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2018 Poster Abstracts

Day 1, Thursday, August 30

1-A-1 BOLD variability during response inhibition as in index of successful performance and behavioral variability: Developmental comparisons

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Currently, most research on the development of response inhibition has focused on average stopping performance. The development of intra-individual variability in stopping performance and brain activation has remained largely unstudied, possibly because of difficulties in estimating intra-individual variability in stopping latencies and brain activation. In the present study, 19 children (aged 10-12) and 26 adults (aged 18-26) performed a stop-signal task while lying in the scanner. Both children and adults were successful in inhibiting on about 50 % of the stop-trials and did not differ in their average stop-signal reaction time (SSRT). However, when calculating intra-individual variability in SSRTs, children's SSRTs were more variable compared to adults, with children showing more extremely long SSRTs. Children and adults did not differ in average brain activation during inhibition, but intra-individual BOLD variability during successful stopping was significantly higher in adults compared to children across the whole inhibition network, including right Inferior Frontal Gyrus (rIFG), basal ganglia, and subthalamic nucleus. Across the whole group, rIFG BOLD variability was a significant predictor of average SSRT and this relation was fully mediated by behavioral variability. Together these results indicate that neural and behavioral variability indices might be a more sensitive measure of developmental differences compared to the standard average-based measurements.

1-B-2 Neural correlates of affective and cognitive Theory of Mind: A novel functional neuroimaging cartoon task for children

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Objective: Theory of Mind (ToM)/mentalizing refers to the ability to assign meaning to the mental states of others (i.e. feelings, beliefs, intentions) and understand that these may differ from our own. Neuroimaging studies assessing TOM do not always meet the needs of younger populations (e.g. design, age-appropriateness and child-friendliness). Here we developed an fMRI cartoon task targeting cognitive and affective TOM and evaluated it in healthy young adults (fMRI) and children (behaviorally).

Methods:27 adults (14♂/13♀; 26years) completed an fMRI ToM task using 30 cartoon stories for affective (AT), cognitive (CT) ToM and physical causality (PC) and questionnaires on psychopathy, empathy, emotion regulation. SPM12 neuroimaging analyses included pre-processing, whole-brain and ROI random effects group analyses for (AT>PC, CT>PC, (AT CT)>PC / p<0.05, FWE-corrected). Results:Significant activation for mentalizing was observed in medial prefrontal cortices, bilateral precuneus, temporoparietal and right temporal gyrus, corresponding to prior meta-analytic evidence. Perspective-taking and cognitive reappraisal positively correlated with AT in-scanner performance (p<0.05). Behaviorally, feasibility in children starting at age 3 years was confirmed. Conclusion:This new fMRI TOM task elicits neuronal activation comparable to prior work in adults and is feasible for young children and will be provided open-access. The neural correlates of mentalizing will further our knowledge of socio-emotional development preceding childhood psychiatric disorders and academic performance.

1-B-3 Heightened reactivity to emotional cues extends into young adulthood

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Adolescence is characterized by heightened sensitivity to emotional information that can lead to a break down in self-regulation. Evidence is emerging that young adulthood, like adolescence, remains a vulnerable period in the development of emotion regulation. The current study tests the hypothesis that this vulnerability is due to fine-grained behavioral changes often missed by standard statistical analyses. A sample of 377 healthy participants (5 - 30 years of age; 169 males) completed an emotional go-nogo task with happy, fearful and calm faces as target and non-targets. Continued changes in affective processing in young adults were tested with mean reaction time (RT) and standard deviation (SD) RT, compared to ex-gaussian distributions of RT (mu, sigma and tau) using linear mixed-effects models with sliding age bins of four years (FDR-corrected p's < .05). The results show significant changes in Mu indicating slowing of responses to fearful faces in adolescents, whereas mean RT demonstrated no age-specific effects. SD RT showed greater variability to fearful faces in young adults, which was driven by the ex-gaussian measure tau (infrequent late responses), not sigma (RT variability). Both adolescence and young adulthood were associated with specific changes in reaction times to emotional information, particularly negative valenced cues, demonstrating prolonged emotional reactivity throughout development. The results are consistent with accounts of hierarchical changes in emotion reactivity and regulation circuits throughout adolescence into young adulthood.

1-B-4 The adolescent gut-brain-axis & depressive symptomatology

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Despite promising evidence that the gut microbiome plays an important role in brain function and affective disorders, such as depression, it's unknown what role the microbiome plays in these systems during adolescence. In this study of adolescent girls (13-15-years-old), we propose to assess cross-sectional associations among intrinsic functional brain connectivity, gut microbial composition and function, and depressive symptoms during adolescence; a fundamental period of change across these systems. Depressive symptomatology will be measured via parent and self- report questionnaires as well

as a semi-structured diagnostic interview. Functional brain connectivity will be assessed via resting state functional connectivity(rsfMRI; amygdala seed to whole brain parcellation). Gut microbial composition and function will be sequence for 16sr RNA and metagenomics. Our aims are to understand 1) How rsfMRI associates with depression symptoms 2) How the functional gut microbiome relates to intrinsic functional connectivity during adolescence 3) How gut-brain relationships account for individual differences in depressive symptoms in girls in the transition into adolescence. We plan to use a multivariate method (sCCA) capable of discovering complex linear relationships between two high-dimensional data sets. Given the novelty of these questions, these tests will be exploratory and based on theory heavily pulled from non-human vertebrate animals and adult experimental manipulation studies. Full details of the preregistration will be distributed at the poster.

1-B-5 Age-related changes in neural mechanisms of safety signal learning

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Anxiety disorders, which often emerge during childhood and adolescence, are characterized by difficulty discriminating between threatening and safe contexts (Britton et al., 2011). Translational studies have demonstrated dynamic developmental changes in frontoamygdala circuitry that supports fear learning, and mechanisms of fear reduction may differ across development. Here we investigated the neural mechanisms of safety signal learning, which has been shown to effectively reduce anxiety-like behavior in animal models and attenuate fear response in healthy adults (Christianson et al., 2012), in healthy youths and adults (N=37; ages 6-30) during a developmentally-adapted fMRI task. Conditioned stimuli consisted of geometric shapes and the unconditioned stimulus (US) was an aversive noise (50% reinforcement rate). Following acquisition, we tested transfer of safety learning via a compound cue that paired the safety signal with the conditioned stimulus (CS+) in the absence of the US. An age x condition interaction revealed higher ventromedial prefrontal cortex (vmPFC) engagement to the compound safety cue than to the CS+ alone among adults, but not youths ($F(3,105) = 4.857$, $p = .003$). There were no age-related differences in amygdala response to safety. These findings provide initial insight into age-related changes in frontoamygdala circuitry supporting safety learning in humans and may inform optimization of interventions for pediatric anxiety based on the biological state of the developing brain.

1-B-6 Age-related changes in cognitive control in affective contexts

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Background: Difficulties in regulating affect are a core characteristic of common mental health disorders and are associated with deficits in cognitive control, particularly in affective contexts - affective control (AC). The current study sought to investigate how this AC capacity relates to mental health over the course of adolescence. Methods: We developed an AC task, which was administered to 91 females across three age groups: 11-14 yrs (n = 29), 15-18 years (n = 31) and 22-30 years (n=31). The task requires individuals to sort cards according to changing rules: colour, number or item type (shape in the neutral and emotional expression in the affective conditions). Mental health problems were assessed with the Strengths and Difficulties Questionnaire and emotion regulation capacity was assessed with an experimental task and the Difficulties Regulating Emotions Scale. Results: Mental health problems were

associated with AC, F (1,85) = 18.92, p < .001, R2 = .18. AC partially accounted for the association between age group and mental health problems; standardised indirect effect: z = 2.52, p = .01, AIC = 739, with the effect being strongest in young adolescents. AC also partially accounted for the association between self-reported emotion regulation difficulties and mental health, standardised indirect effect: z = 3.29, p = .001, AIC = 701. Conclusions: Poor AC, especially in young people, is associated with more mental health problems and higher levels of emotion regulation difficulties. Improving AC therefore may constitute a promising target for prevention.

1-C-7 Age-specific functional and connectivity changes following inhibitory control training in children and adolescents

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Executive functions, and particularly inhibitory control (i.e.,the ability to withhold a prepotent response), play a critical role in academic success. While the effect of cognitive training on IC efficiency improvement has been studied either in children or in adults, the neurocognitive effects of IC training from childhood to adolescence is understudied. This is surprising given that childhood and adolescence is a developmental period defined by a high brain plasticity and environmental sensitivity during which the IC neural network become more specialized and integrated. We used functional and diffusion magnetic resonance imaging (MRI) and a longitudinal design to test the effects of an intensive (25 sessions, 15 min a day, 5 weeks) and individualized IC computerized adaptive training on tactile devices. 64 healthy children (27 males, 9 to 11- year-old) and 59 healthy adolescents (20 males, 16 to 17-year-old) were randomly assigned to receive either IC (parametric Stroop and Stop-signal tasks, SST) or active control (AC) (knowledge-based task) training. IC efficiency (assessed by SST performance) improved more in the IC than in the AC group. This behavioral change was paralleled by group- and age-specific in functional activations in the bilateral insula for 'Successful vs Failed inhibition' contrast in SST and in the white matter microstructure in cingulum bundle. Taken together, the results provided evidence of age-specific functional and connectivity change in the IC network after IC training.

1-C-8 Asymmetric effects of high-stakes on reinforcement learning across adolescence

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Reinforcement learning allows individuals to incrementally update value representations to guide optimal goal directed behavior. However, it remains unclear how stakes, the value of a prospective goal, influence the developmental emergence of reinforcement learning. 84 participants aged 13-20 completed a reinforcement learning task during fMRI. Participants repeatedly selected between cue pairs that were probabilistically associated with different monetary outcomes: high gain (50¢/ 0¢), low gain (25¢/ 0¢), high loss (-50¢/-0¢), and low loss (-25¢/-0¢). Analyses revealed that for optimal choice accuracy, there was an age by stakes (high/low) by valence (gain/loss) interaction. While younger adolescents learned better from high stakes losses, older adolescents learned better from high stakes gains. FMRI analyses revealed asymmetric stakes-selective recruitment of the ventral striatum with age. There was an age by stakes by valence interaction for ventral striatum (VS) activity during the receipt of monetary feedback. Younger adolescents showed heightened VS activity for high relative to low stakes

losses, but showed no differences in recruitment for gain outcomes. In contrast, older adolescents exhibited robust increases in VS activity for high relative to low stakes gains but did not differentiate loss recruitment by stakes. These findings suggest that reinforcement learning abilities may shift with age due to changing strategies in value-based learning and ongoing functional development of canonical reward circuitry.

1-C-9 Adolescents take fewer risks than children or adults when risky outcomes are equiprobable

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Laboratory tasks that require learning outcomes and probabilities through experience most reliably evince an adolescent peak in risk taking. To elucidate mechanisms that may underlie risk taking based on experience, we tested whether asymmetry in the relative weighting of favorable and unfavorable outcomes might account for age-related change in risk taking. Participants aged 8-27 (N=62) chose between pairs of risky (50% large gain, 50% no gain) and safe (consistent gain outcome) "point machines" to learn their associated outcomes and probabilities. Each outcome was displayed with a picture. After the task, we tested incidental memory for pictures to determine whether choice context (e.g. risky/safe choice) modulated later memory. We used a reinforcement-learning model to assess the asymmetry in learning rates for favorable (α+) and unfavorable (α-) outcomes. Surprisingly adolescents exhibited less risk taking and more sensitivity to unfavorable over favorable outcomes than both children and adults. Though memory did not differ by age, accuracy differed by α+ and α-, and was higher for pictures shown after risky than safe choices. While unexpected, teens' lower risk taking and greater weighting of unfavorable outcomes may result from the 50/50 probability structure of our risky machines. Risks that teens take in the real world typically involve less frequent unfavorable outcomes. Our work highlights the importance of understanding age differences in how individuals evaluate the statistical properties of their environment, and how such information guides future choices.

1-C-10 Explaining explore-exploit trade-off differences between younger and older adults

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Older adults (OA) need to make many important and difficult decisions. Often, there are too many options available to explore exhaustively, creating the ubiquitous tradeoff between exploration and exploitation. How do OA make these complex tradeoffs? We studied how older (N = 32, mean age = 70.47) and younger adults (N = 29, mean age = 24.31) solved four and eight option N-armed bandit problems with the numbers of current gambles and average rewards displayed on the screen to minimize the role of working memory. We further measured structural connectivity in cortico-striatal loops using diffusion weighted MRI and performance on a number of psychometric tests in a seperate session. We found that OA reliably chose the most rewarding options less often than younger adults (YA). Furthermore, causal inference showed that performance was directly connected to a numeracy test, and, controlling for age, independent from cortico-striatal connectivity strength, fluid intelligence, working memory, IQ, and risk taking. Together, OA seem to process uncertainty that is associated with options in more complex choice environments sub-optimally, suggesting more limited task representations. The stronger the demands of the choice environment, the larger the age-difference, indicating limited available cognitive resources in OA. This result fits to multiple contexts in the complex

cognitive aging literature, and in particular to the context of challenges in the maintenance of goal-directed learning mechanisms.

1-C-12 Computational model of anxious mood in adolescence

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Understanding the development of emotional pathologies in adolescence, such as anxiety, is predicated on understanding what anxiety is computationally and how it is instantiated in the brain. The present study sought to experimentally test a computational theory of anxious mood. The theory claims that moods arise from a weighted average of prediction errors, which is used to infer that there is momentum of increasing or decreasing rewards or punishments in one's environment and can expedite learning. The experiment, which is currently being conducted, will comprise 60 adolescents who engage in an aversive learning task, in which subjects must learn the probabilities that three different stimuli will generate an aversive outcome (a loud white-noise burst). The task comprises two blocks: one in which aversive momentum is increasing, and one in which probabilities of aversive outcomes change randomly. The study has two main hypotheses: (1) that when aversive momentum is increasing, all subjects will feel more anxious, and their level of anxiety will be explained best by the computational model advanced here and (2) that those with dispositional anxiety will incorrectly infer aversive momentum in the task block in which probabilities are changing randomly. This will be the first study to provide evidence the momentum theory of mood (Eldar et al., 2016) by experimentally manipulating momentum, and the first to apply the theory to the study of normal and pathological anxiety.

1-D-13 Attenuated Pavlovian learning biases in adolescence*

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Adolescence is a period rich with new experiences. Learning to engage in rewarding experiences, and avoid punishing ones, relies on multiple systems. Pavlovian learning (cue-outcome) and instrumental learning (cue-action-outcome) are powerful systems for reward and punishment learning. When demands are congruent (approach cue, obtain reward), these systems cooperate; however, when action and outcome valence are opposed (approach cue, avoid punishment), the Pavlovian system can disrupt the instrumental system, reducing learning. The influence of these learning systems under conflict has not been studied over development. N=88 participants 11-22 years old learned from probabilistic reinforcement to execute or withhold a button press (Action) to obtain reward or avoid punishment (Valence). The intersection of these factors is congruent (press to obtain reward, withhold to avoid punishment) or incongruent (press to avoid punishment, withhold to obtain reward). We employed and compared a series of computational models to estimate psychological effects typifying biases in learning. There was an interaction of age on Action-by-Valence learning. To explain, we fit linear and non-linear models of age to a Pavlovian bias model parameter. We found a significant U-shaped fit with lowest Pavlovian influence in late adolescence. This better explained learning than simpler age or computational models, suggesting that during adolescence there is an attenuation of Pavlovian learning biases. This could afford adolescents better instrumental learning when information is in conflict.

1-D-15 Economic decision-making across adolescence

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Economic decision-making across adolescence Griffin, C., Ahmed, S., Foulkes, L., Leung, J., Parker, J., Griffiths, K., Dunning. D., Dalgleish, T., MYRIAD & Blakemore, S-J. Background and Aim Economic tasks are often used to assess decision-making in adolescence, but it is unclear whether there are age-related differences in performance during this developmental stage. The current cross-sectional study was designed to investigate whether performance in economic decision-making changes across adolescence, and whether interactions exist between different types of decision-making. Sample and Design Data collection of ~500 participants aged 11-16 is currently underway in schools in and around London and Cambridge in the United Kingdom. Participants complete three computerised tasks: a delay discounting task (measuring ability to resist immediate award), the dictator game (measuring altruistic prosocial behaviour) and a sunk-cost bias task (measuring the ability to make rational decisions based on relevant costs). Analysis plan A linear mixed-effects model will be conducted to investigate whether performance on economic decision-making tasks is dependent upon the age of participants, and whether there is an interaction between performance on these tasks.

1-D-16 Inhibitory control deficits over the immediate impulse for reward in adults with a history of attention deficit hyperactivity disorder: The role of elevated inattention symptoms

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ADHD is associated with increased risk for addiction and delay discounting. We examined the neural basis of inhibiting a response to an immediately rewarding stimulus to obtain a larger delayed reward in 106 adults with ADHD histories from the Pittsburgh ADHD Longitudinal Study and 32 non-ADHD Healthy Controls (HC) from the community (n=138, age 27-43). ADHD symptoms in adulthood were based on self- and informant-report with the BAARS-IV (Barkley, 2011). Subjects completed the Monetary Incentive Go-NoGo task while undergoing fMRI. Subjects were asked to either inhibit a previously rewarded (R) Go stimulus and forgo a small immediate reward in order to obtain a larger reward later on (R-NoGo) or inhibit an unrewarded stimulus (U-NoGo). HC demonstrated greater inhibitory control, M=85% than probands, M=80%, $p<.05$ across conditions. Probands did not differ ($ps>.1$) from HC in the BOLD response observed in the DLPFC, operculum parietalis 4 (OP4), and thalamus, which was greater during correctly inhibited NoGo vs. U-Go trials. Within probands, inattention was negatively correlated with NoGo accuracy, $\beta=-0.29$, $p<.01$ across conditions; and inattention was more negatively correlated with activation in OP4 during the R-NoGo vs. U-NoGo trials (Interaction $p<.05$; R-NoGo: $\beta=-0.24$, $p<.01$; U-NoGo: $\beta=0.06$, $p>.1$), and the thalamus (Interaction, $p<.05$; R-NoGo: $\beta=-0.23$, $p=.01$; U-NoGo: $\beta=0.03$, $p>.1$).We conclude that probands experiencing inattention symptoms have difficulty recruiting sensorimotor and action control to forgo immediate small rewards in order to attain larger rewards later on.

