. These systems are hypothesized to be foundational to symbolic number and mathematics abilities, but their exact role, especially in preschool conceptual development, remains unclear and highly debated. Here we used an individual differences approach to test for a relationship between the spontaneously evoked brain signatures (using event-related potentials) of PI and the ANS and initial conceptual development of symbolic number as displayed by counting proficiency in preschoolers. We observed that only individual differences in the neural signatures of the PI system, but not the ANS, explained a unique portion of variance in children's counting proficiency above general cognitive, executive, linguistic, and maturational factors. Further comparison between developing and proficient counters suggested the possibility that better counters were individuating more items. These results provide the first empirical evidence that early individual differences in spontaneous attentional processing of objects, a component of PI, are related to high-level conceptual development of symbolic numerical abilities.

P-1-83 The relationship between pubertal status and neural activity in reward processing and cognitive control regions during risky decision-making

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It has been hypothesised that adolescent risk-taking behaviour results from a dissociation in the developmental timing of the brain networks involved in reward-processing and cognitive control respectively. This fMRI study explored whether changes in brain function in reward-processing and cognitive control regions when performing a risk-taking task were related to pubertal development, independently of chronological age. Fifty male participants aged 12-14 years were scanned whilst performing a variant of the balloon analogue risk-taking task. Self-reported pubertal stage was used to assign boys to Early or Late puberty groups, and salivary sex steroid hormone levels were assessed. Oestradiol levels were positively correlated with neural activity in the right orbitofrontal cortex and left lateral prefrontal cortex (PFC) when opting not to make a risky choice, independent of chronological age. Both testosterone levels and puberty group were positively correlated with ventromedial and

lateral PFC activation during the processing of outcomes of a risky decision, independent of age. There were no differences in subcortical activation with pubertal development or age. These results provide evidence for functional changes in both reward-processing and cognitive control cortical regions during pubertal development. However, the pattern of functional changes observed does not support the hypothesis that functional differences that emerge in early adolescence between reward-processing and cognitive control regions are driven by a differential influence of puberty on these regions.

P-2-84 Reduction of neural variability within cognitive and action systems supports developmental improvements in working memory performance

David Montez[1], Daniel Simmonds[1], Beatriz Luna[1]

[1]University of Pittsburgh

Working memory (WM) accuracy and reaction time continues to improve through adolescence. These mean improvements occur in parallel with a marked reduction of the within- and between-subject variance of responses. This suggests that neural systems that support the ability to engage working memory are available by adolescence but systems that underlie the ability to recruit these in a consistent fashion strengthen with development. Here we present fMRI findings from a longitudinal sample of 56 subjects sampling 8 to 30 years of age, as they performed a variant of the memory-guided saccade task. Subject's eye positions were monitored which allowed us to quantify trial-to-trial saccade metrics such as latency and accuracy. We applied dimensionality reduction techniques to assess subject-level trial-to-trial variability of recruitment of networks supporting WM maintenance and retrieval as well as oculomotor performance. Results showed age related improvements in mean performance (accuracy and RT) and importantly, decreases in variability of these responses. These developmental reductions in behavioral variability in spatial WM were found to be driven by tandem improvements in the stability of oculomotor- and maintenance-related brain networks. Together, these results suggest that underlying the maturation of WM, is the ability for the brain to reliably engage cognitive and action systems.

P-1-85 Age influences caudate activity in Social Mindful decisions

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[1]VU university, [2]VU, [3]VUmc

Social Mindfulness, a novel concept indicating the inclination to mind others' interest during decision making, is thought to increase with age. However, research to date has not investigate the underlying neural mechanisms of the development in social mindfulness. We therefore tested this hypothesis in 49 healthy individuals, aged 16-31 using the new Social Mindfulness paradigm. Participants had to choose one item out of two similar categories (e.g. red and green apples) presented in a ratio 2-2 (control) and 3-1. In the 3-1 ratio, the choice has implications for the second player: When choosing the single item (the 'unmindful choice'), there will be no choice left, whereas choosing one of the identical items (the 'unmindful choice'), the second player is still left with the possibility of choice. Age was unrelated to the

number of mindful choices participants made. Brain analysis associated age with differential patterns of brain activation during mindful decision making. The right caudate was increasingly activated with age, whereas the precuneus and superior temporal gyrus were increasingly deactivated. During unmindful decisions, age increased cuneus, precuneus and angular gyrus activity. It seems that with age, other mechanisms are activated, since there are no behavioral differences. The

P-2-86 Conceptual development in Theory of Mind is reflected in emerging neural distinctions

Hilary Richardson[1], Jorie Koster-Hale[2], Mika Asaba[3], Natalia Velez-Alicea[3], Rebecca Saxe[1]

[1]MIT, [2]Harvard, [3]Stanford

Young children build and revise intuitive theories of the world, creating abstract causal concepts to interpret their limited evidence. This type of cognitive development requires reorganizing and refining knowledge according to new, relevant conceptual distinctions. What aspect of children's brain development underlies such conceptual change? Seven to twelve year-old children were asked to explicitly evaluate others' beliefs based on different types of evidence (e.g. aural vs. visual, or good vs. bad), and participated in an fMRI scan during which they listened to stories involving characters who formed beliefs based on these different types of evidence. We used Multi-Voxel Pattern Analysis (MVPA) to measure the presence of distinctions in the pattern of neural response in brain regions implicated in Theory of Mind to beliefs supported by different types of evidence. Children were behaviorally sensitive to the source modality of evidence (aural vs. visual), and this distinction was robustly represented in the right temporo-parietal junction (RTPJ). Children who were more sensitive to the quality of evidence (good vs. bad) in the independent behavioral task had more distinct spontaneous neural response patterns in their RTPJ to these conditions. These results suggest that MVPA can be used to measure emergence of conceptual distinctions within the domain of Theory of Mind.

P-1-87 Evaluation of a Bayesian cognitive model for adolescent risky decision making in the Stop Light Game

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Developmental cognitive neuroscience is at the forefront of research on adolescent risk taking. However, commonly used tasks have relatively low ecological validity (the Balloon Analogue Risk Task [BART]), or confound risky and adaptive responding (the original Stoplight Game). To address this, we redeveloped the Stoplight Game - a simple driving simulation with a series of intersections, the goal of which is to get the lowest time. At each intersection, yellow lights prompt a choice: to stop (the safe option) or go and risk a crash (the fastest option if successful, but slowest if not). Each run comprises 20 intersections of three crash probabilities (.25, .5, .75), with time penalties set so 'go' and 'stop' have equal expected value. Subtle cues distinguish intersection types, so learning will lead to lower times. The current study tests how social context and exclusion change risky decision making on this task. Diverse

participants (N=53, ages 11-17) from local schools underwent fMRI while playing the game alone, and while being watched by peers pre- and post-exclusion from Cyberball. We model the cognitive process underlying behavior on this task, an approach that has been fruitful in describing several latent parameters in BART behavior (e.g., Plescak, 2008; van Ravenzwaaij et al., 2011). We evaluate a modification of van Ravenzwaaij and colleagues' Bayesian cognitive model using simulated Stoplight data, and use the above sample to investigate the role of regions including vS, lPFC, and TPJ, focusing on peer influence and exclusion.

P-2-88 Neural and behavioral effects of social exclusion on decision quality in adolescents

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Making advantageous decisions in social situations is a key developmental challenge for adolescents. Teens with a deficit in this ability may be more likely to make poor choices with potentially serious outcomes. The current study examined individual differences in the neural and behavioral effects of negative social interaction with peers on subsequent decision making. Adolescents (N=53, ages 11-17) underwent fMRI while completing a decision-making task before and after an event of social exclusion by peers. In a modified version of the Stoplight Game, participants decided whether to stop or go for a series of traffic lights. Go decisions resulted in faster times on the game but also increased the chance of a crash resulting in a time delay. Crash probabilities varied based on different onsets of the yellow light. Teens completed self-report measures of susceptibility to social influence and real-world risk behavior. Teens with lower resistance to peer influence made significantly fewer successful go decisions following social exclusion ($p=.02$) resulting in worse performance on the game ($p=.05$). The drop in advantageous decisions predicted both early initiation and frequency of real-world risk behaviors, including tobacco and marijuana use and sexual behavior (all p values $< .03$), even after controlling for age. Imaging results explore the role of key regions in decision making and social interaction, including vS, lPFC, insula, and TPJ. Results suggest that an event of social exclusion may influence a teen's ability to make advantageous decisions in uncertain situations.

P-1-89 Longitudinal changes in resting-state functional connectivity in depressed and anxious adolescents in relation to treatment.

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Previous cross-sectional studies indicated differences in resting state functional connectivity (RSFC) between the amygdala and the prefrontal cortex (PFC) in adolescents with depressive and anxiety disorders. However, not much is known about the longitudinal changes in RSFC that occur after treatment. This study tested longitudinal changes in RSFC in 20 treatment-naïve adolescents (12-19

years old) with a depressive or anxiety disorder and 24 healthy control group adolescents who were group-wise matched on age and gender. All adolescents were scanned at two occasions, which were separated by a six-month period during which the adolescents from the clinical group received treatment as usual. We used a seed-based region-of-interest (ROI) approach with seeds in bilateral amygdala. There was a strong decrease in self-reported depression and anxiety symptomatology over time within the clinical group. As expected, whole brain analyses showed strong positive connectivity between the amygdala and several subcortical and cortical regions. In addition, there was a significant session x group interaction in which the clinical group showed an increase in positive connectivity between right amygdala and medial PFC over time. The current results provide new insights on longitudinal changes in RSFC in depressed and anxious adolescents and fit well with the current ideas on disturbed top-down regulation by PFC over the amygdala in participants with depressive and anxiety disorders.