1-D-17 Weight status affects anticipatory processing of rewards, food intake, and network integration in adolescents

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Functional magnetic resonance imaging (fMRI) studies have observed differences in reward processing in overweight (OW) relative to healthy weight (HW) adolescents, revealing both a hyper and hypo brain response to rewards in OW relative to HW participants. But few studies have examined various reward types in the same paradigm, and no studies have measured actual food intake. In this pilot study, we examined the anticipation of multiple rewards in 26 adolescents, aged 12-17 (13 OW). Participants completed an fMRI scan, 7 minutes of resting state, and a test meal. In the fMRI scan, participants completed a card-guessing task where they could win money, food, or no reward by correctly guessing if a computer-generated number would be higher or lower than 5. Preliminary findings demonstrated a blunted response to rewards in OW participants; attenuated activation was observed in the caudate and cingulate gyrus in food reward trials and the mPFC cluster and cingulate in money trials in OW relative to HW adolescents, and this activity was inversely correlated with calorie consumption. On average, OW participants consumed 250 calories more than HW participants. Finally, correlations and network indices were used to examine the frontal-parietal and salience network integration, networks key in task control. On average, HW participants had denser network integration relative to OW adolescents, demonstrating critical differences in integration. Findings have implications for adolescent decision-making in food choice and have translational potential in improving obesity interventions.

1-D-18 Affective sensitivity to real-world exploration is heightened in adolescence.

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Research across species suggests that the novel stimuli and environments encountered during exploration can benefit affective functioning. However, few studies have examined human exploratory behavior in natural settings or its influence on affect in our everyday lives. GPS tracking can index human exploratory behavior by capturing variability in large-scale daily movement patterns, or "roaming entropy". Here, we investigated whether roaming entropy differs as a function of age, how it relates to affective state, and whether it is associated with social connectivity. Over a three-month period, we measured roaming entropy in 26 adolescents (12 to 17) and 31 adults (18 to 27) and used ecological momentary assessment to evaluate positive and negative affect every 48 hours. Average roaming entropy was higher in adults than adolescents. Days in which individuals' daily roaming entropy was higher than their recent historical average were associated with greater positive affect in both age groups. Adolescents, but not adults, reported greater negative affect on days in which entropy was lower than their historical average. Individuals with higher average entropy reported having larger social networks, suggesting a relationship between exploratory behavior and social connectivity. Consistent with empirical findings that novelty engages reward processes, our data suggest that variability in our day-to-day activities may promote positive affect, and that affective sensitivity to environmental novelty may be particularly pronounced in adolescence.

1-D-19 Striatal activation to social reward moderates the relationship between peer victimization and increases in depressive symptoms in adolescents

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The extent to which social contexts influence psychosocial outcomes in adolescence may be moderated by individual differences in neural sensitivity to social stimuli (Schriber & Guyer, 2016). We tested this hypothesis by examining how activation in the nucleus accumbens (NAcc) to maternal praise moderates the effects of peer victimization on increases in depression over one year. Thirty-eight youth (11-17 yrs; 20 f) completed the Parental Expressed Emotion fMRI task, in which they listened to audio clips of their mothers providing praise and talking about neutral events. Average BOLD activation during praise>neutral in the bilateral NAcc (anatomically-defined) was extracted for each participant. Direct and interaction effects between self-reported peer victimization and NAcc activation at T1 on depressive symptoms at T2 were tested, controlling for T1 depressive symptoms, age and gender. The model ($R2 = .55$, $F(6, 31) = 6.34$, $p < .001$) revealed an interaction between peer victimization and left NAcc activation ($B = 1.42$, $SE = .40$, $t(6, 31) = 3.53$, $p=.001$). Greater peer victimization predicted increases in depressive symptoms only for youth with high left NAcc activation to maternal praise. These findings suggest that high NAcc activation to social reward may represent a neural marker for interpersonal sensitivity. This neural marker may help to explain why some youth are more susceptible to the detrimental effects of negative social contexts, such as peer victimization, consistent with the neurobiological susceptibility to social context hypothesis (Schriber & Guyer, 2016).

1-D-20 Age effects on neural reward related reactions to monetary gains for self and charity in adolescence

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Prior studies have consistently found that adolescents show more reward-related activity in the ventral striatum (VS), for monetary and social rewards. This might explain increased risk-taking behavior seen in middle to late adolescence. Recently, it has been suggested that this increase in sensitivity to rewards might also lead to an increase in prosocial behavior. The social reward gained from performing a prosocial action may also be stronger in adolescence, and as such increase motivation to perform prosocial actions. We collected fMRI data for 160 participants (ages 11-21) during a task in which they could earn money for themselves and for a self-chosen charity by selecting one of two options with unknown outcomes, to reveal an outcome for self, charity or both. fMRI results revealed gaining for self and for both parties resulted in ventral striatum activity, but not for charity. Furthermore, with increasing age, activation in the ventral striatum when winning money for self and both decreased. After scanning, participants could donate to charity in a coin division task. Donation behavior was correlated to more charity-versus-self-related ventral striatum activation. Our results demonstrate a link between VS activity and prosocial giving, and replicate the finding that reward-sensitivity for personal-rewards is stronger in early-adolescence. Interestingly, sensitivity to vicarious rewards was unrelated to age, but was significantly related to individual differences in prosocial behavior.

1-D-21 Differential effects of parent and peer presence on neural correlates of risk taking in adolescence

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Adolescence is a developmental period associated with increased health-risk behaviors and unique sensitivity to input from the social context. Changes in the developing brain reorient adolescents towards social cues, making them especially sensitive to their social context, such as in the presence of parents or peers. Peer presence increases adolescent risk taking, associated with greater reward-related activity, while parental presence decreases risk taking, associated with decreased reward-related activity and increased cognitive control. Yet the effects specific to peers and parents are still unknown. The current fMRI study compared within-person peer and parent influences on risky decision-making during adolescence (ages 12-15 years; N = 56). Participants completed the Yellow Light Game, a computerized driving task, during which they could make safe or risky decisions, in the presence of a peer and their parent. Behavioral findings revealed no effects of social context on risk-taking. At the neural level, a collection of affective, social, and cognitive regions (VS, TPJ, dlPFC) was more active during decision-making with peers than parents. Additionally, functional connectivity analyses showed greater coupling between affective, social and cognitive control regions (TPJ-insula, VS-TPJ) during decision-making with parents than peers. These findings highlight the complex nature of social influence processes in peer and parent contexts, and contribute to our understanding of the opportunities and vulnerabilities associated with adolescent social sensitivity.

1-E-22 Age differences in social preference

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Objectives: Adolescents are particularly sensitive to their social surroundings. The current study was designed to test the hypothesis that adolescents would spend more time than adults choosing to look at social (vs. non-social) stimuli, in preference to an academic diligence task. Methods: Participants were adolescents (aged 11-16) and adults (23-35), recruited from the Greater London area. Questionnaires assessing social reward processing and autistic traits were administered, followed by an adapted version of the Academic Diligence Task (ADT). In the ADT, participants are given the option to engage in a simple and boring maths task for 10 minutes. Participants were told that at any point within the 10 minute period they could stop doing maths and switch over to a less boring task, which in this case was looking at pleasant and rewarding photographs. There were two conditions: Social (photographs of people interacting) or Non-Social (photographs of landscapes). The order of conditions (Social vs Non-Social) was counterbalanced between participants. The WASI matrix reasoning test was administered as a measure of IQ. Results and Conclusion: Adolescents and adults spent a different amount of time looking at Social vs. Non-Social stimuli. There was a significant developmental shift supporting the proposal that adolescence is a period of significant social-orientation whereby social stimuli is of greater importance to adolescents than adults. This adds to a body of growing evidence depicting adolescence as a sensitive period of sociocultural processing.

1-E-23 Differences in functional connectivity between on-track and under-performing math learners in first grade

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Early math intervention efforts indicate positive impacts on math outcomes for students at risk in the early elementary grades (Clarke et al, '16; Clarke et al, '14). However, there remains a subset of those who do not respond to these targeted interventions (Fuchs & Vaughn, '12). If the needs of all learners are to be met, additional research is needed to find mechanisms to increase the efficacy of interventions and decrease non-responsiveness (Miller et al, '14). Our aim here was to identify differences in functional connectivity and math performance between on-track learners, and those who qualified for an RCT of a research validated math intervention. Baseline rsfMRI scans were completed on 50 first-graders along with Panamath (Halberda et al, '08) outside the scanner, 27 of which were on-track learners. Data were analyzed using FSL, including AROMA for denoising prior to group ICA, dual regression to examine group differences and TFCE for significance. Interrogating published RSNs (Smith et al, '09), we found significantly altered connectivity for on-track learners compared to those needing learning support between the angular gyrus and the default mode network. We also found altered connectivity associated with performance on Panamath with the fronto-parietal network. Ultimately, gaining insight into the learning needs of students will be critical for refining and expand the tools, materials, and services educators utilize to ensure all learners have full access to the field of math and to related STEM fields as they advance in their schooling.

1-F-25 Aversive learning strengthens episodic memory in adolescents and adults

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Adolescence is often filled with emotional experiences that may change how individuals remember and respond to stimuli in their environment. Recent studies in adults have shown that learned aversive associations can generalize across a category of stimuli and lead to enhanced memory for the reinforced category of trial-unique exemplars. The present study tests whether learned aversive associations similarly lead to better memory and generalization across a category of stimuli in adolescents. Participants complete a pavlovian category conditioning task where one of two categories is partially reinforced with an aversive odor, and return 24 hours later to complete a surprise recognition memory test. Preliminary data analyses including 30 individuals ages 13 to 25 (half of our planned sample) show better corrected recognition memory for the reinforced than the unreinforced category of exemplars in both adults and adolescents. Further analysis reveals that enhanced recognition memory is driven by better memory for the reinforced exemplars in both age groups. Thus, while we do not presently observe category conditioning effects in either adolescents or adults, we do see enhanced memory for the items with an acquired aversive association in both adults and adolescents. These findings build on previous work in adolescent and adult humans and rodents showing similar acquisition of aversive pavlovian conditioning using simple stimuli across age groups. Analyses in the full sample will examine age continuously to test for age-related changes in memory across adolescence.

1-F-26 Emotional working memory capacity in adolescents with varying mood

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Background Sufferers with comorbid depression and anxiety disorders report difficulties in their cognitive functioning, in part due to their inability to tackle emotionally-laden intrusive thoughts. Adolescence is a critical period for cognitive development and onset of mental health disorders. Adolescents may exhibit difficulty setting aside intrusive thoughts for everyday mental operations, thus drawing heavily on their working memory capacity (WMC) required for educational attainment. The current study investigates whether adolescents with low mood show difficulty in their WMC within emotion-related contexts. Method Data is being collected from ~500 participants aged 11-16 in Cambridge and London schools. Participants completed blocks of trials each comprising 2-5 neutral words. Concurrently, a distraction task (counting pink squares on the screen) appeared sporadically over a neutral or emotionally-salient background (i.e. images of bullying or social exclusion). Participants were instructed to recall the number of squares after each trial and then recall the words in order at the end of each block. A self-reported CES-D questionnaire will be used to measure the risk of clinical depression. Analysis plan Linear mixed-effects regression analysis will be conducted to investigate whether performance on the WMC task is dependent on mood (CES-D questionnaire scores), and whether there is an interaction between performance on the WMC task and salience of the background image (negative vs neutral) with varying mood. Age and gender effects will be explored.

1-F-27 Context pattern separation across the lifespan

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Our capacity to form and retrieve episodic memories improves over childhood but declines in old age. Understanding these changes requires decomposing episodic memory into its components: (1) mnemonic discrimination of similar people, objects and contexts, and (2) relational binding of these components. We designed novel memory tasks to assess these component processes involving animations that are appropriate across the lifespan (ages 4 - 80 in our sample). In Experiment 1, we assessed mnemonic discrimination of objects as well as relational binding in a common task format. Both components follow an inverted U-shaped curve across age but were positively correlated only in the aging group. In Experiment 2, we examined mnemonic discrimination of context and its effect on relational binding. Relational memory in low-similarity contexts showed robust gains between the ages of 4 and 6, and 6-year-olds performed similarly to adults. In contrast, relational memory in high-similarity contexts showed more protracted development, with 4- and 6-year-olds both performing worse than young adults and not differing from each other. Relational memory in both context conditions declined in aging. As in Experiment 1, performances in low- and high-similarity contexts were strongly related only in the older adults. This multi-process approach provides important theoretical insights into lifespan changes in episodic memory.

1-F-28 Poor long-term memory in children: A case of mistaken identity?

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Children's poor performance on visual long-term memory (LTM) tests has been considered in the context of hippocampal maturation and LTM function, yet it may instead be due to differences in viewing behavior and early perceptual and semantic processing. To assess the impact of such confounding factors, we created a novel scene recognition task with a brief (200ms) stimulus viewing time, decoy trials, and both immediate and delayed tests. We tested individuals age 7-28 years (N=103) and obtained hippocampal volume measures from children and adolescents (N=57). Participants of all ages could perform the task, but scores at both immediate and delayed test correlated positively with age (r=0.45 and 0.39; ps<0.001). Differences in hit rate between immediate and delayed test (Loss) were virtually identical for children, adolescents, and adults (Means 0.34, 0.32, 0.33; SE 0.03) with no correlation between Loss measure and age (r=-0.02). Using a mediation analysis (95% CI) we showed that 53% of the effect of age on hit rate at delayed test is explained by hit rate at immediate test. There was no significant relationship between hippocampal subfield volumes and Loss or perceptual precision (PP: target hits vs decoy false alarms) at delayed test. Rather, CA1 volume was correlated with PP at immediate test (r=0.33, p=0.01). Our findings suggest that children's poor performance on visual LTM tasks may not reflect LTM function differences, but rather differences in early viewing behavior and visual processing - functions that have themselves recently been linked to the hippocampus.

1-F-29 The more you know: Investigating why adults get a bigger memory boost from semantic congruency than children

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Previous work indicates that semantically congruent information is remembered better than semantically incongruent information. However, few fMRI studies have studied the neural correlates of this congruency effect in typical development. The current fMRI study examines - in a sample of 47 younger children (8-9), 47 older children (10-12), and 30 young adults (18-25) - developmental differences in the neural correlates of episodic memory encoding and retrieval for semantically congruent vs. incongruent object-scene pairs. In the scanner, participants encoded object-scene pairs by judging whether each pair belonged together (i.e., congruent response) or not (i.e., incongruent response), and episodic memory was tested with a source memory test (i.e., which scene was this object paired with?). Consistent with prior work, source accuracy improved with age. Additionally, in all age groups, source accuracy was greater for congruent than incongruent pairs. This congruency effect was greater in adults than both younger and older children. Functional MRI results indicate age-related differences were found in left PFC in both univariate activity and functional connectivity. Moreover, age-related differences in pattern similarity between encoding and retrieval trials (i.e., encoding-retrieval similarity) were also observed in left PFC. Follow-up analyses will examine longitudinal changes in behavior and the brain in children who returned for multiple sessions approximately 1.4 years apart.

1-G-30 Associations between childhood trauma exposure and neural correlates of cognitive emotion regulation in adulthood

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By mid-adolescence, 1 in 4 youth will have been exposed to trauma (Dunn et al., 2011). Given that approximately 30% of mental health disorders are associated with prior childhood adversity (Kessler et al., 2005), delineating core mechanisms linking early life adversity with long-term outcomes is critical to understanding factors that differentially promote risk versus resilience across the lifespan. Reappraisal, a cognitive emotion regulation strategy, has been of particular interest given its suggested role in psychological adjustment. However, much remains unknown about the association between childhood adversity and brain activation during reappraisal in adulthood. The current study examined the association between reappraisal and its neural correlates in adulthood and childhood trauma across a continuum of severity using bootstrap analyses (N=22; data collection is ongoing). An adapted reappraisal task was conducted using a novel stimulus set appropriate for a trauma-exposed developmental sample, as this investigation is part of a broader ongoing study in children, adolescents, and adults. In the current sample, subregions of the ventrolateral prefrontal cortex (e.g., inferior frontal gyrus) were recruited during reappraisal, consistent with prior research. Initial results suggest that higher trauma severity during childhood was associated with lower prefrontal activation during reappraisal in adulthood. These findings may provide initial insight into alterations in emotion regulation that could further elucidate the link between childhood trauma and long-term outcomes.