P-2-90 Newborn amygdala connectivity: Implications for infant fear and cognitive development at 6-months

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Fear is necessary for survival, and human infants exhibit multiple fear-related behaviors beginning in the second half of the first year of life. Animal models show early emerging fear depends on developing amygdala circuitry. In human children and adults, amygdala connectivity to subcortical and cortical brain regions underlies normative and pathological fear. Yet neural systems involved in emergence of fear during human infancy remain poorly understood. Moreover, although emotion and cognition are inextricably linked at the level of brain and behavior, cognitive development is often neglected in studying fear. We examined amygdala functional connectivity with rs-fcMRI in 64 neonates (28 females; M=25.9 days, SD=12.6), and measured infant fear (Infant Behavior Questionnaire) and cognitive development (Bayley Scales of Infant Development) at 6-months. Stronger, positive neonatal amygdala connectivity to bilateral anterior insula, ventral striatum, left parahippocampal gyrus, right premotor cortex and right temporoparietal junction predicted higher fear. Stronger amygdala connectivity to anterior medial prefrontal cortex predicted a specific phenotype of higher fear and advanced cognitive development. Amygdala functional connections implicated in normative and pathological fear across the life span have roots in a functional neural architecture evident by the time of birth. Consideration of emerging fear in the context of cognitive development will likely contribute to a more nuanced understanding of fear, its neural bases, and its implications for future mental health.

P-1-91 Puberty predicts inhibitory control improvements on an fMRI Go/No-go task across adolescence

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Although it coincides with adolescence, puberty is an independent process that is thought to have a unique influence on brain-behavior maturation across adolescence, above and beyond associations with chronological age. Using self-reports of pubertal maturation (Peterson Developmental Scale) and a Go/No-go fMRI task, the current study examined how pubertal maturation influences inhibitory control performance in 59 youth (36 girls), ages 10-17. Step-wise regressions were implemented to determine the best model fit (age, sex, and pubertal development) for task performance (accuracy, omissions, commissions, and Go reaction time (RT)). The best models for accuracy, omissions, and commissions included pubertal development as a significant predictor in each of these models (p's<0.01), but not age. Pubertal development significantly predicted better accuracy, as well as fewer omission and commission errors. In addition, sex was a significant predictor in the omission model (p=0.02) and a trend for the accuracy model (p=0.07), with higher accuracy and fewer omission errors on the task in boys compared to girls. For correct Go RT, age was a significant predictor (p=0.005) in the best-fit models, and puberty was not. These findings suggest that previous reports of cognitive improvements in accuracy of inhibitory control from childhood to adulthood may be driven by pubertal development, whereas faster RT is better accounted for by age-related processes. Current efforts include examining the pubertal-related neural correlates of these behavioral improvements on the fMRI Go/No-go task.

P-2-92 Associations between aerobic exercise and cortical brain structure in adolescent males

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Aerobic exercise has been shown to impact brain structure and cognition in children and adults. To date, however, no study has examined how aerobic exercise relates to cortical brain structure during development. Using structural MRI and FreeSurfer semi-automatic segmentation, the current study examined how aerobic fitness (indexed by VO2 max) related to volume, thickness, and surface area in 34 male adolescents, 15 to 18 years of age. We hypothesized that aerobic fitness would relate to greater thickness and volumes in frontal, parietal, and motor regions. After correcting for multiple comparisons, our results showed greater aerobic fitness (e.g. higher VO2 max) was related to decreased surface area of the left postcentral gyrus, left cingulate cortex, right primary motor cortex, and right superior temporal sulcus and middle temporal gyrus (p<.05). Furthermore, greater aerobic fitness related to decreased volume of the left postcentral gyrus (p<.05). No relationships were detected between aerobic fitness and thickness. These findings suggest that aerobic fitness during adolescence relates to surface area differences in regions important for motor perception (superior temporal sulcus) as well as somatosensory processing (postcentral gyrus) and motor planning (primary motor). Given that decreases in cortical surface area during late adolescence is thought to reflect a more efficient "adult-like" phenotype, longitudinal studies are warranted to determine if exercise during adolescence may accelerate the refinement of motor neural circuitry.

P-1-93 Neural correlates of the development of the evaluation of social vs. non-social information during adolescence

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Social cognition undergoes profound changes during adolescence, which might in part be determined by the development of two neural networks: the social brain and the executive control network. In a developmental fMRI study, we investigated BOLD signal in 39 participants (aged 11-31 years) while they evaluated and manipulated social or non-social information. In the social task, participants evaluated themselves or a friend, or compared themselves with their friend. In the non-social task, participants evaluated their hometown or another town, or compared the two. The consistency of participants' responses increased with age, and was greater for non-social information. Activation of the relational integration network, including the rostrolateral PFC (RLPFC), was observed in the comparison condition of both the social and non-social tasks. Medial prefrontal cortex (MPFC) showed greater activation when participants evaluated social as opposed to non-social information. There was no further increase in social brain activation when participants compared themselves to their friend as opposed to when they rated either themselves or their friend separately. Developmentally, there was greater activation in the right anterior insula in adolescents compared to adults during the comparison of non-social (as opposed to social) information. This study demonstrates parallel recruitment of the social brain and the executive function network during the manipulation of social information, in adolescents and adults.

P-2-94 Development of Reward and Cognitive Control Connectivity using Group Iterative Multiple Model Estimation (GIMME)

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Characterizing the bi-directional interactions of reward and inhibitory control brain systems is imperative to gain a fuller understanding of decision making across the lifespan. Here, we compare and contrast the interaction between key neural regions involved in reward and inhibitory control (e.g., striatum, FEF; correct trials only) in a large (N=90) sample of children, adolescents, and adults as they performed an incentivized antisaccade task. FMRI task data were used to derive functional ROIs, which were then analyzed using an effective connectivity approach called Group Iterative Multiple Model Estimation (GIMME) (Gates et al., 2011). This approach allows for the recovery of effective connectivity maps for both groups and individuals, considering both contemporaneous and lagged relationships, thus allowing a unique examination of both developmental and individual differences in the relationships between key brain regions involved in decision making. Our initial results indicate similarities in task-related neurocircuitry as well as age group by incentive differences in connectivity within incentivized antisaccade task trial epochs (e.g., striatal to FEF ROI connectivity is heightened in adolescents during response preparation during reward vs. neutral trials, $p<0.05$). The nature and directionality of identified task-related differences will be noted and discussed. These results suggest continued maturation through adolescence of brain systems underlying the integration of rewards with inhibitory control behavior (i.e., "motivation").

P-1-95 Effort discounting in children exposed to prenatal smoking

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Smoking during pregnancy is associated with decreased academic achievement in children - an association that may be related to the effects of nicotine on the developing mesolimbic dopamine system. Effort discounting, the disinclination to expend effort toward the pursuit of rewards, is one candidate behavioral phenotype associated with mesolimbic dopamine system functioning that may contribute to decreased academic achievement. The current study hypothesized that prenatal nicotine exposure would be related to greater effort discounting in a dose-dependent manner. To test this hypothesis, 407 8-year old children were recruited from a longitudinal epidemiological study of rural families and completed a decision-making task wherein they played a computer-adaptive card game that required them to actively make decisions about how much cost in terms of time (waiting), effort (alphabetizing lists), or uncertainty (probabilistic reward) they were willing to expend/tolerate for differing amounts of reward (points). Placed within a multilevel logistic regression model, the children's choices provided for both assessment of between-child differences in discounting and how the patterns of responding were related to the number of cigarettes mothers smoked during pregnancy. Results revealed that greater nicotine exposure was associated with greater effort, but not delay or probability, discounting, independent of a variety of control variables (e.g. child gender and IQ, maternal use of alcohol and illicit drugs during pregnancy, and family risk).

P-2-96 Qualitative change in number processing upon learning to count

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Current theories diverge on whether developing an understanding of counting should be characterized as an incremental learning process for young children or if it requires true conceptual change. To address this question we compared numerical processing measured by event-related potentials (ERPs) in children that had or had not yet mastered counting. In our study, we asked children to compare a number of objects presented to a number word presented immediately beforehand. We systematically manipulated the numerical relationship between the number of objects and the number word to determine the degree of neural sensitivity to number comparison in each group. We observed that the neural response of both groups was sensitivity to the numerical relationship in the comparison task, but in qualitatively different ways. More specifically, developing counters showed a neural response that scaled with the numerical ratio between numbers being compared such that the largest neural response was to the closest ratio comparison. Proficient counters showed a response that was also scaled with ratio, but where the largest neural response was to the most distant ratio comparison. These contrasting patterns of response to numerical ratio suggest that developing counters and proficient counters may be construing relationship between number words and quantities in qualitatively different

ways. As such, these results are at least consistent with the idea of conceptual change in early numerical development.

P-1-97 A multi-level analysis of brain networks underlying adolescent effortful control

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Understanding the neural basis of adolescent self-control is a cornerstone of developmental neuroscience. Previous work has emphasised prefrontal cortex regions, but recent fMRI evidence suggests the importance of: 1) activation and functional connectivity of the cognitive control network (CCN); 2) deactivation and functional connectivity of the default-mode network (DMN); and/or 3) an interplay between the two systems. We investigated these hypotheses by studying the temperament trait of effortful control (EC) during the performance of a cognitive control task and during the resting-state. Seventy-three 16-year-old adolescents performed the Multi-Source Interference Task and underwent a resting-state acquisition. A graph theoretic approach was used to study relationships between 73 brain regions and EC at the following levels: task-related (de)activations, task and resting-state subnetworks, and modules of interconnected regions. Results indicated that EC was not associated with task-related activation or deactivation. Task-related connectivity analysis revealed a distributed subnetwork (56 edges) consisting of connections within and between the CCN and DMN ($p<0.001$). A resting subnetwork was also found (34 edges), mainly comprised of connections between CCN and DMN regions ($p<0.001$). These subnetworks were embedded within a bipartite organisation of brain functional connectivity into two main modules. These results emphasised the importance of dynamic, large-scale networks to adolescent self-control rather than the activation or deactivation of specific brain regions.

P-2-98 The influence of social approval from peers on cognitive control during adolescence

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Many distinctive adolescent behaviours, such taking risks with friends, initially seem ill-considered. But they may hold great motivational value for adolescents if they strengthen their social ties with their peers, as adolescence is a period characterised by the increased importance of social relationships and approval from others. Recent work has suggested that adolescents' motivation to engage in goal-directed behaviour is influenced by the social and motivational salience of their goals. Social reward, in the form of approval from peers, may enhance adolescents' ability to exercise cognitive control over their behaviour in order to receive this approval. However, not all peers may influence behaviour in the same way. Therefore, in the present study we utilised methods from the field of social network analysis to examine how social ties between peers influence goal-directed behaviour. Data collection has just been finalised in a sample of approximately 100 adolescents aged 11-13 years. All participants

completed an incentive-based go-no go task, which contained feedback in the form of social approval from peers. These peers were selected based on the adolescents' nominations of peers within their social network whom they liked or disliked. Data analysis will focus on how the effects of social approval on task performance differ based on which peers provide this approval, as well as on how the sensitivity to social approval differs between adolescents with different positions within their social network. Results will be presented during the conference.

P-1-99 Social distraction interacts with long-term memory and attentional orienting in visual search with complex scenes: an EEG study.

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Social distraction is evident in everyday life and experimental tasks. Less is known about its consequences on learning and memory, and the neural underpinnings of these potential relationships. The current study investigates the relationship between behavioral/eye-tracking differences in visual search with complex social and non-social scenes, and memory performance for target location. Thirty-two young adults and 16 children 5-10-years-old searched for targets in 80 scenes three times each. Memory precision for target location was then tested. After a break, reaction time was measured in trials in which participants covertly oriented to targets appearing in those scenes at either valid (previously learned) locations or invalid (different) locations. For adults, longer search time for social scenes emerged by the third block, and eye-tracking revealed significantly more attention to social distracters. Further, memory for target locations was poorer for social scenes and distracter type (social/non-social) moderated RT in the orienting task. Preliminary data with children suggests developmental differences. For ongoing EEG data collection, we hypothesize that poorer memory for social scenes will be reflected in preparatory activity in the covert orienting task, with significantly less alpha desynchronization contralateral to the memory-predicted location for social scenes. Overall, this data indicates that social distraction interacts with memory performance to affect later orienting to complex scenes. Ongoing EEG collection investigates the neural underpinnings.

P-2-100 Positive and Negative Neural Feedback Processing of Risk Decisions Across Social Contexts in Adolescents

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Risky decision-making is an iterative process, constantly synthesizing information from prior experiences to either promote or inhibit future risk-taking decisions; therefore, predicting future risk behaviors first requires an understanding of how risky decisions are processed. The influence of social context on feedback processing is of particular importance in adolescence, a time of increased risk-taking decisions in the presence of peers compared to children and adults. In particular, peer rejection is associated with

higher rates of risk-taking, yet how different social context influences the feedback of risky decisions has been relatively understudied. In the current fMRI study, we adapted the original Stoplight Game (a driving simulation designed to measure risk in the presence of peers) to de-correlate task performance with risk as well as differentiate how varied peer interactions influence neural feedback following the outcome of a risky (or safe) decision. We modeled 4 types of feedback (2 positive: go (no car) or stop (car), and 2 negative: go (car) or stop (no car)) across social contexts (alone, after peer acceptance, and after peer rejection). Preliminary data (N=53, ages 11-17 years old) suggests differential feedback processing following peer acceptance versus peer rejection. After peer rejection (versus acceptance), there was greater middle and posterior cingulate cortex (CC) to both types of negative feedback; and greater caudate, dorsal anterior CC, and middle CC to both types of positive feedback.

P-1-101 Structural development of the social brain and links with social cognition

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In recent years numerous studies have provided support for the prolonged trajectories of structural brain development, particularly in the prefrontal and temporal brain regions, from childhood through young adulthood. One longitudinal study has shown that the 'social brain regions' involved in social cognition and mentalizing, such as the medial prefrontal cortex [medial Brodmann Area 10 (mBA10)], temporoparietal junction (TPJ), posterior superior sulcus (pSTS) and anterior temporal cortex (ATC), show developmental changes across adolescence (Mills et al., 2014). In the current study, we replicate these findings in a longitudinal sample of 211 participants, who were scanned twice with two years in between (T1 ages 8-24). Grey matter volume and cortical thickness in mBA10, TPJ and pSTS decreased from childhood into the early twenties. Furthermore, we explored whether two measures of social competence; friendship quality and perspective-taking skills, explained additional variance beyond age in changes in structure of the social brain regions. Results indicate that friendship quality is related to changes in surface area and volume particularly in mBA10, such that participants with higher friendship quality had less mBA10 surface area and grey matter volume. Importantly, our results not only replicate prior findings on structural changes in the 'social brain regions', they also link these changes to measures of social competence. As such, our findings are relevant for our understanding of the developmental changes in social cognition across adolescence.

P-2-102 Neural correlates of social aggression in young children provoked by negative feedback in a social judgment task

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In daily life, children experience acceptance and rejection by peers (social judgments), which can be distressing and can lead to aggression. Recent studies have investigated behavioral reactions of social acceptance and rejection with a social aggression network task in adolescents (Overgaauw et al., in prep). However, not much is known about the neural correlates of social acceptance and rejection in young children. Therefore, we designed a task to measure the reaction to social judgments in 4-6 year old children. Children performed a task in which they saw positive, negative and neutral social judgments on their chosen cuddly animal by same-aged peers (90 trials). Electro encephalogram (EEG)and electro cardiogram (ECG) data were acquired to examine the neural and physiological correlates of processing social judgments. In the second part of the task social aggression was measured by a button press with which children were able to destroy balloons of the judging peer. In total, we included 46 children (mean age 5.32 years old (SD= .90), ranging from 4.17 to 7 years old, 54.3% boys), for 29 of whom we have EEG data. We will present behavioral, EEG and ECG data of these children. The ECG data may be used to validate the new paradigm as previous research showed that processing of negative feedback causes heart rate slowing independent of the neural response (Gunter Moor et al., 2014). The feedback related ERP components P300 and FRN will be analyzed to examine differences between the neural reaction to social judgments, and they will be related to behavioral outcomes.

P-1-103 A longitudinal fMRI study of self-evaluation across adolescence

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Adolescence is a formative period for the development of identity and self-concept. Personal identities as well as social identities begin to form during this period, and these identities are supported by one's self-concepts in various arenas, such as social or academic domains. While numerous studies have shown that cortical midline structures (CMS) are associated with self-referential processing in adults and adolescents, few studies have investigated how these processes develop over time. To probe this question, we examined data from a 6-year longitudinal fMRI study in which typically-developing children (N = 27) performed a self-evaluation task at the ages of 10 (T1), 13 (T2), and 16 (T3). During the block-design task, participants listened to short phrases in the social or academic domain and judged whether or not it described themselves, or a familiar fictional other (Harry Potter). We explored linear and quadratic developmental trends for self > other contrasts, across and between social and academic domains. Preliminary results showed consistent activation during self-evaluations in CMS, such as medial prefrontal cortex (mPFC) and medial posterior parietal cortex (mPPC). However, activation patterns in these regions showed divergent trajectories. Posterior areas (mPPC) showed linear trends over time, while anterior ones (mPFC and dorsal anterior cingulate cortex) showed quadratic trends with peak activations at T2. These results suggest that the roles of different CMS in self-concept development vary over time and across regions in unique ways during adolescence.

P-2-104 Individual differences in executive control and negative affect as they influence the ability to ignore emotionally distracting information in mid-adolescence

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During mid-adolescence, teens are very reactive to emotional information, even when it should be ignored. Here we examined the degree to which self-reported executive control abilities and self-reported negative affect influence the ability to ignore emotionally-salient but task-irrelevant information. To do so, we imaged 25 adolescents while they performed an emotional Stroop task requiring them to ignore a task-irrelevant face while attending to the emotional valence of a task-relevant word. In addition, a localizer task and multi-voxel pattern analysis (MVPA) were used to index the degree to which the task-relevant word and the task-irrelevant face were being processed on each Stroop trial. Neither self-reported executive control abilities nor negative affect predicted overall behavioral interference on the Stroop task. However, our results indicated that the greater a youth's self-reported executive control, the less face processing on a given trial influenced an individual's reaction time (RT) for that trial. In contrast, the greater a youth's self-reported negative affect, the more face processing on a given trial influenced an individual's RT for that trial. These results demonstrate that individual differences in both cognitive control and negative affect influence the salience of emotional information during adolescence, and that such relationships can be revealed by MVPA.