1-G-31 Long-term effects of prenatal glucocorticoid exposure on neurophysiological correlates of novelty monitoring and post-novel behavioral adaptations during childhood and adolescence

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Synthetic glucocorticoid (sGC) exposure, a treatment for women at risk of preterm delivery, was shown to yield long-term impacts on neurocognitive development, especially in regions with abundant glucocorticoid receptors, e.g. prefrontal cortex (PFC). An important role of the PFC is to monitor unexpected events in changing environments to ensure flexible behavioral adaptions. To investigate impacts of prenatal sGC exposure on neurocognitive processing of novel events, this study assessed neural correlates of novelty monitoring and post-novel behavioral adaptions in term-born children and adolescents prenatally exposed to sGC and their age-matched comparison groups. Our sample comprises 53 children and 52 adolescents among which mothers of 49 participants underwent problems during pregnancy and were treated with sGC (PP/GC-group) and 56 control participants. Electroencephalograms (EEG) were recorded while participants performed a Flanker with Novelty monitoring task (Wessel et al., 2012) that contains frequent standard and infrequent trials of novel objects following participants' response. We focused on long-term effects of prenatal sGC exposure on the Novel-N2 event-related potential (ERP) component and post-novel reaction times. We are currently conducting analyses to investigate main effects of group (PP/GC vs. controls), condition (Novel vs. Standard) and developmental stage (childhood vs. adolescence) as well as their interactions using linear mixed-effect models. Neural-behavioral correlations and potential modulating effects by prenatal sGC exposure are explored.

1-G-33 Attention to emotional faces in 8-month-old infants: The impact of the time-course of maternal depressive symptoms during the pre- and postnatal periods

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Introduction Maternal depressive symptoms are common during the pre- and postnatal periods and may place the child at risk for self-regulation problems. We inspected the associations between the trajectories of maternal depressive symptoms during the pre- and postnatal periods and infant's attention patterns to faces. Individual differences in attention may provide information about the personal salience of different emotions at this early age. Method The sample is a sub-sample of mother-infant dyads (n=363) from a large, multidisciplinary FinnBrain Birth Cohort Study. Eight-month-old infants' attentional disengagements from happy, fearful, neutral, and phase-scrambled faces were assessed using eye-tracking (EyeLink1000) and the overlap-paradigm. These measures were compared in three groups (Consistently low, n=280; Increasing, n= 34; Decreasing, n=48) clustered from maternal self-reported depressive symptoms (EPDS) between gestational week 14 and six months postpartum. Results Both infant groups of symptomatic mothers (Increasing and Decreasing vs Consistently low) showed heightened bias for fearful faces as compared to other stimuli. Infants of mothers with decreasing symptoms showed a generally higher disengagement probability as compared to infants of mothers with increasing symptoms ($p = 0.009$). Discussion Maternal depressive symptoms may alter infant social-emotional processing and exacerbate threat processing. Depending on the timing of exposure to maternal symptoms, different mechanisms, may impact the development of infant attention to faces.

1-G-34 Early life stress is associated with precocious amygdala development and delayed prefrontal development

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Early life stress (ELS) is associated with an increased risk for later development of emotional pathology such as depression and anxiety. The origins of pathology are thought to be rooted in atypical development of circuits regulating emotional responding, including the amygdala. Here we used a mouse model of ELS, in the form of maternal bedding restriction, and tested the effect on amygdala development, and the development of freezing behavior in a tone-associated fear conditioning paradigm. Previous work has established that tone-associated freezing develops as early 15 days of age and stays relatively stable across early development. Here, we found that mice reared under ELS conditions show an unexpected and significant decrease in freezing behavior at 21 days of age. This decrease in freezing behavior was associated with a precocious maturation and an increase in the density of Parvalbumin (PV)-positive cells in the basal amygdala (BA). In addition, we found that ELS mice had a delay in prefrontal to basolateral amygdala projections. To test if the increase in PV-cells was related to suppressed freezing behavior, we took advantage of optogenetic techniques to silence this population of cells in the BA during acquisition and testing phase in the conditioning paradigm. We found that silencing BA PV cell restored normal levels of freezing behavior in ELS reared mice. These

results have implications for understanding the effects of ELS on the ontogeny of circuit development and its impact on the development and expression of fear associated responding.

1-G-35 Resilient brain responses to social exclusion

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Improved understanding of the factors that contribute to resilience after childhood adversity (CA) is crucial in order to reduce CA related mental illness. Here we examine the neurobiological factors that contribute to adolescent resilience after CA, by examining resilient brain responses to social exclusion. Sixty-six participants (38 females, Mean age=24.7) from a prospective cohort study (Roots, N=1238, age 14-24) underwent brain-scanning while playing the Cyberball task to assess brain responses to peer exclusion (Williams and Jarvis, 2006). Degree of resilient functioning will be quantified as "psychological functioning relative to CA severity" (van Harmelen et al., 2007) and will be calculated for all Roots participants assessed at age 24 (N=427) and extracted for the N=66 participants with imaging data. Imaging data will be pre-processed and analysed using SPM12. To examine the effect of social exclusion, we will examine brain responses to the contrasts "no-ball exclusion game" vs. "ball inclusion game" using a whole brain and region of interest approach [ROI; amygdala, insula, dorsal anterior cingulate cortex (dACC), subgenual anterior cingulate cortex (subACC), dorsomedial prefrontal cortex (DMPFC) and ventromedial prefrontal cortex (VMPFC)] (Eisenberger et al., 2012; van Harmelen et al., 2014). We hypothesize that resilience will be associated with reduced rejection related brain responses in the amygdala, insula and subACC and increased modulatory responses in the DMPFC and dACC (Moor et al., 2012; van Harmelen et al., 2014)

1-G-36 Modeling early life stress: An in-depth analysis of limited access to bedding and nesting material and behavioral outcomes in mice

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Experiences of early life stress (ELS) are associated with altered neural development and increased risk for the development of psychopathology across the lifespan. Rodent models of ELS provide a unique tool for investigating the mechanistic neural underpinnings of altered neurodevelopment. We used a limited bedding and nesting model (LBN) to induce stress in the dam which leads to stress in the pups. Limited access to bedding alters the dam's behavioral interactions with the pups during a sensitive period in early postnatal development. Previously, this LBN model is characterized as a model of fragmented and unpredictable maternal care and possibly neglect. However, previous studies are restricted, not considering the full circadian span, evolution of changes of maternal behavior throughout this manipulation, effects on nest building and maintenance, and maternal care prior to and following the LB manipulation. To address this, we leverage a novel continuous video monitoring setup to unobtrusively observe and subsequently analyze maternal behaviors. Through this more in depth analysis, we discovered that LB dams spent more time than control dams on their nest and engaged in a greater number of nest entries (returns to nest) than control dams. Based on this data, we posit that dams in LB conditions engage in hyper vigilant mothering. Additionally, a subset of dams engage in abusive kicking behavior. To tease apart the behavioral outcomes of ELS kicking experiences, we explore anxiety-like behavior in adulthood.

1-G-37 Associations between family environment and child brain function and structure are mediated by accelerated pubertal development*

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Psychosocial Acceleration Theory suggests that pubertal maturation is accelerated in response to adversity. Evidence suggests that development of the amygdala-medial prefrontal cortex (Am-mPFC) circuit is accelerated following suboptimal care. It is unclear if these findings are related. Here, we assess whether associations of family environment (FamEnv) and Am-mPFC circuit are mediated by pubertal development in 9-10 y.o. children. This study includes 2000+ participants from the Adolescent Brain Cognitive Development Study, a prospective population-based United States cohort (http://dx.doi.org/10.15154/1412097). Using Structural Equation Modeling, three latent variables (LV): demographic and parent information, child reported, and parent reported data on family dynamics were compiled into a higher-level FamEnv LV (RMSEA = 0.04). Image processing and analysis were performed by the ABCD consortium. Cingulo-opercular network (CON)-Am RS functional connectivity (FC), anterior cingulate cortex (ACC) thickness (CT), and fractional anisotropy (FA) were used. Mediation models were controlled for age, race, sex, site, and total brain volume. For left CON-Am FC, ACC CT, and ACC FA, significant indirect effects were found ($p = .012$, $p = .007$, $p = .015$). For right CON-Am FC, a significant total ($p = .041$), but no significant (in)direct effects were found. Despite small effect sizes, structural and functional connectivity of circuits important for emotional behavior are distinct in the context of family environment and associated with accelerated pubertal development.

1-G-38 Mother-child interactions affect self- and mother-evaluations and self-related brain activation*

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Self-concept development in adolescence has been linked to activity in cortical midline areas. Little is known about how these regions are involved in assigning traits to family members: an important question, given that adolescence is characterized by changes in mother-child relationships. Here, we studied the relation between mother-child interactions (warmth, negativity, emotional support) and views of self and mother, and we tested for relations with brain activation for thinking about self and mother. Participants (n=143, 11-20y) performed trait evaluations in an fMRI study, where they indicated to what extent a trait described themselves (self task) or their mother (mother task) on a scale of 1 (not at all) to 4 (completely). Results showed that both mothers and children displayed more negativity and less warmth when the child was 15-16 years old (mid-adolescent dip). Mother-child interactions were not related to positivity of the child about themselves or their mothers. However, mothers were more positive about warm children. Brain activation in adolescents for self- and mother-evaluations versus a control task, overlapped in mPFC, right TPJ and right DLPFC. Follow-up ROI analyses showed that with more negativity in mothers, adolescents engage right DLPFC stronger for mother-evaluations. When mothers show more warmth, adolescents engage less right TPJ for mother-evaluations, and more left DLPFC for self-evaluations. These findings show evidence for a neurobehavioral change in mother-relations and trait evaluations, with a potential role of mother-child attachment.

1-H-39 Emerging psychopathology and structural brain development in adolescence

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Adolescence is a developmental period characterized by heightened emotional reactivity, which for some sets the stage for emerging psychological problems. Both internalizing and externalizing problems often start out during adolescence. Previous research suggests a relation between aberrant structural brain development and psychopathology. Longitudinal studies are scarce, but critical to detect which adolescents are at risk to develop psychopathology. The objective of this study was to examine the relations between structural brain development, on the one hand, and depressive symptoms and aggression, on the other. A community sample of 299 participants underwent magnetic resonance imaging during three bi-annual waves (680 scans), spanning 5 years across 8-28 years. Self-reported depressive symptoms were assessed at time point (TP) 3. Self and parent-reported aggression was assessed at all three TPs. Mixed model analyses revealed accelerated frontal cortical thinning for participants with high levels of depression at TP3. Furthermore, mixed model analyses revealed that higher levels of parent-reported aggression coincide with lower hippocampal volume and higher pallidum volume. Higher levels of self-reported aggression coincide with lower volume in putamen, caudate, and accumbens. To conclude, deviant development in cortical regions involved in emotion control relates to depression, whereas deviant development in subcortical regions involved in e.g., reward processing relates to aggression. These longitudinal findings set the stage for early detection of psychopathology.

1-H-40 The relationship between affective and cognitive empathy and grey matter density in the anterior insula in late childhood

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Empathy refers to the understanding and sharing of others' emotions, and comprises cognitive and affective components. While several studies have examined associations between empathy and brain function in adults, fewer studies have investigated brain structural associations with cognitive and affective empathy components, and none have been performed in children. Empathy (particularly cognitive empathy) continues to develop during childhood and adolescence. Investigating relationships between empathy and brain structure during development is important to understand the full picture of the neural correlates of empathy across the lifespan. In a sample of 124 community-dwelling 9-10 year olds, we measured empathy traits using self-report questionnaires and conducted VBM analysis using T1-weighted structural MRI scans. ROI-based analyses were conducted using the insula and MCC/dmPFC based on previous work. We found that affective sharing and empathic concern (both affective empathy components) were positively related to grey matter density in the right insula. Cognitive empathy scores were not related to brain morphology in the insula or MCC/dmPFC. This study is the first to our knowledge to investigate brain morphology and empathy in children. It provides evidence that the structural correlates of affective empathy may be similar to that of adults. The lack of association between cognitive empathy and brain morphology may represent a developmental effect relating to underdeveloped cognitive empathy centres in the brain, or alternatively how children report their own em

1-H-42 Nightmare Math: What specific anxiety can do to the developing brain

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Adequate mathematical competences are indispensable in professional and social life. However, mathematics is often associated with stress triggers anxiety in many children. Despite the high prevalence of math anxiety and the detrimental effects on mathematical performance, only limited attention has been devoted to the neurobiology of math anxiety. Evidence regarding brain substrates of anxiety lend support that our brain not only reacts with adapted brain activation, but also with structural changes due to detrimental experiences. However, no study has ever investigated possible structural alterations due to math anxiety. Therefore, the aim of the present study was to examine consequences of mathematical anxiety on grey matter in typically achieving children and children with developmental dyscalulia (DD). Behavioural and magnetic resonance imaging were acquired and findings corroborated that children with DD suffer more often from math anxiety. In general, boys and girls were equally affected and math anxiety was independent from age or general cognitive abilities like IQ. Remarkably, math anxiety affected specifically arithmetical performance negatively, probably by diminished working memory capacities based on anxiety and stress. Most importantly, present findings showed for the first time that math anxiety is related to altered brain structure. In particular, the right amygdala volume was reduced. In conclusion, math anxiety does not only hinder children in arithmetic, but it goes along with changes in brain structure of fear processing.

1-H-43 Lateralization of the infant brain - a DTI study

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Objectives Diffusion tensor imaging (DTI) can provide valuable information on white matter development. Previous studies have shown that white matter anisotropy increases with age. Some hemispheric differences reportedly exist in early stages of life as well as in adults, yet infant brain lateralization remains unexplored. The object of this study was to examine how fractional anisotropy (FA) is affected by infant age and whether there are hemispheric FA differences. Methods This study is a part of the FinnBrain Birth Cohort Study. 121 healthy infants 2-5 weeks of age underwent magnetic resonance imaging (MRI/DTI). Images were preprocessed with DTIPrep quality control software and tensor fitting was done with FMRIB Software Library (FSL). Track Based Spatial Statistics (TBSS) was then performed using FSL. Finally, voxelwise statistics was done using randomise tool to find correlations between FA and gestational age (GA) of infant as well as differences between left and right hemisphere and between sexes. Results GA was significantly associated with higher FA across all white matter tracts. Left hemisphere had significantly higher FA. Sex differences were not found. Conclusion Leftward white matter asymmetry is frequently reported in adult studies, although the lateralization in adult brain is not as widespread. The significance of the observed lateralization in white matter development for brain development remains to be further addressed by longitudinal studies.

1-H-44 Testing the longitudinal links between brain morphology and executive functions in middle childhood with poverty as a moderator

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Throughout middle childhood, children make large gains in executive functions (EF), defined here as cognitive control, inhibition and working memory, that are driven in part by frontal lobe (FL) maturation. However, only few longitudinal studies have assessed changes in cortical thickness (CT) and surface area (SA), despite evidence that they reflect differential developmental processes that are convoluted in standard volumetric measures. Furthermore, recent findings indicate that the association of FL maturation and EF may differ along the socioeconomic spectrum. We are assessing 147 primary caregivers and their healthy children from Berlin, Germany at two waves. All 81 children who underwent structural MRI at wave 1 (aged 6-7) are currently being re-tested (aged 8-9). CT and SA of bilateral frontal regions involved in EF (dorsolateral prefrontal and anterior cingulate cortex) will be estimated using FreeSurfer. A latent score will be built from three EF tasks if correlations allow (N-back, complex span, rule-switching). Latent difference score structural equation models will examine whether changes in frontal CT and SA predict changes in EF, and whether poverty (family income-to-needs ratio ≤ 1.5 at either or both waves) moderates this relationship. In addition, the same associations will be explored in the whole cortex using linear mixed effects models. First, we hypothesize that stronger cortical thinning and steeper increase in SA are related to better EF. Second, we hypothesize that the association of FL maturation and EF is stronger for poor children.

1-H-46 Maternal dietary docosahexaenoic acid during pregnancy influences newborn hippocampal functional connectivity

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Maternal omega-3 fatty acids during pregnancy are essential for fetal neurodevelopment and can only be obtained from the diet. Among the omega-3 fats, docosahexaenoic acid (DHA) is the predominant structural fatty acid in the central nervous system. Animal studies suggest that maternal DHA during pregnancy is needed for offspring development of learning and memory; however, the results of human studies are inconclusive. A more robust method, sensitive enough to detect potential neurological effects of maternal DHA on offspring neurodevelopment in human infants, is needed. Resting-state functional connectivity (rsFC) provides an opportunity to examine the brain systems underlying cognitive development beginning in the neonatal period. Using rsFC, we examine the association between mean maternal plasma DHA concentrations (averaged over each trimester) and hippocampal rsFC in neonatal brains (N=42; M=24.67 days, SD=11.67 days). Hippocampal rsFC is the focus due to its high expression of DHA and vital role in learning and memory. Higher mean maternal DHA during pregnancy was found to be significantly associated with altered rsFC between the hippocampus and multiple regions of the brain, including regions of the cingulo-opercular network implicated in learning and memory. This result suggests that variation in maternal DHA during pregnancy is associated with variation in functional brain architecture during the neonatal period and provides a potential pathway to which maternal dietary DHA may be relevant for offspring learning and memory.