P-1-105 Neural and behavioral responses to social media differ as a function of perceived peer endorsement in adolescence and emerging adulthood

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Adolescents and young adults use social media more than any other age group, and previous research has found that peer influence occurs in online contexts. We investigated the potential role played by "quantifiable online social endorsement" - e.g., "likes" or "favorites"-- to examine if this subtle indicator of peer opinion significantly influences youth's behavioral and neural responses. Participants (age: 13-21) underwent an fMRI scan while using a tool that mimics Instagram, a popular photo-sharing app. Participants viewed photos that had been ostensibly "liked" by peers, though in reality, the number of "likes" was experimentally manipulated such that half of the photos appeared with many likes (popular) and half with few likes (unpopular). Both adolescents and college-age participants demonstrated significantly different behavioral and neural responses as a function of photo popularity: they were more likely to "like" popular photos and refrain from "liking" popular photos, and popular photos elicited significantly greater activation in reward-related regions (e.g. nucleus accumbens, orbitofrontal cortex) than unpopular photos. These effects were also shown when participants viewed photographs depicting risky behaviors like drinking alcohol or smoking. Our findings identify a novel means by which peer influence about potentially dangerous behaviors can occur on social media; as youth navigate their online worlds, subtle indicators of social endorsement affect the way they perceive information online and their subsequent behaviors in response to that information.

P-2-106 Training related changes in the neural timing of letter-speech sound integration in dyslexic children

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A reduced neural letter-speech sound integration may contribute to reading impairments in developmental dyslexia. It is still an open question whether this reduction in dyslexics is malleable and whether it relates to behavioral improvements. We investigated changes in event-related potential (ERP) measures of letter-speech sound integration over a 6-month period during which 9-year-old dyslexic readers (n=17) followed a training in letter-speech sound coupling next to their regular reading curriculum. We used Dutch spoken vowels /a/ and /o/ as standard and deviant stimuli in one auditory and two audiovisual oddball conditions. In the audiovisual conditions, the letter 'a' was presented either simultaneously (AV0), or 200 ms before (AV200) the vowel sound onset. Before the training (T1), our results point to expected pattern of typical auditory mismatch responses, together with the absence of letter-speech sound effects in a late negativity (LN) window. After the training (T2), we found earlier (and enhanced) crossmodal effects in the LN window. Interestingly, earlier LN latency at T2 was coupled with higher behavioral accuracy in letter-speech sound coupling. Furthermore, a latency of the earlier mismatch negativity (MMN) in the AV0 condition at T1 was related to reading fluency at both T1 and T2 as well as with reading gains. Our findings suggest prospect for moderate improvement of the reduced neural letter-speech sound integration with reading training and relation between the timing of this neural integration and behavioral improvements.

P-1-107 White matter plasticity associated with working memory training in 6year old children

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Working memory is critical for a range of cognitive functions. Working memory capacity can be improved with adaptive cognitive training. Although studies of adolescents and adults report experience-dependent changes in white matter (WM) associated with such training our knowledge of structure-function relationships in young children is limited. Cogmed's computerized adaptive training program has been shown to improve children's working memory. This pilot study examines training-induced WM plasticity in young children after Cogmed training. Healthy 6-year-old children were randomly assigned to 5-weeks of visuospatial working memory training (N=5) or to a waitlist-control group (N=7). Cognitive assessments (AWMA, CANTAB) and structural magnetic resonance imaging (MRI) scans, with DTI, were obtained for all children on three separate visits, each separated by 6-weeks. Measures collected at visit 1(V1) and 2(V2) provide information about developmental changes in WM and cognition, over 6-weeks, while measures collected before (V2) and after training, visit 3(V3), provide information about training-induced changes in WM and cognition. DTI parameters of WM were analyzed for associations with working-memory scores using functional regression models. Verbal and visuospatial working memory scores were significantly improved for training children compared to

controls (p-values .03 to .0009). Improved scores from V2-V3 were also associated with changes in the WM tract connecting left fronto-parietal regions (p=.006). Associations were not found in controls or prior to training V1-V2.

P-2-108 Neural Dysregulation and Rumination Explain the Link between Chronic Victimization and Depressive Symptoms

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Victimization is linked to depression concurrently and over time. A burgeoning literature suggests that rumination may account for this association. Self-reports of rumination are associated with prolonged amygdala responses to negative stimuli (Siegle et al., 2002). Moreover, altered emotional processing in affective (e.g., amygdala) and control (e.g., rVLPFC) regions is associated with depression. To understand the mechanisms through which victimization is associated with depressive symptoms, we examined two questions: (1) Does rumination explain the victimization-neural dysregulation link, and (2) Does neural dysregulation explain the rumination-depression link? These questions were studied in the context of exposure to chronic social stress in the form of victimization. Specifically, 44 adolescent girls reported on a history of victimization (2nd to 8th grade). The summer after 9th grade, adolescents completed an fMRI scan assessing emotion processing under two conditions: passive observation and matching emotional faces to emotion labels. PPI analyses examined functional connectivity between amygdala (seed region) and rVLPFC ROIs for the passive observation compared to the labeling condition for negative emotions. Results indicated victimization indirectly affects neural dysregulation (amygdala and rVLPFC connectivity) via rumination, and rumination indirectly affects depressive symptoms via neural dysregulation. Findings implicate rumination and neural dysregulation as mechanisms that help to explain the association between victimization and depressive symptoms.

P-1-109 How does attentional control matter? Insights from developmental cognitive neuroscience

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Attentional control plays a crucial role in biasing incoming information in favour of what is relevant to further processing. Our work has been inspired by the need to understand the functional consequences of attentional difficulties in neurodevelopmental disorders. These highlight the need to investigate how attentional control matters over typical development. To this aim, we have explored how attentional constraints interact with memory using behavioural, EEG and MEG methods. In Experiment 1, we recorded EEG while adults and 10-year-olds used cues to guide attention before encoding or while maintaining items in VSTM. Known neural markers of spatial orienting to incoming percepts were examined in the context of orienting within VSTM. Adults elicited a set of neural markers that were broadly similar in preparation for encoding and during maintenance. In contrast, in children these processes dissociated. Furthermore, in children, individual differences in the amplitude of neural

markers of prospective orienting related to individual differences in VSTM capacity, suggesting that children with high capacity are more efficient at selecting information for encoding into VSTM observers. In Experiment 2, the sources and temporal dynamics of attentional modulation in function of encoding into memory were investigated in 10-year-olds and adults using MEG. These developmental cognitive neuroscience findings have implications for an understanding of both developmental disorders and adult attentive observers.

P-2-110 Differential Effects of Attentional Deficits on Language Acquisition: A Cross-syndrome Study

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Our study elucidates some of the basic mechanisms that constrain language development by relating auditory/visual attention measures to language ability. Typically developing 16-month-olds (N=22) were compared to 92 children with a developmental disorder (Down, Fragile-X, Williams syndromes [DS, FXS, WS]) and 41 at familial risk of developing autism (Sibs). In the first experiment, visual attention was measured using an eye tracker. In the second experiment, auditory attention was measured using an ERP oddball paradigm. We found visual disengagement problems in DS and visual engagement problems in WS. We also found atypical ERPs in all groups, including attenuated neurophysiological responses in the Sibs group. Furthermore, we found that some of these measures were related to language ability in some, but not all, groups. Together, our data highlight different mechanisms for acquiring language skills. These findings have theoretical and clinical relevance, particularly with respect to intervention planning.

P-1-111 Investigating the development of facial mimicry in infancy using EMG

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Humans have a tendency to spontaneously and unconsciously copy or 'mimic' others' postures, gestures, facial expressions, and emotions. This mimicry plays an important role in communication and affiliation, yet very little is known about its development. It has been suggested that mimicry is supported by associations between visual and motor representations of actions that are formed through correlated visuomotor experience. The present study investigates this hypothesis by assessing whether infants' facial mimicry is related to the extent to which their parent imitates their facial expressions in a typical face-to-face situation. 30 4-month-old infants participated in a face-to-face play session with their parent from which the amount of parental facial imitation was coded to obtain an index of infants' opportunity to form associations between visual and motor representations of facial actions. Infants also observed movies of an actress performing several facial actions (e.g. eyebrow raising, tongue protrusion, and mouth opening) while we measured activation of the corresponding facial muscles using surface electromyography (EMG). The direction of the eye gaze of the actress was manipulated (direct

vs. averted) to assess whether, like in adults, mimicry is modulated by social signals in infancy. If the ability to mimic facial expressions indeed develops through being mimicked by others, we expect infants who receive a higher degree of parental facial imitation to demonstrate higher levels of facial mimicry.

P-2-112 Failing to break: age predicts increased reactivity to non-target stimuli

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Effective self-control allows people to regulate their behavior, such as to resist tendencies to approach cues in the environment when it is not appropriate. Lapses in self-control may occur when a prepotent response toward a stimulus influences action before inhibitory control can be effectively implemented. Using a go/nogo paradigm, we sought to test whether reaction times on commission error nogo trials were faster than correct responses to target stimuli, and further whether there is an improvement in reactivity toward non-target stimuli across development. 534 participants (ages 5-35, 295 female) completed this task, of whom 184 had fMRI data. We show that reaction times become faster with age ($F(1, 435) = 64.5$, $p < 0.0001$), and that participants were faster to non-targets than targets ($F(1, 463) = 14.2$, $p < 0.0001$). This difference in reaction time also decreased with age ($F(1,411) = 10.1$, $p < 0.0005$). Greater recruitment of frontal subcortical circuitry toward correct target than commission error trials parallels these behavioral findings. Results support an explanation of commission errors often taking place when top-down control mechanisms are not implemented quickly enough to prevent prepotent responses, particularly toward rare events. Improved self-regulatory behavior with respect to habitual behavior may be further facilitated as this neural circuitry matures over the course of development.

P-1-113 DIFFERENCES IN FRACTIONAL ANISOTROPY BETWEEN TOBACCO-USING AND COMBINED MARIJUANA- AND TOBACCO-USING HIGH-RISK YOUTH

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Numerous studies have described associations between alcohol use and reduced white matter integrity, although associations with other commonly used substances are less clear. This exploratory study examined fractional anisotropy (FA), an overall index of white matter integrity, in high-risk youth who primarily use tobacco or both tobacco and marijuana. Adolescents (N = 30) ages 14 - 18 years completed imaging and substance use questionnaires during a larger study, and were grouped based on their reported use of alcohol, tobacco, and marijuana on the Timeline Follow-back into CIG (n = 13; > 15 days tobacco use, < 5 days alcohol use, and < 5 days marijuana use) or CIG+MJ (n = 17; > 15 days tobacco use, > 15 days marijuana use, and < 5 days of alcohol use). Groups were matched in age and gender. A voxelwise t-test (corrected whole-brain $p < .05$, ≥ 20 voxels) showed 45 small (≤ 70 voxels) areas of significant difference diffused throughout the white matter skeleton. Of the 5 largest clusters (80 - 155 voxels), 2 clusters in the right superior corona radiata and anterior thalamic radiation showed FA in CIG > CIG+MJ (Cohen's d = 1.03), and 3 clusters in the right inferior fronto-occipital fasciculus, corticospinal

tract, and internal capsule showed FA in CIG < CIG+MJ (Cohen's d > .94). Other substances have been suggested to have small associations with white matter compared to alcohol. Among this sample of adolescents with low recent alcohol use, these preliminary results suggest diffused differences in FA associated with tobacco use versus concomitant tobacco and marijuana use.

P-2-114 Longitudinal Links between Negative Family Relationships and Adolescent Cognitive Control-related Neural Processing

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Adolescents have an increased need to regulate their behavior as they gain access to opportunities for risky behavior; however, cognitive control systems necessary for this regulation remain relatively immature throughout this developmental period (Luna et al., 2010). While adolescents show general increases in risk taking from childhood, individual differences exist in onset and severity of risk-taking behaviors. One important predictor of individual differences is the quality of adolescent-parent relationships (McNeely et al., 2002; Borawski et al., 2003), such that relationships characterized by conflict and hostility relate to earlier onset and increased severity of risk taking. However, little is known regarding the neural mechanism underlying this relationship. Since adolescents undergo significant neural change, it may be that parent-child conflict impedes or alters development in prefrontal regions subserving cognitive control. To test this hypothesis, twenty adolescents completed a go/nogo task during an fMRI session at 14 and again at 15-years old, and reported on the levels of conflict and cohesion in their families, as well as their engagement in risk-taking behavior. Adolescents with family relationships characterized by high conflict and low cohesion at T1 showed longitudinal increases in risk-taking behavior. The relationship between family relationships and risk taking was mediated by longitudinal changes in left VLPFC activation during cognitive control, such that adolescents with longitudinal increases in activation showed concurrent increases in risk tak

P-1-115 High-stakes rewards and punishments induce "choking" behavior in adolescent reactive cognitive control: Behavioral evidence and frontostriatal mechanisms

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Development of frontostriatal circuit function through adolescence is thought to result in unique integration of reward prospects and cognitive control demands. Here we sought to examine developmental changes in the degree to which high-stakes outcomes would facilitate or paradoxically impair (e.g., "choking") performance when the stakes are high but in-the-moment control demands could not be anticipated. 88 participants aged 13-21 performed a go/no-go task with intermixed low and high monetary stakes conditions while undergoing fMRI. Accurate trials were rewarded, whereas errors incurred a loss. Each block consisted of a stakes cue, a series of target trials, and summary feedback.

There was an interaction between age and stakes whereby adolescents performed better in low than high stakes conditions, consistent with choking, whereas adults showed the opposite pattern. FMRI data revealed that adolescents exhibited increased striatal activity while viewing the stakes cues. For no-go trials, upregulation of bilateral inferior frontal gyrus recruitment for high relative to low stakes increased with age. These findings suggest that adolescents choke when stakes are high, which may be explained by a still-maturing capacity to integrate value information with control demands to strategically upregulate prefrontal recruitment.

P-2-116 Motivational aspects that lead to adherence to workshops Cognitive Stimulation

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Introduction: Cognitive Stimulation Workshops are a theme in expansion in Brazil, but little is said about Workshops for people not enrolled and what motivational aspects leads them to engage in the project. Goals: To analyze the main motivational aspects that drive normal elderly to seek the services of stimulation as well as their expectations for service. Methods: This is a quantiqualitative social research, using the method of action research. The sample consisted of 15 elderly patients age over 60, with 1 to 5 years of schooling who had attended two classes on health (including topics such as Alzheimer's, Vascular Dementia and Depression) and attended assiduously cognitive stimulation group for one year. The classes were held in a citizen club in a city in the state of São Paulo. These participants underwent interviews and informal conversations that point to the understanding of the subject in its action (DESLANDES, 1994). This enabled the capture of repressed or not easily articulated psychological data such as attitudes, motives or assumptions, which needs the participation of the researcher to bring forth the reality of the subject. Conclusion: There are many noticeable gains compared to regular participation in the project, so that was surpassed initial expectations regarding the method, then, what was to answer a priori cognitive demand, such as improving memory, language, attention , concentration, spatial skills, among other functions, started to benefit other aspects such as psychological and social.

P-1-117 Neural change following different memory training approaches in very preterm born children - a pilot study

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Background: There is mixed evidence regarding neural change following cognitive training. Brain activation increase, decrease, or a combination of both may occur. We investigate training-induced neural change using two different memory training approaches in school-aged children born very preterm. Methods: Very preterm born children (aged 7-12 years) were randomly allocated to a memory strategy training, an intensive working memory practice or a waiting control group. Before and immediately after the trainings and the waiting period, brain activation during a visual working memory

task was measured using functional magnetic resonance imaging (fMRI) and cognitive performance was assessed. Results: Following both memory trainings, there was a significant decrease of fronto-parietal brain activation during the visual working memory task and a significant increase of memory performance. In the control group, no neural or performance change occurred after the waiting period. Conclusion: These pilot data point towards a training-related decrease of brain activation, independent of the training approach. Our data highlight the high training-induced plasticity of the child's brain during development.

P-2-118 Learning without motivation ? No role of intrinsic motivation on working memory training gains

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Intrinsic motivation is believed to affect learning, but in many studies the effect of intrinsic motivation is confounded by participants' previous performances in learning situations. The role of motivation in cognitive training is unclear. If motivation affects training gains it may have a direct effect on cognitive improvements or an indirect effect by influencing the amount of time trained. We investigated associations between intrinsic motivation before and during working memory (WM) training on WM improvement in 768 individuals (6-25 years). Motivation measured before training was not associated with baseline performance or with transfer tasks performed at the end of training. Motivation-measurements during training were associated with final outcome, but not after performance at the time of ratings were taken into account. There was only a weak effect of intrinsic motivation on amount of time trained. Our results suggest that intrinsic motivation does not affect improvement after WM training.

P-1-119 Social attention and affective arousal in response to emotion evoking video clips in young children with ASD

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Understanding and adequately dealing with the social environment is the most prominent problem in autism spectrum disorder (ASD) and seems to be present from a very early age. Research has shown that children with ASD tend to focus less on relevant aspects of social information, such as the eyes of others. Reduced attention to social cues might be related to a neurobiological deficit in affective arousal. What happens in the arousal system of very young children with ASD while being exposed to social information has yet to be studied. We will test the hypothesis that children with increased arousal (i.e. more stress) in response to the emotions of others, tend to employ attentional avoidance as a means to cope with these emotions. To answer this question we compared children with ASD (aged 3,5-6 years) to age matched typically developing children. An eye tracking experiment (Tobii systems) was used to investigate social attention, expressed in visual scanning patterns, in response to the viewing of

emotion evoking video clips (angry, sad, fearful, and happy). During these video clips, skin conductance levels and heart rate variability were recorded (Biopac), as a measure of affective arousal. Combining these two methods provides us with a unique opportunity to more closely investigate the coordination between neurobiological drive and the observable social behavior. By investigating the own affective responses in relation to social attention, we hope to gain insight into the neurodevelopmental predisposition to social dysfunction children with ASD face in daily life.

P-2-120 The association between chronic sleep reduction, white matter connections and impulsivity. An adolescent DTI study

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Sleep problems are highly prevalent in adolescents worldwide and have been attributed to changes in sleep patterns such as a preference for later bedtimes and rise times. Chronic sleep reduction in adults has been associated with reduced behavioural control and reduced emotion regulation capacities. However, in adolescents the relation between sleep reduction and self-control is poorly understood. Recent neuroimaging studies in adolescents report that improvement of impulse control can partly be explained by better 'quality' of prefrontal white matter connections. In the current study we examine the interrelations between chronic sleep reduction, impulsivity and white matter connections within 'self-control' networks in a sample of 250 typically developing adolescents. Specifically, we test whether 1) chronic sleep reduction relates to more impulsivity and 2) the presumed relation between sleep reduction and impulsivity is established through an effect on white matter connections. Behavioural results indeed confirm that chronic sleep reduction is related to higher levels of (self-reported) impulsivity, neuroticism and hostility. We are currently analysing whether this association is mediated by integrity of white matter tracts within attention and self-control networks.