1-H-47 The development of interaction-selective "fingerprints" in the brain

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The neural basis and development of face and body perception are well-studied; yet by comparison, only a few recent attempts have been made to identify the brain regions, such as the posterior superior temporal sulcus (pSTS), that underlie the perception of interactive behaviour. The current study investigates how interaction-selective neural responses (i.e. functional responses to interactions > other stimulus categories) mature across typical development. We will acquire diffusion tensor imaging (DTI) data in 30 adults (aged 18+ years) and 30 children (aged 5-12 years), along with functional magnetic resonance imaging (fMRI) responses to videos that depict social interactions, along with other social videos (i.e. faces, bodies, and theory-of-mind content). We will combine DTI with fMRI data to implement a 'fingerprint' connectivity analysis (e.g. Osher et al., 2016) to investigate to what extent functional interaction responses are predicted by a given voxel's probabilistic white matter connectivity to the rest of the brain. After correcting for group differences in head motion, we expect that the adult group will show greater model prediction accuracy than the child group in the pSTS, due to a stronger relationship between functional responses and extrinsic connectivity. We also anticipate greater accuracy in adults than children when predicting functional responses to interactions than to other social categories (e.g. faces) in the pSTS, underscoring the strong functional selectivity for interactions previously observed in the pSTS.

1-H-48 Variation in early life maternal care predicts adolescent prefrontal cortex to amygdala synapse development in mice

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During adolescence, while prefrontal neocortex (PFC) dendritic spine density decreases, reciprocal projections between the basolateral amygdala (BLA) and prefrontal cortex undergo strikingly late growth. To test if the development of BLA-PFC connectivity was sensitive to the early environment we used maternal separation (MS), three hours per day P1-10, as a mouse model of early life adversity, and quantified variation in maternal care. We then used a viral approach to label long range axons in the male offspring and quantified presynaptic boutons in postmortem brain slices during mid adolescence (P28-35). We focused on two frontal efferents projecting from the dorsomedial prefrontal cortex (dmPFC) to the basolateral amygdala (BLA) and dorsomedial striatum (DMS), and two frontal afferents whose axons emerge from cell bodies in the BLA and orbitofrontal cortex (OFC) and ramify within dmPFC. We found MS treatment had specific effects on bouton density in the descending projection from the dmPFC to the BLA, but not other axons under study. The MS group had higher bouton density but smaller median dmPFC bouton size in the BLA. The density of dmPFC boutons in the BLA also correlated with variation in maternal care across groups. Smaller, more numerous dmPFC boutons in the BLA could contribute to previously reported differences in cognitive flexibility in adolescence after MS treatment. Experience dependent scaling of PFC-BLA connectivity could reflect experience expectant adaptation to the environment and may also contribute to greater risk for pathology.

1-H-49 White matter extension of the Melbourne Children's Regional Infant Brain (M-CRIB) atlas

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Aim: Understanding typically developing infant brain structure is crucial in studying neurological disorders of early childhood. Brain MRI atlases providing standardised identification of neonatal brain regions are key in such investigations. We developed the M-CRIB atlas for parcellating 100 cortical and subcortical regions in infants, compatible with the Desikan-Killiany adult atlas in FreeSurfer. We aimed to extend brain coverage to include white matter (WM). Method: MRI data from our M-CRIB atlas sample was used. Participants were 6 healthy term neonates (≥37 weeks gestation; 3 females; mean gestational age at scan 41.55 weeks). High-resolution T2-weighted structural MRI scans were used. Direction encoded fractional anisotropy maps generated using FSL Diffusion Toolbox, were co-registerered to the T2 images and used to aid delineation of the WM regions. The regions and their boundary definitions were mostly based on the JHU neonatal atlas. Our segmentation differed by having 5 corpus callosum (CC) subdivisions (Hofer's classification) instead of a left/right (L/R) division; L/R division for Middle Cerebellar Peduncle, and excluding brainstem divisions. Manual tracing was performed with ITK-Snap and reviewed by a paediatric neuroradiologist for anatomical accuracy. Results: 54 WM regions were segmented per brain: 24 paired and 6 unpaired (5 CC subdivisions, 1 pontine crossing tract). Conclusion: The updated M-CRIB atlas including WM parcellations will be publicly available. It will facilitate research into neonatal brain structure, WM development and disease.

1-H-50 Memory development: Complementary roles of the hippocampus and prefrontal cortex*

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Episodic memory undergoes robust development during childhood and depends on the function of the hippocampus (HC) and prefrontal cortex (PFC). Only limited evidence specifically links individual differences in HC and PFC structure to memory function in children. Here we examined the relation between individual differences in HC subfields and PFC volumes to measures of episodic memory. We assessed episodic memory using a novel paradigm in which we vary the degree of similarity across stimuli and the type of recognition memory. Thirty-five 5-to-6-year-olds (mean age=6.20, N=35, 40% females) studied stimuli consisting of multiple exemplars from a single category ('within-category') intermixed with single exemplars from different categories ('across-category'), and their memory was later tested by yes/no recognition (Y/N) and 2AFC. Memory tested through Y/N for 'within-category', was related to the volumes of HC subfield CA3-DG (r=-0.36, p=0.04), but not to other HC subfields or to PFC volumes. Memory tested through Y/N for 'across-category' stimuli was related to CA3-DG, CA1-2, and Subiculum volumes and to PFC volumes. In contrast, memory tested with 2AFC, was uniquely related to volumes of the lateral PFC, for both 'within-category' (r=-0.43, p=0.01) and 'across-category' (r=-0.42, p=0.02) stimuli conditions. These findings suggest that in young children, CA3-DG uniquely supports memory that requires representation of fine details, whereas PFC supports memory that relies on successful evaluation and decision-making.

1-I-51 A graph theoretical analysis of the episodic memory network during early childhood

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Research has identified a network of brain regions important for episodic memory in adults. Recently this network was identified in young children; however, it's unclear how its organization may differ across development. The present study aims to investigate the functional integration of the hippocampus within the episodic memory network and segregation of the hippocampus from other networks (i.e., fronto-parietal network) in the brain. Resting-state functional connectivity data have already been acquired from 110 4- to 8-year-old children as part of a larger study on memory and brain development. Seed based analyses using the hippocampus will be used to identify the episodic memory network. Graph theoretical analyses will be used to characterize in- vs. out-of-network changes in the role of the hippocampus and to test the hypothesis that the hippocampus is becoming increasingly functionally integrated with the memory network and segregated from other networks in the brain. Two metrics will be used to quantify the importance of the hippocampus within the memory network relative to other networks across the age range assessed: 1) the within-module degree z score will be used to assess the within network connections of the hippocampus 2) the participation coefficient will be used to assess between network connections of the hippocampus relative to other networks in the brain. These findings will be the first to characterize the changing organization of the episodic memory network in early childhood, which has important implications for our understanding of memory development

1-I-52 Dimensions of early adversity in resting state functional connectivity among high-risk adolescents

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Early adversity (EA) alters neurodevelopmental trajectories and drives changes in behavior, cognition, and psychopathology that are apparent by adolescence. We use resting-state functional connectivity (rs-fc) to characterize the influence of EA on brain development in adolescents. We also evaluate whether childhood abuse and neglect, two forms of EA that are rarely directly compared, exert distinct effects on rs-fc. Participants in three separate adolescent samples (11-19 years of age, total enrolled N = 316, 100 with EA) were identified from the community, child welfare system, a community medical program for child abuse, and via high rates of substance use. Subjects have been processed through a modified version of the Human Connectome Project pipeline with improvements to registration and motion correction. Planned analyses will be presented at the conference and include group comparisons (a) between adolescents with and without experiences of EA, and (b) between those that have experienced abuse, neglect, both, or neither (preliminary analyses suggest distinct effects of these exposures: https://tinyurl.com/y9pryoyc). First, seed-based analyses test for altered connectivity with regions previously shown to be affected by EA (amygdala, hippocampus, and ACC). Second, whole-brain analyses identify and characterize networks with EA-related rs-fc changes, going beyond initially hypothesized seed regions. Characterizing large-scale connectivity changes associated with EA provide a basis for understanding its broad neural impacts and contributions to psychopathology.

1-I-54 Reinforcement learning and dynamic network flexibility in adolescence

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Time-varying changes in patterns of functional connectivity can reflect the dynamics of task demands. By formally encoding such changes in network models and applying tools from graph theory, prior work has demonstrated that dynamic network flexibility -DNF- tracks the course of learning (Bassett et al., 2011). In adults, dynamic network flexibility may be a mechanism underlying the integration of information necessary for learning. Specifically, DNF in striatal-cortical circuits in adults relates to better learning and whole-brain DNF is correlated with individual differences in reinforcement learning model parameters (Gerraty et al., 2018). Adolescents have shown better learning on this same task; however, it is unknown how DNF supports reinforcement learning during adolescence. Here we compare DNF in striatal-cortical circuits in adolescents (13-17 years) versus adults while they engage in a reinforcement learning task. We examine DNF in hippocampal-cortical circuits, guided by prior results showing better learning in the adolescents was related to more hippocampal activity in adolescents than adults (Davidow et al., 2016). We predict that striatal-cortical circuits will be associated with better behavioral performance in the adolescent sample. Moreover, we expect greater DNF of the hippocampus will predict learning over time and will explain age group differences in both learning and reinforcement learning model parameters. Results will inform the role of dynamic brain network flexibility in complex learning involving information integration and reward sensitivity.

1-I-55 Structural development and functional connectivity profiles in childhood executive control: Integrating growth trajectories of morphology and network connectivity in children with executive function and attention deficits across school age.

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Objective: Executive function (EF) deficits are common in ADHD, however, less work has examined the role of EF across developing network organization and structure using multiple imaging modalities. Our previous work found that preschool EF deficits were associated with altered connectivity in the salience/cingulo-opercular (SAL/CON) system in childhood. The current study examined these relationships longitudinally to explore how trajectories of both network organization and structure of regions within these systems related to measures of childhood EF and ADHD. Methods: Participants were 124 children, ages 7-15 across 3 annual scan visits. Multilevel modeling was used to analyze relationships between rsfcMRI network global efficiency (GE) in the SAL/CON network and gray matter volume of the anterior cingulate and insula with symptoms of EF deficits and ADHD. Results: Structurally, lower cingulate volume was associated with greater EF deficits and ADHD symptoms. Lower insula volume was associated with ADHD symptoms but not EF deficits. Functionally, CON GE was associated with greater EF deficits. Trend level associations and time-varying relationships were found between SAL/CON GE and ADHD symptoms. Conclusions: Follow-up work is examining how structural volume and functional connectivity in the SAL/CON system relates to EF deficits and ADHD symptoms using bivariate latent growth modeling. These results will help clarify the dynamic changes between structural development and functional connectivity throughout childhood.

1-I-56 Developmental trajectories of hubness and functional connectivity of the Prefrontal Cortex*

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The prefrontal cortex (PFC) exhibits a prolonged developmental trajectory extending from childhood to adulthood. Structural and task-based MRI studies have suggested that different PFC regions exhibit distinct age-related changes into adulthood. Less is known about developmental variations in resting-state functional connectivity (RSFC) and network topology of functionally defined PFC subdivisions, with many studies examining select PFC regions (e.g. VMPFC only). We sought to integrate graph theory and seed-based analyses to characterize age-related changes in both hubness and RSFC patterns associated with different PFC regions. Using Power et al. 2010 parcellations, we selected 30 PFC seeds, covering lateral and medial regions of the dorsal, ventral, and orbital PFC. 615 individuals (8-21 years old) from the Philadelphia Neurodevelopmental Cohort dataset were examined to investigate linear and non-linear (e.g. quadratic, cubic) age-related effects of degree centrality (DC), participation coefficient (PC), and RSFC profiles associated with each seed. Findings demonstrated that the DLPFC and VLPFC displayed exponential decreases in hubness ($p<.001$) while the OLPFC exhibited linear decreases. Differences in age-related hubness trajectories were explained by variations in RSFC profile with different networks. All regions, however, consistently exhibited decreasing connectivity with the DMN as a function of age. Of these regions, DC of the DLPFC and VLPFC predicted complex cognition, which itself exhibited exponential improvements throughout development.

1-I-57 Associations between elevated internalizing symptoms during early childhood and integrity of white matter tracts in cortico-limbic circuitry

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Patterns of early emerging internalizing symptoms vary during childhood, with some children exhibiting few symptoms, and others, considered at higher risk for later depressive and anxiety disorders, showing persistently elevated symptoms over time. While past work on internalizing disorders implicates dysfunction in cortico-limbic circuitry, less is known about whether structural abnormalities precede frank disorder and thus potentially mark risk. We therefore examined ties between longitudinal symptom patterns in 42 typically developing girls, assessed at ages 3.5, 6, 6.7, and 8.5 years, and integrity of white matter (WM) tracts in the cortico-limbic circuitry, assessed at age 6.7 years. Diffusion Tensor Imaging (DTI) data was analyzed using Automated Fiber Quantification (AFQ; Yeatman et al., 2012), which allowed measurement of diffusion properties at multiple points along tracts' length (cf. an average diffusion measure of the entire tract). Latent profile analysis of caregiver-reported child symptoms showed that girls with increasing symptoms over time had reduced fractional anisotropy in segments of the uncinate fasciculus and the cingulum compared to girls with persistently low symptoms. These results point to a putative mechanism underlying the heterogeneity of symptom trajectories across childhood.

1-I-58 Motion's contribution to resting state correlations

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A key problem facing many fMRI studies is the presence of motion artifacts. We develop a series of techniques to characterize the impact of motion in a large fMRI data set and propose mitigation techniques. We collected 530+ 8 minute resting state scans in a cohort of adolescent and adults. To characterize linear and non-linear effects of in-scanner motion on the BOLD signal acquired using a typical EPI sequence, we estimated the following Volterra kernels: 1st order; 2nd order on-diagonal; 2nd order, first off-diagonal; and 3rd order on-diagonal, associated with estimated head motion. This allowed us to reconstruct the spatiotemporal structure of head-motion induced fMRI artifacts. Dimensionality reduction revealed the primary modes of fMRI signal motion related signal covariance. Head motion during fMRI scans induces a wide variety of spatio-temporally structured signal correlations. We find that some of the canonical modes of resting state correlations that are often observed, e.g., the default mode, are heavily biased by in-scanner motion artifacts, or neural activity that is tightly coupled with the onset of motion. In addition, we demonstrate that commonly observed functional connectivity between bilateral motor cortex is primarily the result of BOLD responses that are synchronized with head movement. Conclusion: Some of the canonical patterns of connectivity observed in many studies of the resting brain, in particular the default mode, are heavily biased by in scanner head motion.

1-I-59 Functional networks in term-born infants - a resting-state functional MRI study from FinnBrain Birth Cohort Study

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Introduction Functional resting-state networks (RSN) can provide insight into spontaneous activation patterns of the brain. Characterization of infant RSN's is crucial for developing early biomarkers for later health and gaining deeper understanding of normal functional network development. Therefore, we analyzed the RSN's in healthy term-born infants. Methods 21 full-term naturally born healthy infants (mean age from gestation 25.7 d; SD 5.9; 9 female) underwent a 6 min resting state fMRI sequence during natural sleep. We analyzed the data with MELODIC v3.14 independent component analysis tool implemented in FSL: Group-level ICA was carried out to the data and spatial normalization was done to UNC-T2 infant template. Results Group-level ICA yielded 20 components, of which 11 were identified as RSN's: 1,2) Left and right auditory network 3) cerebellar network; 4) default-mode-network (DMN); 5) frontal network; 6) inferior parietal network; 7,8) left and right superior parietal network; 9,10) dorsal and ventral sensorimotor networks; 11) primary visual network. Conclusions The results reveal aspects of functional organization of the infant brain. The networks represent sets of brain regions involved in primary sensory processing and associative areas are captured in relatively large components.

1-I-60 A functional MRI preprocessing pipeline for neotatal connectomics

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The Human Connectome Project's (HCP) public processing pipelines establish standards for projecting magnetic resonance imaging (MRI) modalities into a common surface-volume space for research and analysis. Neonatal MRI processing lags significantly behind these standards, as current heuristics for inter-modality registration and surface reconstruction fail to address differences in neonatal tissue contrasts. To overcome these limitations and improve neonatal processing standards, we propose a series of preprocessing techniques using Advanced Normalization Tools (ANTs), a new effective set of medical imaging tools, with the standard HCP pipeline. 1) Corruptions present in MR images are corrected using Rician denoising and N4 bias field correction. 2) Cortical and subcortical regions are segmented using JointFusion, a multi-atlas ensemble method. 3) The anatomies are registered into a common space using ANTs. To address issues in the Freesurfer surface reconstruction stage, a combination of histogram shifted and original images are used to generate surfaces, resulting in quality delineations of white and gray matter. As in the HCP pipeline, functional MRI are co-registered and projected onto this common space. This preprocessing allows for inter-subject comparisons of anatomical features and functional connectivity in neonates, and discovery of early brain networks including the default mode, motor-sensory, and visual networks. All software required to run this pipeline has been packaged into a docker image, to provide reliable reproducibility for collaborators.

1-I-61 The relationship between poverty and resting-state functional connectivity in 2-month old Bangladeshi infants

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Poverty has been associated with structural and functional brain alterations. However, it is unclear how early in life the effects of poverty can be detected and whether they are specific to certain brain areas. We acquired resting-state fMRI data in 17 infants from low income families (78±9.1 days) and 16 infants from middle income families (79±9.9 days) in Bangladesh. Whole-brain intrinsic functional connectivity (iFC) was performed using seeds in sensory and motor areas, as well as the amygdala, where iFC has been shown to be susceptible to other early life social stressors, such as interparental conflict. Using two-sample t-tests, no significant group differences were observed in iFC estimates for seeds placed in sensory or motor areas; however, infants from low compared to middle income families exhibited greater iFC estimates in the precuneus for a seed placed in the amygdala. This result suggests that effects of poverty on early brain development are specific to certain functional networks. The present study expands upon earlier work by showing that family income, like other early life stressors, is associated with altered functional development of amygdala connectivity as early as in the first 2 months of life.