P-1-121 Attachment security is related to infants' neural processing of animated parent-child interactions

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Attachment security has been shown to bias infants' attention allocation to and expectations about social interactions (Johnson et al, 2010; Biro et al, 2014). Little is known, however, about the relation between the quality of infants' early interactions with primary caregivers and the neurophysiological responses involved in processing social interactions. In the current study, we investigated the hypothesis that the attachment quality biases infants' emotional-motivational brain processes, in particular the relative hemispheric asymmetry in frontal brain activity. Greater relative right frontal activity is associated with regulating of "withdrawal emotions" such distress, while a greater relative left frontal activity is associated with "approach emotions" such as joy and interest. Ten-month-old infants watched

animations that involved the separation of two abstract characters, a larger and a "crying" smaller one. The separation was followed either with the larger character returning ("responsive caregiving") or with the larger character going further away ("unresponsive caregiving"). Frontal alpha asymmetry was calculated for the separation and outcome part of animations. At 12 months, infants' attachment security was assessed using the Strange Situation Procedure. The study is ongoing. In the first 49 infants with complete data, we found that secure infants, relative to insecure infants, responded to the "responsive" outcome of the animations with greater left frontal activation, $F(1,47)=4.7$, $p=.036$, which suggests a stronger approach-like motivational state.

P-2-122 Puberty, social comparison, and risky decisions in adolescent girls

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Adolescence is a period in development characterized by a greater tendency to take risks, particularly in social settings. Existing neurobiological models have proposed that the rise in sex steroids during puberty--which marks the onset of adolescence--influences the development of brain regions involved in socio-emotional processes. We explored the role of pubertal hormones and social comparison in adolescent risky decisions. To measure risk taking, we designed a child-friendly probabilistic decision-making game called the Jackpot task. In this task, participants could choose to play it safe or take a risk based on explicit information about the risk level and stakes involved in their decision, and the type of cumulative performance feedback (social rank or monetary) they received. This task was administered in adolescent girls (11-13yrs, n=58) while they were lying in an MRI scanner, which allowed for examination of reward-related brain processes associated with their risky choices. Individual differences in risk taking were associated with saliva-based testosterone, but not estradiol level. The relation between testosterone and risk taking was mediated by increased medial orbitofrontal activation. The anticipation of social rank feedback during risky decisions, was associated with increased insula activation, which was stronger in girls with higher levels of estradiol. These findings provide insight into some of the factors that contribute to adolescent risk taking and highlight the importance of using an interdisciplinary approach to investigate adolescent behavior.

P-1-123 Dorsal Stream hierarchical organization and the development of visual attention

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Rationale: Visual pathways are hierarchically organized along a caudal-to-rostral gradient. Information is processed locally in primary visual cortex (V1) and then fed rostrally to higher-order regions. Feedback connections then resolve competition between visual inputs. We tested whether development of connectivity within and between caudal visual regions explains the integrity of local within- and between-region functional connectivity in subsequent hierarchical steps. Methods: Resting-state fMRI scans from the PING Study were analyzed (N=83, Age=3-20). We assessed connectivity within and

between structurally connected regions, specifically V1--MT--inferior parietal (IP)--frontal eye fields (FEF) --prefrontal cortex (PFC). Results: In children only, greater local V1 connectivity predicts greater local IP connectivity, and greater connectivity between V1 and MT predicts greater local PFC connectivity. Critically, greater V1--MT connectivity also predicts better attentional control in children. By adolescence, increases in connectivity between dorsal stream regions are associated with weaker local connectivity within upstream hierarchical regions. Greater V1--MT connectivity in adolescents and adults predicts weaker local MT and FEF connectivity, and greater MT--IP connectivity also predicts weaker local FEF connectivity. These data indicate a shift from local to between-region connections, and potentially from feedforward- to feedback-weighted processes. Future work will explore the directionality of between-region connections using effective connectivity analyses.

P-2-124 Electrophysiological biomarkers of social anxiety: a comparison of right frontal alpha asymmetry and delta-beta cross-frequency correlation

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Social anxiety disorder (SAD) is a common anxiety disorder characterized by an intense fear and avoidance of social situations. The heterogeneity in the clinical presentation of SAD and its comorbidity with other psychiatric disorders necessitates identification of biomarkers that can guide in early detection, diagnosis, and treatment. For the first time, the current study jointly examined two candidate electrophysiological biomarkers previously associated with SAD: right frontal alpha asymmetry and delta-beta cross-frequency correlation. Previous studies tested these biomarkers only during resting state and anticipation. However, cognitive-behavioral studies posit that social anxiety is related to cognitive biases during both anticipation and post-event information processing. Therefore, we tested the predictive value of right frontal alpha asymmetry and delta-beta cross-frequency correlation for SAD during resting state, anticipation and post-event information processing. Furthermore, we tested whether these biomarkers are already present during resting state (which would indicate a biomarker at trait level) or only during symptom provocation (which would indicate a biomarker at state level). EEG data was obtained from low socially (n=33) and high socially (n=23) anxious female undergraduates during (1) resting state, (2) while anticipating to give a short videotaped speech, and (3) while recovering from this speech. Here, we will present the results of this study. We believe that this study will provide valuable insight into the electrophysiological basis of social an

P-1-125 Social attention in high functioning young adults with autism spectrum disorder: Visual gazing during viewing of naturalistic emotional scenes

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Background: Perceiving the right social cues is very important for understanding and navigating through the social environment. Eye-tracking studies in children with ASD are suggestive of restricted social

attention but only few studies have addressed whether this impairment persists into young adulthood, while correct processing of social situations is very important in this phase. We compared spontaneous gaze behavior and processing of own emotions during viewing of dynamic naturalistic emotional scenes between young adults with high functioning ASD (HFASD;N = 53) and their typically developing (TD) peers (N = 31). Method: Stimuli consisted of naturalistic video clips with varying emotional content (sad, happy, cheerful, pain and anger) in social interactions. Social gaze was analyzed with fixation duration (in seconds) for multiple customized areas of interest. Additionally, participants were asked to label their emotions and rate their intensity. Results: Initial analyses suggest that HFASD individuals display a tendency to attend less to social features (eyes, faces and bodies) during social interactions than TD's. Although HFASD individuals experienced the same type of emotions as the TD group, they rated them as less intense. Conclusion: Using naturalistic social-emotional stimuli to investigate social attention in ASD can enhance ecological validity of study results. Our preliminary findings tentatively support the notion that impairments in social attention and deviant emotional processing continue beyond childhood despite a high level of functioning in ASD

P-2-126 The depth of conflict: ERP amplitude at N2 is associated with variation in reaction time in a perceptual interference task

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Background: Children with prenatal exposure to selective serotonin reuptake inhibitor's (SSRI's) or medically untreated depression (DEP) show increased behavioral problems. We suggest that these problems may stem from intrinsic deficits in inhibitory control and interference suppression. Also, we investigate whether individual variation in reaction times on the Attention Network Task (ANT) reflect slowed cognitive processing, a common assumption, or rather a less optimal neural activation. Methods: Children with prenatal exposure to SSRI's (N=28, M=69.02 months, SD=4.76) or DEP (N=42, M=68.41 months, SD=5.16), and a comparison group with no exposure ((N=33, M=67.73 months, SD=5.16) where tested on a modified version of the ANT while recording EEG and behavioral data. To explore the neural correlates of interference suppression, event-related potentials were coded as either fast or slow by using the median-split of behavioral reaction time for each child. Findings: Our findings revealed no effect of prenatal exposure upon interference suppression. However, we found a significant difference in the mean amplitude of the N2 component at frontal electrodes between fast and slow trials, with fast trials being associated with increased amplitudes. There was no effect on peak latency ERP, suggesting that the same cognitive process supports both fast and slow responses, but for slower trials these processes are not fully engaged. Conclusion: These results suggest a link between the amplitude of the frontal N2 component and perceptual conflict resolution in children.

P-1-127 Inhibition of the default mode network during performance of a verbal fluency task in preterm born adults

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Background: Individuals who were born very preterm (VPT; < 32 weeks of gestation) have shown impaired or delayed language function in childhood and adolescence. Here we studied whether language impairments in VPT individuals persist beyond early adulthood and whether these are associated with neuroanatomical alterations during tasks involving language processing. Design/Methods: We studied 24 individuals who were born VPT: 10 had normal neonatal cranial ultrasound classification (VPT-N), 14 had either uncomplicated periventricular hemorrhage (PVH) or PVH with ventricular dilation (VPT-PVH); and 25 term born controls. Image analysis was performed in FSL's FEAT. Z (Gaussianised T) statistics were thresholded using clusters determined by $Z > 2.3$ and a FWE corrected cluster significance threshold of $p < 0.05$. Results: On-line task performance was statistically comparable between the three groups, although VPT individuals showed a lower performance than controls. Increased activation in VPT participants, regardless of presence of neonatal brain injury, compared to controls, was noted bilaterally in precuneus, subcallosal cortex and frontal pole; in left lateral occipital gyrus, right angular gyrus, and left middle temporal gyrus. Together these regions resemble the default mode network (DMN). Conclusions: The functional neuroanatomical alterations showed in VPT adults in DMN, which is typically anticorrelated with the language network, suggest that decreased inhibition of the DMN may be interfering with language processing.

P-2-128 Neural correlates of working memory in children with agenesis of the corpus callosum

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Working memory (WM) is the system responsible for maintenance and online processing of information. In typically developing (TD) children, WM is underpinned by a fronto-parietal network of interacting left and right brain regions. The corpus callosum connecting the two hemispheres is crucial for transfer and integration of information across the brain. Developmental absence (agenesis) of the corpus callosum (AgCC) is a congenital brain malformation resulting from disruption of corpus callosum formation. This study aims to investigate functional organisation of WM functions in children with AgCC using functional magnetic resonance imaging (fMRI). Nine subjects with AgCC and 16 typically developing (TD) subjects aged 8 to 17 years were recruited from the Royal Children's Hospital, Melbourne and completed an fMRI WM paradigm. This WM paradigm allows investigation of activations during encoding and recognition periods. The AgCC compared with the TD group performed poorer on the WM task ($p=.035$). Similarities in activation patterns were found during encoding and recognition for the two groups. For encoding, small differences in cluster localisation were found in frontal and occipital areas. For recognition, increased frontal activation was found in the AgCC compared with the TD group. In summary, although children with AgCC present with atypically developing brains and poorer WM than TD peers, globally similar regions in the TD brain appear to be recruited during a WM task. Small activation differences could reflect the different organisation of WM in this atypical brain.

P-1-129 Effects of Stress on Bodily Freezing in Adolescents

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Freezing is a major defensive stress-response, characterized by reduced body-sway and heart rate. Exacerbated freezing in threatening situations has been associated with increased basal and stress-induced glucocorticoid levels and with long-lasting stress-related symptoms in animals. However, the effects of stress-induced changes on human freezing are unknown. A new measure has been developed to quantify freezing-like behavior in humans using a stabilometric force-platform such that shifts in body-sway can be assessed in high temporal and spatial accuracy. Previous research has shown that exposure to angry (vs. neutral) faces can induce reductions in body-sway and heart rate in humans. We used this method to assess the effects of stress and stress-induced cortisol on human freezing responses to angry vs happy and neutral faces. Participants were 90 adolescents (age 17) who were tested at three time points: prior to, immediately after, and 55 min after the Maastricht Acute Stress Test. To ascertain stress-induction, self-reported, physiological, and hormonal measures were collected prior to, immediately after, and 20, 30, 40, and 55 minutes after stress-onset. Preliminary analyses of the self-report and blood pressure measures indicated a successful stress-induction. We also predicted that stress-induced cortisol levels are associated with increased freezing. Finally, we will explore the association between stress-induced freezing and affective symptoms (e.g., anxiety) to gain a better understanding why adolescence is a phase of increased vulnerability for stress symptoms.

P-2-130 Developmental changes in the influence of COMT genotype on the processing of self-generated thought

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The Val158Met polymorphism of the COMT gene is a major determinant of prefrontal dopamine levels. The Met allele, which results in lower enzymatic activity and higher dopamine availability, has been associated with better executive function and working memory in adults, whereas the Val allele has been associated with advantages in affective processing. A recent study has demonstrated that the effect of COMT genotype on working memory emerges during adolescence, consistent with developmental changes in the dopaminergic system. We investigated the association between COMT genotype and the flexible modulation of the balance between the processing of self-generated, stimulus-independent information as opposed to perceptually based, stimulus-oriented, information in a cross-sectional sample of healthy adults and adolescents (N=300, aged 9- to 37- years). Participants processed self-generated or stimulus-orientated information in alternating blocks, in the presence or absence of affective distractors. We predicted genetic associations would interact with age. Task accuracy exhibited an age-group x genotype x condition interaction. In adults, individuals homozygous for the Met allele made fewer errors when selecting and manipulating self-generated thoughts, while in the developmental group there was no Met allele benefit on performance. These results extend

previous findings of developmental variation in the association between COMT genotype and prefrontal cognition to a novel aspect of executive function: the ability to select and manipulate self-generated information.

P-1-131 Neural oscillatory dynamics of social evaluative feedback processing in women

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Social connectedness theory posits that the brain processes social rejection as a threat to survival. Indeed, neuroimaging studies have demarcated a 'neural alarm system' sensitive to signs of social rejection, and psychophysiological work revealed that the heart shortly 'breaks' after unexpected social rejection feedback. However, evidence of this preferential processing of social disconnection is lacking in EEG studies. Here we examined whether sensitivity to social evaluation could be revealed at the level of neural oscillatory activity. We employed the social judgment paradigm in which undergraduate women were asked to provide their expectancies about being liked/disliked by unknown peers. Expectancies were followed by feedback indicating social acceptance/rejection. Results revealed distinct neural oscillatory activity during feedback anticipation vs. feedback processing stages. Anticipating social acceptance induced a significant increase in beta power that correlated negatively with self-reported levels of behavioral inhibition, depression, and rejection sensitivity. During social feedback processing we found an increase in theta power that significantly peaked when participants were presented with unexpected social rejection feedback. Together, this study offers novel insights into functional distinct roles of oscillatory activity implicated in social evaluative processing. Beta oscillatory power seems to index the fundamental need for social connectedness, whereas theta power indexes the 'neural alarm' system - activated when social disconnection is most salient.

P-2-132 Investigating puberty in developmental MRI samples

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It has been hypothesised that puberty may influence aspects of brain development that occur during adolescence. However, most study designs do not incorporate puberty measures, and those that do use a variety of different assessment tools. This study looks at the relationship between different available pubertal measures using two samples (sample 1: 45 girls, aged 11-13 years; sample 2: 78 males aged 12-16 years), and considers their practical use within MRI studies. Both samples included three pubertal measures: salivary assays of the sex steroid hormones testosterone, oestradiol and DHEA; self-report Pubertal development scale (PDS) scores; and physician assessment of Tanner stage (sample 1) or self-assessment of Tanner stage (sample 2). In girls (sample 1), correlation between hormones was high ($r \geq 0.5$). Physician-assessed breast development was correlated with both oestradiol and testosterone levels, while pubic hair development was correlated with testosterone (all $r=0.4$). In boys (sample 2),

correlation between hormones was variable (r=0.2-0.5). Self-reported genital and pubic hair Tanner stage were highly correlated with testosterone (r>0.6), moderately correlated with DHEA (r>0.2), and showed no correlation with oestradiol. Agreement between Tanner stage and PDS scores showed significant variability in both samples. Overall, different techniques for assessing pubertal development show variable concordance. Care should be taken in study design and interpretation of results to ensure that puberty measures are used appropriately.

P-1-133 Resting State Networks in Young Children with Developmental Delay: An Exploratory Pilot

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Developmental Delay (DD) encompasses a heterogeneous spectrum of symptoms and early diagnoses. Children with DD are at heightened risk for developing behavioral and mental health disorders; however, little is known about the brain mechanisms underlying DD given challenges in conducting fMRI in this group. Our aim was to conduct a feasibility pilot to examine clinical and behavioral characteristics of scanning children with DD, and examine resting state network differences. 17 children (ages 5 & 6) were recruited from a longitudinal parenting study to undergo a separate fMRI pilot. After mock scanner acclimation, they underwent an MPRAGE and two short rsfMRI runs (TR: 780ms; TE: 30.8ms; flip: 55deg; thickness: 2.5m; FOV:200mm; 60 slices; 340 volumes). We examined maladaptive (CBCL) and adaptive (Vineland-II) behavior as well as diagnosis from the parent study. 10 children completed the protocol; those unable to complete were mainly due to excessive movement. There were no statistical differences between completers and non-completers on CBCL scores, however Vineland scores show a trend towards significance, where non-completers had lower scores. Raw motion did not significantly correlate with these scores. Data cleaning and analysis with FSL is underway to further examine differences between completion groups, and examine resting state network differences on clinical and behavioral characteristics, but these preliminary data suggest promise in scanning this diverse population in order to elucidate the brain mechanisms in DD, which may impact treatment trajectory.

P-2-134 White matter tracts and memory abilities alterations following perinatal brain injury in adults who were born very preterm.

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Background:Very preterm birth (VPT;<32 weeks of gestation) has been associated with impairments in memory abilities and functional neuroanatomical alterations in medial temporal and fronto-parietal areas. Objective:To study the relationship between structural connectivity in memory tracts and various aspects of memory in VPT adults who sustained differing degrees of perinatal brain injury (PBI) as assessed by neonatal cerebral ultrasound (US). Methods:64 VPT individuals who had normal US or uncomplicated periventricular haemorrhage (PVH; VPT-1), 20 VPT individuals who had PVH and ventricular dilatation (VPT-2), 48 age-matched controls (all aged 18-20y) received 1.5T MRI.

Tractography was performed using spherical deconvolution. Cingulum (divided into its dorsal and ventral parts) and fornix were dissected. Assessments included California Verbal Learning Test (CVLT), Visual Reproduction subtest of the Wechsler Memory Scale (VR-WMS), and Wechsler Abbreviated Scale of Intelligence (WASI). All results were corrected using false discovery rate. Results:Ventral cingulum and fornix volume differed between VPT-1 and controls (both p=.01); VPT-2 and controls significantly differed in volume of all 3 tracts (all p<.05). Tract volumes correlated with memory scores across groups: dorsal cingulum with CVLT perseveration and CVLT strategy (both p<.01), ventral cingulum with VR-wWMS and fornix (p<.01), fornix with CVLT perseverations (p<.01). Conclusions: Alterations of task-specific white matter tracts may underlie specific difficulties associated with VPT birth and PBI.