1-I-62 Cross-sectional exploration of age-related differences in insular resting state functional connectivity in adolescence

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Adolescence is marked by neural changes and increases in risk-taking whose consequences can lead to persistent negative outcomes. The dual-systems model, a dominant framework, describes these changes as a function of two neural circuits and their associated behaviors: a limbic-striatal circuit that mediates reward sensitivity, peaking in adolescence, and a prefrontal-centered cognitive control network that strengthens into adulthood. The salience network, consisting of the anterior insula and anterior cingulate cortex (ACC), may act as a toggle between reward and control systems, thus serving an important integrative function. Within this network, the insula detects salient stimuli and then directs attention by activating appropriate brain areas. This study examined age-related changes in resting state functional connectivity (FC) of the insula in adolescents. Resting state MRI data, collected on a 3T Siemens Tim Trio scanner, was available for 128 healthy participants (ages 11-25). Using whole-brain resting state FC analyses conducted through FSL, we will analyze the circuits of the anterior insula. Regression analyses will be conducted to quantify age-related variations in insula connectivity when controlling for gender, and motion. We hypothesize age-related linear increases in insula FC with the PFC and a curvilinear pattern of age-related FC with limbic regions across adolescence. To date, seed based analyses suggest linear associations of age. These results will establish circuits of interest for further studies examining behavior and longitudinal development.

1-J-64 Exploring Moderators of Diurnal Cortisol Attunement in Expectant New Fathers and Mothers

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During pregnancy, changes in maternal hormone levels support the prenatal environment and prepare expectant mothers for parenthood. Less is known about how expectant fathers' hormone levels change during the prenatal period. In particular, there is little research investigating associations between couples' hormonal activity, such as cortisol attunement, which may be an important psychobiological pathway supporting the transition to parenthood and shaping infant development. Thus, the purpose of the current study was to investigate expectant parents' diurnal cortisol attunement and moderators of this activity. Data come from an international longitudinal study of 482 low-risk, first-time parents across the U.S., U.K., and Netherlands. Psychosocial and demographic measures were collected from parents when mothers were approximately 36-weeks pregnant. Saliva samples were also collected at three times on two consecutive days by parents and assayed for cortisol. Diurnal cortisol attunement was assessed with multilevel modeling by regressing mother's cortisol on father's cortisol. Results indicated that on average mothers' and fathers' diurnal cortisol trajectories were attuned to each other. Furthermore, this attunement was moderated by father-reported relationship conflict, such that higher levels of conflict were associated with greater cortisol attunement. These findings have implications for understanding associations between expectant parents' relationship quality and endocrine functioning, which may impact the prenatal environment and fetal development.

1-J-66 Immediate biological embedding of maltreatment in children: Moderating effects of FK506 binding protein 5 (FKBP5) gene on cortisol reactivity and amygdala volume in children aged 3-5 years

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Objective: The FK506 binding protein 5 (FKBP5) gene interacts with childhood trauma to predict neurobiological phenotypes and psychiatric disorders in adults. However, the immediate neurobiological impact of maltreatment and its moderation by FKBP5 gene variants in early development is largely unknown. Methods: 80 children aged 3-5 years with verified maltreatment within 6 months and 79 age- and sex-matched controls were genotyped for FKBP5 rs1360780. Maltreatment features were coded using the Maltreatment Classification System. Salivary cortisol concentrations were assessed before and after a cognitive challenge. Amygdala volumes were measured in 46 maltreated children who underwent structural magnetic resonance imaging. Mental health status was obtained by parent report using standard instruments. Results: FKBP5 rs1360780 T allele carriers with maltreatment exposure exhibited increased cortisol reactivity (B=.01, SE=.01, p<0.01). Within the sample of maltreated children, T allele carriers exhibited increasing amygdala volume (B=14.79, SE=5.18, p<0.01) as a function of maltreatment severity. Increased amygdala volume predicted symptoms of depression and anxiety. Conclusion: Maltreatment has profound impact on neurobiological and clinical status in children as young as 3-5 years of age and this impact is moderated by variation in genes relevant for stress regulation. FKBP5 allele status may serve as an early indicator of risk for psychopathology in children exposed to maltreatment and might represent a target for novel intervention strategies.

1-J-67 The bio-behavioral impact of poverty on executive function: A cross-species study*

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Children in high-poverty homes lag behind their higher income peers in neurocognitive indicators of school readiness, such as executive function (EF). However, the mechanisms by which poverty can increase the risk of EF difficulties are unclear. Here we present findings from a cross-species human and rodent study, exploring relations between early-life environments of scarcity-adversity and EF bio-behavioral outcomes in peri-adolescence. Human data come from the Family Life Project, a population-based longitudinal sample (n=1292), which oversampled for impoverished families. In peri-adolescence, EF was assessed using a battery of working memory, inhibition and attention shifting tasks. Rodent data come from a model of early-life scarcity, where rodent mothers were provided with insufficient materials so they could not build a proper nest for their pups. Human results demonstrated a link between early-life poverty exposure and EF impairments in peri-adolescence. Rodent results revealed that scarcity-reared peri-adolescent rodents displayed EF impairments, with evidence of upregulated glucocorticoid receptor levels in the medial prefrontal cortex. Following an intervention in which scarcity-reared rats were co-housed with a control rat, scarcity-reared rats did not demonstrate deficits in EF. Overall, human and rodent results indicate process similarities in terms of scarcity-adversity and EF outcomes. Results provide implications for how early-life adversity disrupts cognitive skills, which are vital to classroom learning and academic achievement.

1-J-68 Stress effects on emotional memory in middle childhood

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In adults, memory for emotional objects is often enhanced, whereas memory for neutral backgrounds paired with the emotional objects is reduced. Furthermore, stress shortly before encoding boosts memory in adults through interactions of norepinephrine and cortisol. The aim of the current study was to examine the effects of stress on children's emotional memory. 135 6-to-7-year-old children were randomly allocated to stress (n = 97) elicited with the Trier Social Stress Test for Children or a control condition (n = 38). After stress induction, children incidentally encoded 75 objects paired with 75 neutral scenes. Five categories, each with 15 objects, were created: negative valence with low (1) or high (2) arousal, neutral (3), and positive valence with low (4) or high (5) arousal. Recognition memory (hits - false alarms) was measured the following day. Unlike adults, children showed a memory suppression effect of negative relative to neutral items, which was more pronounced in girls and boosted by stress in girls. In stressed girls, who had higher cortisol stress reactivity than boys, higher cortisol levels were related to better emotional memory. No corresponding effects of emotionality or cortisol where found on scene memory. This provides evidence for an incidental memory suppression effect of negative objects that is boosted by pre-learning stress in middle childhood, indicating that there may be qualitative differences in emotional memory in children compared with adults. This work was supported by Jacobs Foundation to YLS and CH.

1-K-69 Neuroimaging the prepubertal brain: MRI quality in a large developmental twin sample

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As complement to the growing literature on pitfalls and possibilities of developmental neuroimaging, we evaluated how child-specific scanner adaptations related to scan quantity and scan quality in a large developmental twin sample. 512 7-9-year-old twin children were included for an MRI scan. MR simulation beforehand successfully reduced scanner related distress. Participant's tension and excitement before scanning were associated with the number of completed MRI runs, but not to scan quality (i.e., head motion). Overall, scan quantity was high, and 88% of the children that started the 60 minute protocol completed all runs. Scan quality decreased over the first 5 task-based fMRI runs, increased during anatomical scans and was lowest for the final resting state fMRI scan. In line with previous studies behavioral genetic analyses showed heritability played a part in explaining excessive head motion. Additionally, our results show that subtle head motion (after exclusion based on excessive head motion) was not heritable, indicating that MRI findings of motion-corrected and quality-controlled data are not confounded by genetic factors. These results provide insight in the efficiency of child-specific scanner adaptations and can inform future studies on pediatric neuroimaging in order to provide a better understanding of pre-pubertal brain development.

1-K-70 Graph theory approaches to functional network organization in developmental network neuroscience: A critique for a brave new small-world

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Over the past two decades, resting-state functional connectivity (RSFC) methods have provided new insights into the network organization of the human brain. Studies of neurocognitive development and psychopathology have adapted tools from graph theory to characterize age-related changes and differences between healthy and patient populations. Here, we conducted a review of developmental and clinical network neuroscience, summarizing methodological details from over 100 RSFC studies. Although this approach is prevalent and promising, our review identified four challenges. First, the composition of networks varied remarkably in terms of region parcellation and edge definition, which are fundamental to graph analyses. Second, many studies equated the number of connections across graphs, but this is conceptually problematic in developmental populations and may induce spurious group differences. Third, few graph metrics were reported in common, precluding meta-analyses. Fourth, some studies tested hypotheses at one level of the graph without a clear neurobiological rationale or considering how findings at one level (e.g., global topology) are contextualized by another (e.g., modular structure). Based on these themes, we conducted network simulations to demonstrate the impact of specific methodological decisions on case-control and developmental comparisons. Finally, we offer suggestions for promoting convergence across studies in order to facilitate progress in this important field.

1-K-71 Qoala-T: A supervised-learning tool for quality control of automatic segmented MRI data*

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Performing quality control to detect image artifacts and data-processing errors is crucial in structural magnetic resonance imaging, especially in developmental studies. Currently, many studies rely on visual inspection by trained raters for quality control. The subjectivity of these manual procedures lessens comparability between studies, and with growing study sizes quality control is increasingly time consuming. In addition, both inter-rater as well as intra-rater variability of manual quality control is high and may lead to inclusion of poor quality scans and exclusion of scans of usable quality. In the current study we present the Qoala-T tool, which is an easy and free to use supervised-learning model to reduce rater bias and misclassification in manual quality control procedures. First, we manually rated quality of N = 784 FreeSurfer-processed T1-weighted scans. Different supervised-learning models were then compared to predict manual quality ratings. Results show that the Qoala-T tool using random forests is able to predict scan quality with both high sensitivity and specificity (mean area under the curve (AUC) = 0.98). In addition, the Qoala-T tool was also able to adequately predict the quality of a novel unseen dataset (N = 112; mean AUC = 0.95). These outcomes indicate that using Qoala-T in other datasets could greatly reduce the time needed for quality control. More importantly, this procedure could further help to reduce variability related to manual quality control, thereby benefiting the comparability of data quality between studies.

1-K-72 The effect of lifespan age differences in representational similarity on memory performance

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Stability of object representations across encoding events boosts memory. But also the overlap with other representations affects the ability to memorize the respective material. In old age, representational distinctiveness decreases, contributing to age-related memory decline. However, the development of representational stability (RS) and overlap (RO) during childhood has not been charted yet. We conducted an electroencephalography (EEG) study which examined the influence of RS and RO on memory performance in children (7-9 years), young adults (YA, 20-30 years), and old adults (OA, 65-75 years). During incidental encoding, objects from different categories were presented. Crucially, RS and RO were manipulated by varying the number of exposures (2 vs. 4) and the number of exemplars per category (2 vs. 4). During recognition, old, new, and similar lure objects were presented. Participants indicated for each object whether it was old, new, or similar. In line with the hypothesized benefit of RS on memory, more repetitions increased participants' hit rate for old objects, while leaving the false alarms (FA) to lures unchanged. In contrast, more exemplars increased both: hit rates for old items and FA rates to lures, reflecting a reduced memory specificity due to increased RO. Compared to YA, FA rates were higher in OA, especially for high RO. EEG representational similarity analyses will target the neural signatures of RS and RO. Ultimately, we aim to uncover the neural mechanisms by which differences in representational quality change memory performance across the lifespan.

1-K-73 Visual decoding and preschool-age functional neuroimaging with high density diffuse optical tomography

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Visual decoding involves inferring visual stimulus information from recordings of brain activity. Prior visual decoding studies using fMRI have provided insight into visual system organization in adults. Decoding also has potential clinical utility, e.g. as a means of augmented communication for patients with speech impairments. However, it is challenging to perform fMRI in awake, young children, and it is not economically or technically feasible for patients to use MRI for daily communication, while most other neuroimaging modalities lack the spatial resolution fMRI offers for detailed decoding. Our group has been developing high density diffuse optical tomography (HD-DOT) as a lower cost, more portable functional neuroimaging modality that may be conducive to imaging awake infants and young children, while retaining spatial resolution close to that of fMRI. Here we present our first results on visual decoding with HD-DOT, showing that we are able to decode the position of a checkerboard viewed by a human subject using a template matching strategy with training and testing data acquired on different days. We also establish the feasibility of performing HD-DOT in preschool-age children, showing that we are able to map activations in auditory cortex during a word-hearing task using a new HD-DOT system we built for 3-5 year-olds. Future work will combine further advances in both decoding analysis and HD-DOT instrumentation to study important developmental cognitive neuroscience problems, such as visual system plasticity during the critical period in developmental strabismus.

1-K-74 Determining whether individual decision making differences are quantitative or qualitative using a multiple indicators multiple causes (MIMIC) model.

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This study aims to identify the latent variable driving individual decision making differences as either quantitative (e.g. loss aversion) or qualitative (e.g. decision heuristics). Both simulated and empirically obtained decision making data were analyzed with a Multiple Indicators Multiple Causes (MIMIC) model. Herein behavioral measures and fMRI indices were connected by either a quantitative or qualitative latent variable. By informing the latent variable by both types of data simultaneously rather than sequentially we expect a more complete account of the phenomenon it represents. Simulation results showed that the true nature of the latent variable underlying decision making data could accurately be identified by the corresponding MIMIC model having superior model fit. Analytical accuracy increased with a large sample size and fewer fMRI indices. We concluded that the MIMIC model is an appropriate tool for analyzing individual decision making differences. Next, the empirical decision making data of Van Duijvenvoorde et al. (2016) were analyzed. These data were best explained by a qualitative latent variable with two classes. Model parameters suggested the latent classes to differ in their integration of decision attributes, as reflected by distinct activity changes in the ventromedial prefrontal cortex. As such, we concluded that individual decision making differences are most likely driven by a qualitative latent variable. These findings lend support to decision making theories assuming individual decision making differences to be qualitative in nature.

1-L-75 Subcortical and cerebellar alterations in boys with pure ADHD and comorbid ADHD with conduct disorder analyzed using FreeSurfer?s volume-based processing stream

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Conduct disorder/oppositional defiant disorder (CD/ODD) is a childhood psychiatric disorder highly comorbid to attention-deficit hyperactivity disorder (ADHD) affecting about 50% of children with ADHD. Volume reductions have so far been identified in bilateral amygdala, accumbens, hippocampus, cerebellum, corpus callosum (CC) and total gray matter for ADHD, and in bilateral amygdala as well as left hippocampus for CD/ODD. Still, findings of structural alterations differ as many previous studies did not distinguish pure ADHD and comorbid ADHD and CD/ODD. Hence, the goal of this study was to disentangle subcortical and cerebellar volume alterations between pure and comorbid ADHD compared to TD. T1 weighted images from 36 boys with ADHD, 26 boys with ADHD and comorbid CD/ODD and 30 typically developing (TD) boys, all aged 11 to 17, were acquired and matched regarding age, IQ and pubertal status. We used FreeSurfer's volume-based processing stream to analyze subcortical structures and the cerebellum. Intracranial volume was entered into all analyses as a covariate. We found volume reductions in bilateral cerebellum and total subcortical volume for both pure and comorbid ADHD vs. TD as well as larger posterior CC volumes for pure but not comorbid ADHD vs. TD. Significant differences for distinct subcortical volumes did not emerge. Contrary to previous findings, boys with pure ADHD showed bigger CC volumes. This could stem from the specific sample of pure ADHD without any comorbidities indicating distinct morphology of the CC in the two ADHD subgroups of comorbid and pure ADHD.

1-L-76 Effects of anxiety on risk-taking behaviors and neural activity in typically-developing adolescents

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The onset of anxious phenotypes peaks in adolescence; over 31% of US adolescents report symptoms of anxiety, which lead to increased risk for anxiety disorder, depression, addiction, and suicide. Over-sensitivity to risk and reward in the limbic system coupled with immature prefrontal regulatory circuitry in typically-developing (TD) adolescents result in an increase in risk-taking behaviors, which serves to enhance independence and learning. However, this may be impacted by anxiety, as anxious phenotypes often include atypical risk-taking behaviors (risk aversion). In this study, we investigated the effects of anxiety on risk-taking behaviors and neural activity in 25 TD youth. Participants (9-13y/o) underwent an fMRI scan, during which they played the Driving Game, a risky decision-making task involving driving on a simulated track and trying to reach the end as quickly as possible to maximize a monetary reward. Participants also completed the Anxiety and Related Disorders Interview Schedule to assess anxiety symptom severity. While previous research has found a link between anxious phenotypes and risk aversion, preliminary results of our behavioral analyses did not find evidence of a significant correlation between anxiety and # of risks taken. However, initial fMRI analyses suggested a connection between anxiety and amygdala activity during outcome anticipation (the moments between taking a risk and finding out the outcome). These preliminary results suggest a link between anxiety and brain activity, but not behavior, during risk-taking in neurotypical youth.