P-1-135 Auditory discrimination in sleeping preterm infants

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Auditory discrimination during active sleep was studied in preterm infants and their fullterm counterparts using the brain's automatic change-detection response, the mismatch negativity (MMN) response of the event-related potentials. Subjects were healthy preterm (32-36 weeks, N=14) and fullterm (38-41 weeks, N=20) infants of the first month of life. Acoustic stimuli with large deviance in passive oddball paradigm were used (1000 Hz standard (p =0.85) and 2000 Hz deviant (p = 0.15) tones). Research data revealed distinctive features in morphology and specificity in parameters of mismatch response components in children at early ages. Contrary to results from adults infant's components were manifested in two positive peaks (fullterm group) or in one negative peak (preterm group), and were greater in amplitude and longer in latency. A significant positive correlation was observed between infant's conceptual age and amplitude, and significant negative correlation was found between infant's conceptual age and latency of the MMN component. Results indicated infant's mismatch response undergoes several developmental changes during first weeks of postnatal life and allowed proposing specificity in parameters of infant's mismatch components represented proceeding maturational changes in auditory cortex at early ages.

P-2-136 Neurodevelopmental indices of social cognition and their relations to social functioning

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Theory of mind (ToM), the capacity to reason about others' mental states, is central to navigating the social world. Prior research indicates that functional specialization of cortical circuitry for mental state reasoning is related to children's ToM task performance. We hypothesize that neural mechanisms subserving ToM are linked to broad variation in children's social and adaptive functioning. Investigating these social brain-behavior relations can elucidate neural mechanisms related to social difficulties in both typical and atypical development (e.g., autism). To test our hypothesis, we conducted an fMRI

study of neurotypical children ages 8-13. Participants completed a false belief task in the scanner, in which they listened to vignettes describing social scenarios and then evaluated characters' beliefs. In addition, participants and parents completed measures assessing children's social and adaptive functioning. Whole-brain analyses indicated enhanced activation during false belief reasoning in two ToM regions: the right temporoparietal junction (rTPJ) and anterior superior temporal sulcus. Controlling for the effects of general cognitive ability (IQ), activity in the rTPJ positively correlated with children's social functioning in daily life. These findings suggest that brain mechanisms subserving ToM index individual variation in children's everyday social functioning. Ongoing analyses investigate relations between neural ToM mechanisms and impaired social and adaptive functioning in children with autism.

P-1-137 Sensorimotor Integration in Typically Developing Children and Those with Autism

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Research has shown that 80-94% of children with autism (ASD) have some kind of sensory abnormality and/or suffer from motor delays. While most of the research related to sensory and motor delays in children with ASD has been conducted in isolation, little is known about the link between the two, or sensorimotor integration. We define sensorimotor integration as the brain's ability to successfully transform sensory data into a motor response. The current fMRI study examined the neural substrates of sensorimotor integration in typically developing children (TD; N=2) and those with ASD (N=6) between 6-8 years of age. The sensorimotor integration fMRI paradigm consisted of two conditions: children were asked to 1) imitate individual pictures of a left hand performing "meaningless" gestures (imitation condition) or 2) to perform a simple motor movement (thumb or finger response) as the control condition. After correcting for multiple comparisons (p's<0.05), the results showed TD children primarily recruited areas in the motor cortex during the control condition and the visual cortices, cingulate gyrus, pre-motor and pre-frontal areas during the imitation task. In contrast, the children with ASD recruited nearly the same brain regions for both tasks, including the visual cortices, right parietal, bilateral pre-motor areas, and right pre-frontal cortex. These findings suggest that both a simple motor task and an imitation of a hand gesture requires extensive thinking and planning in children with ASD, when the simpler motor task comes more automatically in TD children.

P-2-138 Time-resolved analysis of delayed fMRI signal change during social evaluative feedback processing in the adolescent brain

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Prior neuroimaging work has shown that the medial prefrontal cortex is differentially involved in the processing of social evaluative feedback. Typically, neural activity is modeled by the canonical HRF function within 2.5 sec after feedback presentation. However, this method precludes from finding

effects that occur at earlier or later stages during feedback processing. This study employed a re-analysis of neuroimaging data obtained with the social judgment paradigm (Gunther Moor, et al. 2010) using Finite Impulse Response filters (FIR). The FIR function models the BOLD response with less constraints on shape and within multiple time bins to better capture the temporal change in fMRI activity. Additionally, we tested for gender differences in neural activation patterns and examined whether self-reported social anxiety was related to feedback-related brain activity. As expected, FIR results showed activity in brain regions not found using the HRF function, and identified delayed neural responses and associations with social anxiety dependent on gender. For example, increased activity in the subgenual ACC after social rejection feedback was specific for females, as well as a negative correlation between dACC activity and social anxiety. These responses occurred in later time bins after feedback presentation (> 2.5 sec.). This study demonstrates the advantage of using the FIR method by offering an elaborate view on delayed neural activity to social evaluative feedback processing and individual differences therein.

P-1-139 Audiovisual speech perception in children with and without a history of otitis media

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While some previous studies have found deficits in speech perception, language and reading skills in children with a history of chronic middle ear disease, others have not. The extent to which these children benefit from seeing in addition to hearing the speaker is largely unknown. Here we report a study involving 20 children in Kindergarten with chronic otitis media during their first 3 years of life and 20 controls matched on age, sex, social economic status and non-verbal cognitive ability. In addition to measures of speech production, verbal memory, vocabulary and early literacy, we assessed their auditory only, visual only and audiovisual speech perception. Children with a history of chronic otitis media performed more poorly than controls when speech was only heard or seen, but benefitted significantly more than controls when speech was presented audiovisually. Results will be discussed within a framework of the importance of audiovisual integration for learning to read.

P-2-140 Predictors of individual growth rates in mathematics achievement

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Research in understanding children's individual differences in math achievement has been flourishing. Various abilities have been identified as being important for math achievement: children's IQ, Working Memory (WM) and counting abilities, and their ability to compare and/or conduct simple arithmetic with nonsymbolic (i.e., abstract quantities) or symbolic (i.e, in their Arabic form) numerosities. Notably, so far only children's average general math achievement in cross-sectional, correlational or longitudinal designs is being addressed. In reality, though, no one is average and all individuals develop at their own

rate. We addressed the question: Which cognitive predictors uniquely predict children's individual growth rates? We conducted a large-scale longitudinal study assessing children's general math achievement in the beginning and end of grades 1 and 2. Latent growth modeling revealed that children's performance on all components of WM, their IQ, counting skills, nonsymbolic approximate comparison, symbolic approximate comparison and addition explained individual differences in children's initial status in math achievement. Children's performance in the symbolic approximate addition task (i.e., in the form of: "a+b" vs. "c"; "Which was larger?") was the only skill, however, which uniquely predicted individual growth rates in math achievement until the end of grade 2. This study highlights the importance of children's approximation skills and brings forth important implications for interventional designs and mathematics education.

P-1-141 Neural control of social emotional actions in adolescence

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Increased limbic and striatal activation in adolescence has been attributed to a relative delay in the maturation of prefrontal areas resulting in the increase of impulsive reward-seeking behaviors often observed during puberty. However, it remains unclear whether and how this general developmental pattern translates to the control of social emotional actions, a fundamental adult skill refined during adolescence. Using an fMRI-adapted social Approach-Avoidance Task, this study identifies how neural properties of emotional action control change as a function of pubertal development in 14-year-old adolescents (n=47; 21 males). Pubertal maturation, indexed by testosterone levels, shifted the neural regulation of emotional actions from the pulvinar nucleus of the thalamus and the amygdala to the anterior prefrontal cortex (aPFC). Adolescents with more advanced pubertal maturation showed greater aPFC activity when controlling their emotional action tendencies, reproducing the same pattern previously observed in adults. In contrast, adolescents with less advanced pubertal maturation showed greater pulvinar and amygdala activity when exerting the same amount of control. These findings qualify the generic notion of a shift from subcortical to prefrontal processing during puberty, suggesting that the pulvinar and the amygdala are the ontogenetic precursors of the mature emotional control system centered on the aPFC. We are currently testing the transition of the maturational shift of subcortical-prefrontal control by sampling the same participants later in their pubertal maturation.

P-2-142 Resting state functional connectivity in amygdala-DMN regions and emotion processing in adults who were born very preterm

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Background: Very preterm birth has been associated with psychiatric disorders involving emotion regulation, social competence and communicative skills. However, the neuroanatomical mechanisms

underlying socio-emotional impairments in very preterm born individuals are unknown. Method: 36 very preterm born (VPT; <33 weeks of gestation) participants and 38 controls were studied. Mean age of both groups was 29 years. All participants were scanned at rest in a 3T scanner. Resting state functional connectivity (rsfc) MRI data were preprocessed and analysed with SPM8. A seed-based analysis focusing on three amygdalar subregions (centro-medial/latero-basal/superficial) was performed. All results were corrected for false discovery rate using $p<0.05$. Participants' ability to recognize specific emotions was assessed using dynamic stimuli of human faces expressing six basic emotions at different intensities using the Emotion Recognition Task (ERT). Results: VPT individuals compared to controls showed less rsfc between the left superficial amygdala and the right posterior cingulate cortex (PCC)($p=0.017$) and the left precuneus ($p=0.002$). The VPT group further showed more rsfc between the left superficial amygdala and the middle temporal gyrus ($p=0.008$). The groups significantly differed in recognising faces moving from a neutral expression to the lowest intensity of anger ($p<0.0001$). Discussion: The hypoconnectivity between the amygdala and areas belonging to the default mode network, the PCC/precuneus, may suggest disruption between emotion regulating regions and mentalization.