1-L-77 Motor abilities, executive functions and cerebral blood flow in pediatric cancer survivors

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Survival rates for pediatric cancer have increased up to over 80%, because of improved diagnostic tools and treatment. However, Pediatric Cancer Survivors (PCS) bear a high risk for late effects including executive function (EF) deficits, impaired motor abilities (MA) and altered functional neuroanatomy. The aim was to investigate the relationship between EF and motor abilities in PCS including resting cerebral blood flow (CBF) as potential underlying mechanism. In total, 91 (42 PCS with and without CNS involvement, 49 matched healthy controls) between 7-16 years of age (M=11.14; SD=2.35) participated in the study. Motor abilities were assessed using the German Motor Ability Test (fitness, strength, coordination); EF using the Stroop task (inhibition, shifting) and the Corsi Block task (updating). CBF was assessed using 3D arterial spin labeling; ROIs were defined as ACC, basal ganglia, hippocampus, M1, SMA, prefrontal cortex. Independent t-tests revealed lower performance in EF and MA in PCS ($ps < .05$) than in controls. No group differences were found for regional or global CBF ($ps > .05$). Coordination is linked to EF in both groups (control: $r = .25$, $p=.04$; PCS: $r=.53$, $p < .001$). Although global CBF was strongly related to age ($r=-.49$, $p < .001$), regional and global CBF were not related to EF and MA ($ps > .05$). Results show that late effects in MA and EF are evident in PCS and both domains are strongly interrelated. Results indicate that interventions targeting motor coordination might have the power to contribute to to the rehabilitation of cognitive late effects in PCS.

1-L-78 The late positive potential as a marker of altered emotional processing and regulation in youth at high and low familial risk for depression: Associations with daily life emotional functioning and depression risk trajectories

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The Late Positive Potential (LPP) is an evoked potential beginning 400-600ms post-stimulus that reflects sustained attention to stimuli of motivational significance and is sensitive to instructed emotional regulation. Familial depression risk has been associated with alterations in neurobehavioral indices of emotional processing. It is unknown whether high risk youth would show alterations in their LPP in response to emotional stimuli, nor how the LPP might relate to real world emotional functioning. We examined 45 low risk and 45 high risk adolescents (aged 9-13, 50% female), defined by parental depression history. Youth viewed positive, negative, and neutral images during both passive viewing and regulation conditions. We hypothesize that high risk youth will have more difficulty reducing their LPP amplitudes in response to negative images or enhancing their LPP to positive images. To establish brain-behavior relationships, LPP amplitudes during passive and regulation conditions will be associated with parallel real-world indices of emotional responding and regulation. For example, we hypothesize that LPP to positive images will predict daily life positive affect, and less change in LPP following regulation to negative images will predict poorer regulation following negative daily life events. Youth are also completing a 1-year clinical follow-up, and we predict that alterations in emotional reactivity and regulation will predict depression symptom trajectories. Results will improve our understanding of brain-behavior relationships that may confer risk for depression.

1-L-80 Structural brain connectivity networks differences in children with autism

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This study examined structural brain connectivity in children with autism spectrum disorder (ASD) compared to typically developing children (TD). Children with ASD often struggle with social communication, executive functioning and sensory sensitivities. Structural connectivity could help identify a neurobiological basis for these characteristics. We used quality controlled data from 33 males, ages 9-16 (17 ASD, mean age=13.2 ± 1.8; 16 TD, mean age=11.4 ± 1.7). Image acquisition included T1 and T2 weighted structural images, and high-angular diffusion weighted imaging (DWI). Imaging data was run through the Connectome Mapper pipeline which involved parcellation of gray matter using the Gordon atlas, and probabilistic tractography throughout white matter. We found a significant difference in structural connections across several networks between the ASD and TD groups ($F(1, 14)=6.87$, $p<0.001$). Posthoc comparisons showed a subset of networks that had increased connectivity in ASD, including connections between the auditory and somatomotor networks ($p=0.01$, corrected). Other networks showed decreased connectivity in the ASD group. These included connections between the visual and ventral attention ($p=0.023$, corrected) systems, as well as connections between the visual and auditory ($p=0.034$, corrected) networks. These structural connectivity difference between ASD and TD

children, primarily in perceptual and motor networks, could relate to some of the behavioral difficulties that children with ASD face. We hope to further investigate how these findings and behavior relate.

1-L-81 Cerebral blood flow and executive functions in children after arterial ischemic stroke

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Objective: Pediatric arterial ischemic stroke (AIS) is a rare incident which can entail alteration of the cerebral blood flow (CBF) and impair executive functions. We investigate CBF in children after AIS and examine the relationship between CBF and executive functions. Methods: 29 children with AIS at least 2 years prior to the assessment and 47 healthy controls were included. All children underwent arterial spin labeling in the MR. Global and regional CBF (bilateral anterior cerebral artery ACA; middle cerebral artery ACM) were assessed. An asymmetry index (ACA contralateral - ACA ipsilateral) / (ACA contralateral + ACA ipsilateral) was calculated. Executive functions were assessed with standardized neuropsychological tests. Results: Children after AIS differed significantly from controls in working memory ($p=.02$, $d=.55$) and cognitive flexibility ($p=.01$, $d=.64$; controlled for IQ). Global CBF did not differ significantly between groups. CBF in the ipsilateral ACM was significantly lower ($p=.038$, $d=.45$) and the ACM asymmetry index was significantly higher ($p=.022$, $d=.51$) in children after AIS. Global and regional CBF correlated significantly with age in both groups (all $r<-.54$, $p<.01$). No significant associations occurred between executive functions and CBF. Conclusion: Even years after pediatric AIS, we observe an impact on executive functions (working memory, cognitive flexibility). Global CBF is normal after AIS but regional alterations in the anterior CBF persist which were unrelated to executive functions. Smaller region of interest might reveal different results.

1-L-82 Atypical theta connectivity in infants with familial risk for autism in response to social stimuli

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Autism Spectrum Disorders (ASD) are characterised by social communication difficulties. Theta oscillations are related to social processing. EEG connectivity reflects how different brain areas synchronise, and might be atypical in ASD. This longitudinal study aimed to examine whether theta EEG connectivity during infancy associates with later ASD diagnosis and traits. 14-month-old infants viewed social and non-social videos during EEG recording. Connectivity was calculated with the debiased weighted phase lag index for 4-5 Hz in infants with low risk (N LR = 17), and high risk who showed typical development (N HR-TD = 27), atypical development (N HR-Atyp = 16), or met ASD criteria (N HR-ASD = 8) at 36 months of age. ASD traits were measured using interviews, questionnaires, and observations. Whole brain theta connectivity was higher for the social than the non-social condition across all groups ($p<.001$, $r=.32$), in the LR group ($p=.004$, $r=.49$), and the HR combined group ($p=.058$, $r=.26$). There was a similar trend in the HR-TD group ($p=.058$, $r=.26$), while the difference did not reach significance in the HR-Atyp and HR-ASD groups ($p's\geq.208$, $r's\leq.32$). Differences between conditions were most pronounced in parietal and occipital areas in LR infants, and in frontal and parietal areas in HR infants. No association were observed between connectivity and ASD traits. Theta band connectivity patterns during social and

non-social processing might be related to atypical development in infants at familiar risk for ASD, rather than later ASD diagnosis or traits.

1-L-83 Neural correlates of safety cue learning in children with and without anxiety disorders

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Background: Anxiety disorders often emerge early in life, and about one in ten children is diagnosed with an anxiety disorder. Safety cue learning is a promising new approach for fear reduction. The goal of the present study is to compare neural correlates of safety cue learning between children with and without anxiety disorders, to gain more insight into this disorder and its treatment. Methods: We aim to have tested 25 healthy children and 15 children with anxiety disorders (age 8-18) by Flux; we have already tested 16 healthy children and 6 children with anxiety disorders. We are measuring skin conductance response (SCR) and brain activity (functional magnetic resonance imaging (fMRI)) during our novel conditioned inhibition task. This task consists of four phases (conditioning, testing, extinction and reversal) and uses an aversive noise as unconditioned stimulus. By presenting the threat and safety cues at the same time during the testing phase, we study a possible way to reduce fear. fMRI data will be analyzed using FSL, and exploratory analyses will combine SCR and fMRI data using amplitude modulation. Hypotheses: We hypothesize that combining threat and safety cues reduces threat (as indicated by decreased SCR and decreased amygdala activity) compared to combining threat and novel cues in healthy children. We hypothesize that children with anxiety disorders show less differentiation between the threat-safety and threat-novelty cues, suggesting deficits in safety cue learning that will correspond to alterations in hippocampal-frontoamygdala circuitry.

1-L-84 Statistical learning is associated with autism symptoms and verbal abilities in young children with autism

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Statistical learning, the ability to extract regularities in our environment, may be fundamental for social behavior. We tested 124 young children (ages 2-8 years), 56 children with autism compared to 68 typically developing children with a novel visual statistical learning task on an iPad to determine whether individual variability in statistical learning was associated with autism symptoms. Averaged together, children with autism demonstrated less learning on the task compared to typically developing children. However, multivariate classification analyses, which characterized individual behavior patterns, demonstrated a subset of children with autism had similar learning patterns to typically developing children and that subset of children had less severe autism symptoms. Children with autism and typically developing children with higher verbal abilities demonstrated superior statistical learning abilities. Together, findings suggest that statistically averaging data resulted in missing critical heterogeneity. Variability in statistical learning may help to understand differences in symptoms across individuals with autism. The results have significant clinical implications for identifying distinct learning patterns in young children with autism that could be used to tailor and inform treatment decisions.

1-L-85 Concordance of self- and collateral-reported ADHD symptoms, anger-irritability, and impairment in a study of neural correlates of adult outcome for children with ADHD

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In a study of adult brain structure and function following childhood Attention-Deficit/Hyperactivity Disorder (MH101086), an optimal method for characterizing current symptoms was needed. Little research has addressed after childhood the problem of symptom under-reporting known to characterize ADHD. To address this problem, the current study compared self- and collateral informant-report of symptoms and impairment. Participants (n=99, 89% male) were from the Pittsburgh ADHD Longitudinal Study. Ages were 27-43, M(SD)=33.4(3.5). ADHD symptoms in adulthood were assessed with the BAARS-IV (Barkley, 2011) and included subscales of inattention (9 items), impulsivity/hyperactivity (9 items), and ODD (3 items assessed anger/irritability). Impairment was from the IRS (Fabiano et al., 2008). Informant report was mostly parents (91%). Self-report was significantly lower than collateral-report for mean scores of inattention (self: M(SD)=0.57(0.52); collateral: M(SD)=0.80(0.72); t=-2.86(97), p<.01), anger/irritability (self: M(SD)=0.63(0.54); collateral: M(SD)=1.00(0.93); t=-3.76(98), p<.001), and impairment (self: M(SD)=1.41(1.50); collateral: M(SD)=2.41(2.16); t=-4.34(97), p<.001). Symptom severity scores and impairment would be .69-.74 SD lower if collateral report was unavailable. We conclude, in relation to studying the structure and function of the brain, that collateral reports are important for assessing symptomatology and impairment in the fourth decade of life. Relying only on self-reported ADHD symptoms could lead to underestimating symptom severity and impairment.

1-L-86 The behavioural phenotype associated with mutations in STXBP1

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A genetic diagnosis is now possible for an increasing number of individuals with intellectual disability (ID). STXBP1 is a presynaptic gene that plays a key role in the release of neurotransmitters. It is predominantly expressed in the brain and is one of several genes identified as rare, monogenic causes of ID. However, it is not yet known if STXBP1 is associated with a specific behavioural phenotype. To address this, we report a systematic, nationwide study of the medical, developmental, and behavioural characteristics of 14 individuals with de novo mutations in STXBP1. To investigate the presence of specific behavioural characteristics associated with STXBP1, participants were compared to 47 individuals with pathogenic mutations in other ID-causing genes, from the Brain and Behaviour in Intellectual Disability of known Genetic Origin (BINGO) study cohort. Non-parametric and parametric analysis were applied to the data, where appropriate. Phenotypic features include; neonatal feeding issues, sensory problems, motor, language and developmental delay ranging from moderate to profound. Thirteen out of fourteen participants had a history of seizures, which differed in age of onset, frequency, and severity. Increased social motivation, hyperactivity, impulsivity and disruptive behaviour differentiated the STXBP1 participants from the BINGO comparison group. Taking a gene-first approach has allowed us to generate new hypotheses about presynaptic physiology, learning, and aspects of behaviour control. This in turn can help to focus clinical assessment and intervention.

1-L-87 Development of mixed-strategy decision making in adolescents with and without borderline personality disorder

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We conducted a cross-sectional study investigating decision-making in healthy adolescents and outpatient psychiatric adolescents with borderline personality disorder traits (BPD). Choice impulsivity is a core feature of BPD, consistent with dysfunction of frontostriatal circuits. Mixed-strategy decision-making recruits frontostriatal networks, providing an ideal platform to probe developmental changes and identify factors contributing to functional outcomes. Participants competed in an oculomotor version of the mixed-strategy game, Matching Pennies, against a dynamic computer opponent that exploited predictabilities in choice patterns. The task required flexibly adapting strategies in response to changing reinforcements, and minimizing predictabilities in choice patterns. We used entropy measures to quantify the degree of randomness in choice sequences, and investigated how performance changed as a function of age, gender, impulsivity measures, and clinical indices of symptom severity in BPD. There was a significant difference between BPD and age- and gender- matched controls on the combined dependent variables affecting Matching Pennies performance after controlling for age, largely driven by decreased entropy (e.g., greater predictability in choice) in BPD. Age-related improvements in performance occurred across all groups, evidenced by increased reward rate, increased entropy, and decreased sensitivity to negative reinforcement. These findings could help identify biomarkers that predict functional outcomes and inform early intervention strategies for at-risk adolescents.

1-L-88 A subject-level approach to identify heterogeneous neural substrates of autism

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Background: Neurodevelopmental abnormalities in heterogeneous disorders such as autism spectrum disorders (ASD) are still poorly defined. Consequently, results are inconsistent and often fail to replicate across multiple studies. Method: As a solution, we propose a new method to capture individual variance in ASD using a novel distance-based machine learning method based on subject-specific attributes. Across 17 independent cohorts, our matching algorithm paired 100 individuals with ASD to 100 controls. A subset of the sample was held out as an out-of-sample test set, and the remaining data was used as a training set to obtain optimal cross-validated model weights. Model fits were evaluated against a null distribution of 5,000 permutations. Results: Based on within-pair Euclidean distances computed for symptom severity measures and Freesurfer cortical thickness and surface area measures on T1-weighted MRI, nineteen cortical thickness and ten surface area model-selected features were associated with variation in ASD symptom severity at the individual level. The approach was further validated in an independent cohort. Conclusion: Overall findings suggest that selected features are core abnormalities in ASD and implicate regions of the default mode and salience networks. The robustness of these new findings is critical progress in the reliable identification of neuroanatomical abnormalities in autism. We argue that modelling subject-level variation in the neural correlates of symptom severity is key to understanding heterogeneous neurodevelopmental disorders.

1-L-89 Can we build a neuromarker of behaviorial regulation in children with and without ASD?

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Background: Children with ASD show elevated scores in behavioral (dys-)regulation (BR), which associate with daily-life challenges and an increased risk for psychiatric comorbidities. While prior work implicates prefrontal and limbic areas in BR, aspects of BR such as inhibition and emotion control are multi-faceted and likely involve widely distributed brain connectivity. However, these connectivity patterns have yet to be described. Hypotheses: 1. We hypothesize that functional connectivity models of BR can be built in children with and without ASD ('neuromarkers'), and used to successfully predict BR scores in an unseen sample of children with and without ASD. 2. We hypothesize that BR subscales associate with both shared and distinct neural pathways. Preprocessing and Analysis Plans: A sample from the ABIDE II database, GU (46 TD, 37 ASD children, age range 8-13 years), will have rsfMRI data of ~5min length cleaned with ICA-AROMA and GSR. Connectome-predictive modelling (Shen et al., Nat Prot 2017) will be used to build models that relate to the BRIEF BR scales: inhibiting, shifting, and emotion control, across TD children and children with ASD. The predictive value within this sample will be assessed via leave-one out validation. These neuromarkers for BR will then be used to predict scores in another, age-matched sample from the ABIDE II database, KK (155 TD, 55 ASD children). Finally, conjunction and disjunction maps for the predictive models will be computed to assess common and distinct pathways between the three BR aspects.

1-L-90 Brain morphology and resting-state connectivity in paediatric cancer survivors

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Paediatric cancer and its treatment pose a major threat to ongoing brain development with implications on both, regional brain volume and widespread functional networks. In the present study, we use a multi-modal approach, including voxel-based morphometry (VBM) and resting-state functional connectivity (rs-fMRI) for an evaluation of the neural characteristics of former non-CNS cancer patients. 23 children and adolescents (Off-therapy ¡Ý 1-year; mean age: 11.44 years) and 34 healthy controls (mean age: 11.52 years) were included. High-resolution T1-weighted magnetic resonance (MR) structural and rs-fMRI imaging was applied. We conducted brain tissue segmentation using VBM (CAT12 Toolbox) to assess grey and white matter volume, and independent component analysis (ICA) to examine functional brain networks at rest. Next, we used seed-based analyses (CONN Toolbox) to investigate whether altered structural regions show a modified pattern of functional connectivity. The VBM analysis revealed reduced grey matter volumes of bilateral accumbens, caudate, hippocampi and amygdalae in former patients. Overall, the rs-fMRI analysis showed no difference in functional networks between groups. However, the seed-based analysis revealed increased functional connectivity in former patients between the left caudate and the cingulate gyrus and precuneus, and between the vermis and the bilateral occipital cortex, the temporal fusiform cortex, and the left superior parietal lobule. The

observed hyperconnectivity in former patients suggests mechanisms in cancer survivors without CNS involvement.

1-M-92 Detection of novelty in infants from low-SES backgrounds: A functional near-infrared spectroscopy study

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Functional Near-Infrared Spectroscopy (fNIRS) is a brain imaging method that measures oxygenated and deoxygenated hemoglobin and blood flow patterns in the brain. Some research has used fNIRS to measure cognitive processes in infants. However, there is limited fNIRS research with socio-economically and ethnically diverse samples of infant participants. To address this gap in the literature, we investigated hemodynamic activation during a habituation-dishabituation task in Hispanic/Latino/a infants from low-SES backgrounds. Here, we tested the hypothesis that infants will demonstrate an increase in hemodynamic response in frontal brain regions to novel stimulus presentations. We recruited 53 parents and their 9-month old infants to participate in this study. The paradigm included a habituation phase in which infants were presented with a series of identical face stimuli and a dishabituation phase during which infants were presented with novel face stimuli alternated with the familiar face stimuli. fNIRS data was acquired during the habituation and dishabituation phase from frontal, temporal, and occipital regions. Results indicate that infants demonstrated increases in oxygenated hemoglobin activity between novel and familiar stimuli. Furthermore, there was a larger increase in oxygenated hemoglobin in the prefrontal regions relative to occipital and temporal regions. This study suggests that frontal activation is involved in novelty detection early in life and highlights the feasibility of using fNIRS to study neurocognitive development in high-risk infant populations.

1-M-93 Development of sensory competition in the visual cortex: An fMRI study in school-aged children

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The visual system is constantly bombarded with too much information to process at once. When multiple stimuli are present at the same time, they are not processed independently, but interact with one another to compete for representation in the visual system (Desimone and Duncan, 1995). Here, we investigated how such sensory interactions occur in the visual cortex of adults and children (age 6 to 12) by using fMRI in the conceptual framework of biased competition theory. The amount of sensory competition was measured by comparing BOLD responses to multiple stimuli presented either simultaneously or sequentially in the periphery of the visual field. The spatial distance between the objects was also varied in order to modulate the amount of sensory competition as a function of receptive field (RF) architecture across the visual system. In adult participants, competitive interactions were scaled to RF sizes across the visual processing hierarchy, thereby corroborating previous findings. In contrast, in children, we found sensory competition effects in extrastriate areas beyond the RFs. These results suggest that, unlike adults, suppressive interactions from the extra-RF surrounds may contribute during development to mediate competition interactions among multiple objects that are simultaneously presented. Since selective attention operates on competitive interactions to filter out distracter information in the adult brain, this filtering mechanism may be implemented quite differently in the developing brain.

1-M-94 Positive reinforcement modulates fronto-limbic systems subserving emotional interference in adolescents

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Fronto-limbic systems play an important role in supporting resistance to emotional distraction to promote goal-directed behavior. The current study examined the functioning of these systems in adolescents and whether positive reinforcement could play a modulatory role in ways that could promote resistance to emotional distraction. Fifty healthy adolescents (age 10-13) completed an emotional delayed working memory fMRI paradigm with emotional distracters (none, neutral, negative) while positive reinforcement (monetary reward) was provided for correct responses under some conditions. Adolescents showed reduced behavioral performance to negative distracters and greater activation in right amygdala, and prefrontal cortical (PFC) regions (subgenual anterior cingulate, ventromedial, dorsomedial, ventrolateral) on correct trials with negative distracters. Activation in the ventrolateral PFC was more responsive to distracters, which is consistent with its proposed role in facilitating the effective coping with the presence of emotional distraction. Positive reinforcement improved behavioral performance and counteracted the effects of negative distracters as evidenced by significant reductions in activation in the amygdala, dorsomedial PFC, and ventrolateral PFC. Overall, lower amygdala activation was associated with improved behavioral performance under positive reinforcement. Findings extend results on emotional interference from adults to adolescents and demonstrate that positive reinforcement could be used to potentially promote insulation from emotional distraction.

1-M-95 Feature integration across the dorsal and ventral streams in childhood

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[1]Brown University

Introduction. Here we used a visual search paradigm that manipulates the demands on dorsal-ventral visual stream interactions (Heindel, Festa et al., 2009) to examine the relationship between selective attention and feature integration in childhood. Methods. Children (N=99; 4-10 yrs) searched for a vertically moving circle target among vertically and horizontally moving distractors of varying set sizes. Targets and distractors required either motion-luminance (dorsal pathway) or motion-color feature integration (dorsal-ventral pathway interaction). Results. At baseline, younger children were better at detecting luminance relative to color moving targets, and this feature integration effect diminished with age ($F=4.609$ $p=.03$). Moreover, children were also worse at detecting luminance targets among distractors, relative to color targets among distractors ($F=6.874$, $p=.01$), and this effect was driven by younger children ($F=3.834$, $p=.05$). Conclusion. Feature integration within the dorsal pathway (motion-luminance) develops earlier than feature integration that requires connections between the dorsal and ventral visual pathways (motion-color). Visual search for moving targets was impacted by developmental differences in inefficient baseline color-motion binding.

1-M-97 Rule learning supports the development of attentional biases in 9-month-old infants

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[1]Brown University

Rationale: We recently showed that 8-month-olds use the prefrontal cortex (PFC) to learn abstract rules for action, and that they flexibly update these rules into working memory depending on contextual demands (Werchan et al, 2015, 2016). The impact of the formation of these higher-order working memory representations on subsequent downstream cortical processing in infants is unknown. Method: Nine-month-olds (n=14) were presented with visual cue-reward pairs in a rule learning and generalization task. The cues varied by the visual features of Color and Shape, where Color consistently predicted the left-right spatial location of a cartoon reward (e.g., "Blue→Left", "Red→Right"), and Shape was irrelevant for learning. Infants' eye movement reaction times were recorded as an index of learning. Critically, infants' attentional bias to the visual features of Color and Shape were measured before and after rule learning. Results: Infants learned the abstract rule, as demonstrated by decreases in eye movement reaction times with trial exposure, $F(3,39)=3.15$, $p=.036$. Moreover, infants generalized this abstract color rule to novel shapes, as shown by faster reaction times in generalization relative to learning, $t(13)=2.27$, $p=.041$. Critically, we found that the efficacy of rule learning was correlated with the change in infants' attentional bias to Color, $r(14)=.813$, $p=.001$. Our results thus indicate that learning abstract rules shapes infants' visual processing and attentional biases to relevant information in a novel visual context.

1-N-98 No evidence that foreign language learning in older age improves cognitive ability: A randomized controlled trial

Rasmus Berggren[1], Jonna Nilsson[1], Martin Lövdén[1]

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Researchers have proposed that learning a foreign language in older age is a promising avenue for combatting age-related cognitive decline. We set out to test this hypothesis with a randomized controlled trial in a sample of 160 healthy older participants (ages 65-75) who were randomized to either 11-weeks of language learning or 11-weeks of relaxation training. Differences between groups in improvements on latent factors of verbal intelligence, spatial intelligence, working memory, item memory, or associative memory were small and not statistically significant. We argue that this finding is not due to either poor measurement, low course intensity, or low statistical power, but rather that language learning in older age is likely to have no or negligible effects on cognitive ability. We place this in the context of the cognitive training literature and conclude that while skill acquisition expands the behavioral repertoire it does little to improve cognitive processing ability.

1-N-99 A naturalistic home observational approach to pre-schoolers' language, cognition, and behaviour

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Early life home language input and parenting are critical for children's development, yet large home observation studies of both domains are scarce. We used digital audio-recorders to unobtrusively observe 107 pre-schoolers, who were aged 24 to 48 months (M = 32, SD = 6.5), and their families over 3 days (M = 15.06 hours per day, SD = 1.87) to test associations between home language input and parenting with pre-schoolers' language, cognitive abilities and behaviors. The recording software estimated the number of words a child heard per day. In addition, we transcribed six 5-minute excerpts per family (i.e. 30 minutes overall) to extract estimates of children's and parents' lexical diversity, positive and critical parenting, and children's internalizing and externalizing behaviors. We found that home language input (i.e. number of words and lexical diversity) was positively associated with children's cognitive ability and lexical diversity. In addition, we observed that home language input varied as much within as between families across days (intra-class correlation = .48). Parenting predicted children's behavioral outcomes but was not related to their cognitive or lexical ability. Overall our findings suggest that home language input affects child development in cognition and language, while parenting informs their behavioral development. Furthermore, we demonstrated that digital audio-recordings are useful tools for home observation studies that seek to disentangle the complex relationships between early life home environments and child development.

1-N-100 No bilingual advantage for executive function: Evidence from a large sample of children in the Adolescent Brain and Cognitive Development (ABCD) study.

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Learning a second language in childhood is inherently advantageous for communication. However, parents, educators, and scientists have been interested in determining whether there are costs associated with being bilingual, and also whether there are actually additional cognitive advantages. Learning a second language may have costs. For example, the quantity and quality of exposure to each language may differ, and this may affect vocabulary development in each language. Learning a second language may also have additional benefits. In fact, one of the most exciting and at the same time controversial findings is the reported bilingual advantage for the so-called executive functions (EF), e.g., skills like attention, ignoring irrelevant information, task switching, and resolving conflict that are central to the voluntary control of thoughts and behaviors. Although a number of small-sample studies have reported a bilingual EF advantage, there have been some failures to replicate, and recent meta-analyses have called into question the reliability of the original empirical claims. Here we show, in a very large sample (n = 4524) of 9-10-year-olds from a demographically representative sample across the United States, that there is no evidence for a bilingual EF advantage. We further show that previously-reported deficiencies in English vocabulary in bilinguals are substantially mitigated or eliminated when controlling

for demographics. Learning a second language in childhood engenders no EF benefit, and also produces no substantial cost to English vocabulary development.

1-N-101 The developmental trajectory of language and executive functions white matter tracts from infancy to early childhood: a diffusion tensor imaging study

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[1]Technion- Israel Institute of Technology

Background: Extensive improvements in executive functions and language abilities are accompanied with changes in the brain's gray and white matter during the first few years of life. Diffusion tensor imaging (DTI) provides a unique window into the pediatric brain anatomy and has provided critical information regarding white-matter development. The aim of the current study was to characterize the developmental trajectory of white matter tracts related to language and executive functions from infancy to 9 years in typically developing children. Methods: Diffusion tensor imaging data were acquired from seventy-four 17-107 months old typically developing children (mean=69 months; females=39). Effects of hemisphere and age on diffusion properties (mean diffusivity, radial diffusivity, axial diffusivity and fractional anisotropy) were measured at 99 points along the length of white matter tracts related to executive functions and language processing including the Cingulum Bundle (CB), Superior Longitudinal Fasciculus (SLF), Inferior Longitudinal Fasciculus (ILF), Inferior Fronto-Occipital Fasciculus (IFOF) and Arcuate Fasciculus. Results: Diffusion properties exhibit variability along the length of the tracts with hemispheric differences along development. Furthermore, stronger correlation between age and diffusion properties were pronounced in the left vs the right hemisphere especially for tracts related to language processing. Conclusions: Our results provide a detailed examination of the effect of age and hemisphere on diffusion properties of white matter tracts related to l

1-N-103 Effect of executive-functions triggering with dialogic reading on language processing in children

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Background: Frequent shared reading leads to better language and executive functions (EF) abilities. Dialogic reading (DR) is a well-validated shared-storybook reading intervention. The aim of this study was to examine the effect of DR compared to screen-exposed intervention on EF abilities and language processing using behavioral and EEG measures. Methods: Thirty-eight preschoolers participated in the current study and were assigned to two intervention groups: DR group and screen-based group. We examined the effect of DR intervention on EF and language processing using the Attention Network Task (ANT) and narrative comprehension tasks during an EEG examination and compared the DR group results to those of the screen-based group. Results: The DR group showed higher scores in EF and language tasks, but lesser working memory abilities compared to the screen-based group. During the ANT paradigm, greater accuracy rates, shorter reaction times, and a smaller gap between N200 and P300 amplitudes were found for the DR group compared to the screen-based group. The DR group also demonstrated increased occipital alpha waveforms compared to the screen-based group, which was correlated with better narrative comprehension scores. Conclusions: Based on our results, we suggest DR intervention in preschool-age children as an effective program for improving EF abilities and language processing.

1-O-103 Desikan-Killiany-Tourville atlas compatible version of M-CRIB neonatal parcellated brain atlas: The M-CRIB 2.0

Bonnie Alexander[1], Wai Yen Loh[1], Lillian Matthews[2], Andrea Murray[1], Chris Adamson[1], Richard Beare[1], Jian Chen[1], Claire Kelly[1], Peter Anderson[1], Lex Doyle[1], Alicia Spittle[1], Jeanie Cheong[1], Marc Seal[1], Deanne Thompson[1]

[1]Murdoch Children's Research Institute, [2]Harvard Medical School

Introduction: We recently published the M-CRIB atlas, comprising 100 neonatal brain regions including 68 compatible with the Desikan-Killiany (DK; 2006) adult cortical atlas. A successor to the DK is the Desikan-Killiany-Tourville (DKT; Klein, 2012) atlas, in which regions with unclear boundaries were removed, and many existing boundaries were revised to conform to sulcal fundi, more easily facilitating surface-based labeling such as is performed in FreeSurfer. Here we aimed to confer the same advantage in our M-CRIB 2.0 atlas, by modifying cortical regions to comply with the DKT protocol. Methods: Data were the T2-weighted MRI scans in our M-CRIB atlas, for ten healthy neonates (postmenstrual age at MRI 40-43 weeks, 4 female), and corresponding parcellated images. Edits were performed in volume space by one operator (BA) using ITK-SNAP. A new protocol was produced, replicating the boundaries of all DKT regions as closely as possible in this volumetric neonatal sample. Exact DKT boundary descriptors were used where possible, some M-CRIB descriptors retained, and some new descriptors included. The ten parcellated images were edited accordingly, including deletion of frontal and temporal poles and "banks sts", and updating of many other regions. Results and discussion: The M-CRIB 2.0 atlas comprises 94 regions: 62 updated cortical regions, and subcortical and cerebellar regions of the M-CRIB atlas. This atlas provides comparibility with adult DKT-labeled data, and will be more readily adaptable for potential incorporation into surface-based neonatal parcellation pipelines.

1-O-104 The teenage brain: Public perceptions of neurocognitive development during adolescence

Sibel Altikulaç[1], Nikki Lee[1], Chiel van der Veen[1], Ilona Benneker[2], Lydia Krabbendam[1], Nienke van Atteveldt[1]

[1]Vrije Universiteit Amsterdam, [2]Mencia de Mendozalyceum

Over the past decade, important insights about neurocognitive development during adolescence have been acquired. As these insights have raised much interest among the public, we investigated how communication of these scientific insights has shaped public perceptions of the 'teenage brain'. When asking free associations with the word 'teenage brain', adolescents (n = 363, Mage = 14.5 years) and parents (n = 164, Mage = 47.2 years) more often mention undesirable behaviors (e.g. "irresponsible") than desirable behaviors (e.g. "creative"). Despite these dominantly negative associations, priming adolescents with positively versus negatively framed statements about adolescent brain development did not influence their subsequently performed risk-taking, impulsivity and response-to-failure tasks. However, we did find a more nuanced effect of the priming statements: Adolescents' negative beliefs about adolescent brain development reinforces negative behavior by increased risk-taking behavior, and adolescents' positive beliefs reinforces positive behavior by using positive strategies to cope with academic setbacks. The current findings underline the impact of pre-existing worldviews which build up over time, and that these are not easily influenced by a one-time instance of information, but rather reinforce the impact of new information. To prevent negative perceptions of the 'teenage brain' from

becoming self-fulfilling prophecies, it is important that communication about adolescent neurocognitive development is framed in a more balanced way.

1-O-105 Investigating shared and nonshared factors contributing to variation in temperament development in MZ twins*

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Temperament is linked to many other aspects of our lives - educational achievement, mental health conditions, behavior regulation, peer relationships - therefore it's important to investigate how our environments impact this development. However the factors influencing temperament development are largely unknown. Recently, the importance of the nonshared environment on child neurodevelopment has become evident, with the research indicating that an individual's unique environment is important for temperament development. By combining temperament, environmental (such as the twin relationship, parental treatment, unique experiences), and MRI data, we can begin to evaluate how our temperaments/personalities develop and learn what factors are important in brain and temperament development. This study aims to investigate the shared and nonshared contributions of the brain and environment to variation in temperaments of MZ twins aged 9-15 years. Using a co-twin control design, we are collecting self-reported environmental data and MRI data of the brain - specifically structural and diffusion imaging data. We are interested how the properties of neural structures (e.g. gray and white matter volume, cortical thickness or surface area), and diffusion metrics (e.g. white matter microstructure and network connectivity) impact upon both the twin temperaments and variation in twin temperaments.

1-O-106 Functional integration of reward and social-cognitive brain systems during a real-time social interaction

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The reward experienced during social interaction may contribute to the development of social-cognitive abilities. Middle childhood (ages 8-12) is an ideal age to examine the relationship between social reward and social-cognitive processing since this is a time in which children's social interactive competence grows. However, no study has yet examined functional connectivity between reward and social-cognitive brain systems during a real time interaction. The current developmental fMRI study utilized an interactive chat paradigm in which participants (N=24) shared information about themselves (e.g., "I have a cat") with an age-matched peer who replied with either an engaged ("Me too!") or non-engaged response ("I'm away"). In the control condition responses were sent to a computer that randomly matched the participant's answer ("Matched!") or was unavailable ("Disconnected"). While all stimuli were prerecorded, participants believed that the peer was interacting with them in real time. We used the ventral striatum (VS)-a hub of reward processing-as a seed region for a whole brain gPPI analysis. Our results suggest that the VS is more functionally connected to the bilateral TPJ and precuneus-regions associated with social-cognitive processing-when engaging with a peer compared to the control computer trials. These results indicate a functional relationship between brain regions associated with reward and social-cognitive processing during a real-time interaction.

1-O-108 Sex differences in brain development are apparent in functional connections of the fetal brain

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Sex-related brain and behavioral differences are apparent across the life course, but the exact processes that guide their emergence remains a topic of vigorous scientific inquiry. A small number of studies report sex differences even before birth in fetal behavior and brain structure. However, sex-related differences in whole brain network connectivity during human prenatal development have yet to be examined. Here, we evaluate gestational age (GA)-related change in functional connectivity (FC) within and between neural networks, and investigate how these patterns differ between sexes. Using resting-state fMRI we examined neural FC in 118 human fetuses between 25.9 and 39.6 weeks GA, 70 male and 48 female. Infomap was applied to subject FC matrices to identify functionally discrete networks that were then evaluated using a consensus procedure that produced an optimal model comprised of 16 distinct fetal neural networks distributed throughout the cortex, subcortex, and cerebellar regions. Enrichment analyses assessed FC-GA correlations separately in each group, and Mcnemar's $\chi 2$ test identified where age-related change in network FC differed between males and females. We discovered that within and between network FC differs between sexes in utero. Specifically, associations between GA and posterior cingulate-temporal and fronto-cerebellar FC was observed in females only, whereas increased intracerebellar FC was correlated with greater GA in males more than females. These data confirm that sexual dimorphism in functional brain systems emerges during human gestation.

1-O-109 What characterizes adolescents who have difficulties with making academic choices? Relations with behavioral and neural correlates of self-concept and self-esteem

Laura van der Aar[1], Sabine Peters[1], Eveline Crone[1]

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An important challenge for adolescents is to make future-oriented academic choices that fit with their identity, such as choosing a major in higher education. However, educational decision-making is a complex process, and individual factors such as how adolescents think about - and evaluate themselves could complicate this process, possibly leading to a less than optimal decision. Here, we combined behavioral - and neural correlates of multiple self-concept measures to examine what characterizes adolescents who experience difficulties with making future-oriented academic choices. We included 38 adolescents (16 - 24y, M = 18,7y) who were at the start of participating in a training program named "the Gap year program". This program is developed for adolescents who have dropped out of higher education and focuses on increasing self-awareness and self-esteem. We compared these adolescents with a group of 46 peers (17 - 21y, M = 19,4y) who reported to already have successfully chosen a major. Behavioral results showed significant differences in multiple self-concept measures, with participants starting the Gap-Year program scoring lower on general self-esteem, self-concept clarity, and academic self-concept compared to adolescents who do not experience difficulties with academic choices. On a neural level, thinking about self was reflected in mPFC activity and this activity was heightened for individuals with more self-esteem. These results possibly suggest that healthy levels of self-esteem are an important condition for the ability to make future-oriented academic choices.

2-B-1 Prosocial and antisocial influence across adolescence

Saz Ahmed[1], Lucy Foulkes[2], Jovita Leung[1], Cait Griffin[1], Jenna Parker[3], Kirsty Griffiths[3], Darren Dunning[3], Tim Dalgleish[3], . MYRIAD, Sarah-Jayne Blakemore[1]

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Background and Aim Social influence occurs when an individual's thoughts or behaviours are affected by other people. Adolescents are particularly susceptible to social influence and previous studies have shown that this susceptibility decreases with age. The current study was designed to investigate whether there are differences in the impact of social influence on the reporting of prosocial (any act intended to help another person) and antisocial (any act intended to cause harm or distress to another person) behaviour across adolescence. Sample and Design Data collection of ~500 participants aged 11-16 is currently underway in schools in and around London and Cambridge in the United Kingdom. Participants complete a computerised task in which they rate how likely they would be to engage in a prosocial (e.g. "help a classmate with their schoolwork") or antisocial behaviour (e.g. "make fun of a classmate"). They are then shown the average rating (in fact fictitious) that other adolescents had given to the same question, and are then asked to rate the same behaviour again. Analysis plan A linear mixed-effects model, based on the model used by Foulkes, Leung, Fuhrmann, Knoll and Blakemore (2018) will be conducted to investigate the degree to which participants change their rating in the direction of others' ratings and whether this social-influence effect is dependent on the type of information (antisocial vs. prosocial) and the age of participants.

Day 2, Friday, August 31

2-B-2 Atypical neural correlates of social attention engagement in the pathway to autism social traits

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Although genetic risk factors possibly affecting brain development in Autism Spectrum Disorder (ASD) have been identified, little is known about the mechanisms leading to the emergence of behavioural symptoms. Early social attention disruptions have been proposed to be involved in the causal pathway to ASD social traits. We investigated whether neural correlates of social attention engagement in infancy predicted autism diagnosis and socialization skills at 3 years. Multichannel electroencephalography (EEG) while looking at faces was collected at 8 months from 67 low-risk infants (LR) and 145 infant siblings of children with ASD, considered at high familial risk for ASD (HR). HR infants were divided into three outcome groups defined at 36 months: 48 had typical development, 24 had atypical development but not ASD, and 19 developed ASD (HR-ASD). In line with previous studies, we found that the Nc ERP component was less enhanced in HR-ASD infants attending to faces with direct gaze. Differences in the spatio-temporal characteristics of scalp field topographies were observed between LR and HR-ASD infants. Specifically, shorter duration and higher global field power of the brain microstate corresponding to endogenous attention orienting to faces were predictive of worse social skills in HR-ASD children. Our results suggested that atypicalities in neural correlates of social attention are

associated with worse social outcome. This confirms that atypical social attention engagement is involved in the pathway for the development of ASD traits.

2-B-3 Age-related neural changes in the effects of emotional context on cognitive control

Orma Ravindranath[1], Sarah Ordaz[1], Aarthi Padmanabhan[1], Finnegan Calabro[1], Beatriz Luna[1]

[1]University of Pittsburgh

Emotion processing and cognitive control show marked development through adolescence, during which these systems have an enhanced effect on decision-making. Past fMRI studies have examined effects of emotional stimuli on task performance and neural activation, reflecting greater reactivity in adolescence. Here, we aimed to extend our understanding of the effects of emotion on cognition by investigating beyond event-related reactivity to how emotional states can affect cognitive control. We employed background connectivity, in which task-based signals are removed from fMRI data to examine background fluctuations in neural activity reflecting overall state. 46 14-31 year olds (23 females) completed an affective inhibitory control antisaccade task in a 3T scanner. Each trial included a positive, negative, or neutral sound playing before and during the trial, as well as silent control trials. Outside the scanner, subjects rated the valence and arousal of all sounds on a Likert-type scale. Across subjects, accuracy improved with increasing age within negative sound trials only. Negative sounds were also perceived as more "arousing" in adults as compared to adolescents. Using an amygdala seed to examine whole-brain background connectivity, results showed age-related strengthening of connectivity between the left amygdala and cognitive regions including the precuneus, frontal pole, and dorsal anterior cingulate cortex. Taken together, results suggest that negative affect may undermine cognitive control in adolescence due to immature executive control over emotional processing.

2-B-4 Examining individual differences in trusting behavior using social network analysis

Hester Sijtsma[1], Nikki Lee[1], Marlieke van Kesteren[1], Nienke van Atteveldt[1], Lydia Krabbendam[1]

[1]Vrije Universiteit Amsterdam

During adolescence you learn who to trust and who not to trust, and to adapt your trusting behavior in response to behavior of others. Paradigms such as the trust game are used to gain insights in these processes. In the current fMRI study we examined in which situations adolescents adapt their trusting behavior, and with the use of social network analysis we investigated individual differences in adapting one's behavior. Twenty-nine adolescents (Mage=17.2, SD=0.5, 21 female) played two trust games in the MRI scanner. Prior to the task participants were primed that the partner in the one game was trustworthy, while the partner in the other game was untrustworthy. In reality both algorithms were equally trustworthy. Using multi-level analysis, behavioral results show that there is no change in trusting behavior in the trustworthy condition. In contrast, in the untrustworthy condition trusting behavior significantly increased throughout the game. Examining individual differences in the untrustworthy condition, it became clear that adolescents with a high friendship centrality started off with a high initial investment and, subsequently, show less growth in investments over time compared to participants with an average to low friendship centrality. This means individual differences in trusting behavior can be explained by the position in a social network in daily life. fMRI task effects and brain activation patterns in relation to social network position will be presented at the conference.

2-B-5 Medial prefrontal cortex supports identification of increasing threat in adolescents*

Sarah Tashjian[1], Adriana Galván[1]

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Facial expressions are one of the most salient cues from which we derive social information. During adolescence, cognitive skills that support evaluation of social threat improve due to ongoing neurobiological and socioemotional changes. We examined individual differences in neural activation as participants were presented with face images that morphed from not threatening to increasingly threatening. During functional magnetic resonance imaging (fMRI), 47 adolescents (21 male; MAge=15.87) made binary judgments (threatening or not threatening) for each face image presented in a series. The faces varied along established dimensions of threat (Oosterhof & Todorov, 2008) yielding stimuli ranging in threat valence from 1-7 (least to most threatening). Behavioral discrimination index scores were calculated for each participant representing that participant's tendency to classify faces as threatening or not during the task (threat bias). Participants demonstrated a linear increase in threat bias as faces morphed along the threat continuum, $p < .001$. Analyses using linear parametric modulation along the threat continuum identified significant activation in the medial prefrontal cortex (mPFC) to faces > baseline, $Z > 2.3$, $p < .05$, corrected. These findings demonstrate that the mPFC is sensitive to subtle variations in perceived threat during adolescence. Results expand our understanding of the neural systems related to threat judgments of ambiguous facial stimuli and extend previous research on the mPFC as a relevant hub of social information processing during adolescence.

2-B-6 Middle temporal activity during social cognition moderates the relationship between anxiety symptoms and peer victimization in mid- to late adolescent girls

Veronika Vilgis[1], Kate Keenan, Alison Hipwell, Erika Forbes, Amanda Guyer[1]

[1]University of California, Davis

Interpersonal stress theories postulate that anxious individuals may elicit behaviors from others that create stressful interactions. Social-cognitive skills are one factor that moderates the link between anxiety and adverse social experiences. Specifically, understanding others' emotions, intentions, and beliefs in social situations may buffer anxious youth from experiencing social problems such as peer victimization (PV). We tested the hypothesis that brain activity engaged when reflecting upon one's own emotional state in response to another's emotional state would moderate the relationship between anxiety and PV, whereby those with lower levels of brain activity in key social cognitive processing regions would experience greater subsequent PV if they also had high levels of anxiety. In contrast, higher activity in these neural regions, indicative of better social cognitive skills, would buffer anxious youth from PV. Participants were 119 girls from the Pittsburgh Girls Study-Emotion substudy who completed an emotional face processing fMRI task (age 16), and reported on anxiety symptoms (age 15) and experiences of PV (age 17). Middle temporal gyrus activity moderated anxiety and PV; girls with low versus moderate or high levels of middle temporal gyrus activity during social cognition experienced significantly greater levels of PV. Individual differences in the engagement of social-cognitive processing brain regions may contribute to advantageous and disadvantageous outcomes in adolescent girls.

2-C-7 Lifespan differences in the regulation of learning rates during sequential decisions with uncertainty

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Age-related differences in learning may arise through a combination of normative and counter-normative influences on learning. Here we test and extend this idea with a lifespan study using a task that requires sequential predictions of outcomes. This provides a continuous measure of the learning rate and allows delineating the factors that govern learning. These factors differed across the lifespan, with older adults showing evidence for underestimation of uncertainty, adolescents and children over-using value information, and children and older adults showing a strong tendency to repeat the same prediction across several trials (perseveration). In a follow-up experiment, we manipulated two factors to better understand this counter-normative tendency: 1) motivation, by providing differential incentives to update and 2) penalizing perseverative predictions, with a random shift of the initial prediction away from the previous prediction. While we found no evidence for an effect of the incentive-manipulation on perseveration, all age groups stopped perseverating in response to changes in the initial prediction. Nevertheless, there were still differences in learning performance between age groups. This may suggest that perseveration serves as a compensatory mechanism for deficits in the regulation of the learning rate according to normative influences. Together, our results indicate that age-related differences in learning are related to both normative and counter-normative factors and that the contribution of these factors is sensitive to the demands of the environment.

2-C-8 Age differences in the neural basis of explicit motor sequence learning

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Little is known about age differences in the engagement of areas like prefrontal cortex (PFC), supplementary motor area (SMA) and putamen during explicit motor sequence learning. Due to ongoing maturation of PFC during child development, it is an open question to what extent these regions support motor learning in children. This is particularly critical in the initial phases of learning when cognitive control demands are relatively high. In the present study, we investigate differences in the neural basis of explicit motor sequence learning between children (7-8 years, projected n=35) and adults (projected n=35). In an associative visuo-motor task, participants see four squares corresponding to four response buttons; via trial and error, participants learn several 4- to 8-element sequences by practicing them until they are performed without errors at least seventeen times. Behavioral pilot data support a distinction between an initial learning phase and a late automatized phase of explicit sequence learning. For both age groups, analysis of functional magnetic resonance imaging data will consist of a contrast between those two learning phases in predefined regions of interest. A group comparison between children and adults will be computed afterwards. We expect that in the initial learning phase children show higher putamen activity, whereas adults show higher PFC activity. We will examine how these activity differences affect SMA engagement in the late automatized phase in children and adults.
https://osf.io/ezrgc/?view_only=322756ae84f74ae7bcdb6c4a0b4be237

2-C-9 Characterizing patterns of variability related to strategy shifts in learning across development

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A common pattern observed across a wide range of cognitive tasks is that younger children tend to exhibit greater variability during learning, and this variability decreases with age. While widely acknowledged as a feature of development, the computational processes underlying such variability remain to be discovered, and its potential functions for learning remain poorly characterized. The goal of this study was to understand how precise measures of variability can elucidate developmental differences in the way we learn. We used an information integration categorization task (Ashby & Gott, 1988) with individuals ages 8-22 to assess variability in strategy use in learning across development. In our preliminary data we found that overall classification accuracy and reaction time improved with age. Using a computational model to determine strategy types and switches on a trial-by-trial basis (Hélie et al., 2017) we found that children used random and rule-based strategies whereas adolescents and some adults adopted more complex information integration strategies. Interestingly, adolescents outperformed adults in this task, having higher classification accuracy and adopting more complex strategies earlier on. We also found that children took longer before making their first strategy switch, and before settling on a final strategy. While variation in strategy use and duration differed with age, strategy switch frequency did not. Taken together these results uncover how specific measures of variability relate to classification learning across development.

2-C-10 Where you lead, I will follow: Observing older sibling risky behavior changes adolescent brain and behavior*

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OBJECTIVE: Older siblings can be a salient influence on adolescent risk-taking through deviancy training, a process through which risky behaviors are learned. Although sibling influence predicts adolescent risk-taking behavior above and beyond the effects of parents and peers, no study has examined the neural processes underlying social learning from older siblings on the neurobiology of adolescent risk-taking. METHODS: The sample included 40 families with a focal adolescent (Mage=12.19 years; 22 females) and an older sibling within 4 years of age (Mage=14.63 years; 18 females). Participants completed the Yellow Light Game, a risk-taking task adapted from the Stoplight Game, during fMRI. Older siblings completed the task first, which was recorded. The focal adolescent completed 4 scans: playing two rounds, observing their older sibling's recorded performanced, and playing a final round. RESULTS: After observing their older sibling's risk-taking performance, adolescent's risk-taking behavior became significantly more similar to their older sibling's risk-taking behavior, suggesting that social learning occurred. At the neural level, this social learning process occurred via increased activity in the ventromedial prefrontal cortex. CONCLUSION: This is the first study to show that adolescents socially learn to take risks from older siblings, at the level of behavior and brain, suggesting that social learning engages brain regions associated with valuation and decision-making.

2-C-11 Parental influences on discrimination learning

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The present research examined how parents influence prefrontal-subcortical development and associated discrimination learning in two ways. First, we examined how early caregiving shapes discrimination learning in childhood and adolescence. 46 youth (7-16 years) who were previously institutionalized (PI) in orphanage care and 43 comparison youth (7-16 years) completed a fMRI aversive learning task. Both groups discriminated between the CS+ and CS-, as evidenced by self-report and amygdala responses, but the PI group demonstrated stronger prefrontal-hippocampal connectivity. This age-atypical connectivity predicted less anxiety two years after testing among PI youth, suggesting an adversity-induced adaptation. Second, we tested how youth learn by observing their parents versus other adults. 33 typical youth (6-17 years) underwent fMRI scanning while watching their parent and a stranger completing a conditioning task. Participants were then directly presented with the CS+ and CS- to "test" for observational learning. Participants showed better learning for their parent than the stranger at test, as indicated by self-report and amygdala responses. Intriguingly, children whose parents reported higher trait anxiety drove this parental learning bias. The relationship between parent anxiety and learning was mediated by children's medial prefrontal-amygdala connectivity. Together, results show that parenting influences prefrontal-subcortical development and associated learning.

2-C-12 Neurocomputational mechanisms and development of prosocial learning across adolescence

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Prosocial behavior - voluntary social behaviors intended to benefit others - is important for social bonding and being liked by others. To behave prosocially, learning about the consequences of our actions for other people is crucial. An important period for the development of (pro)social behavior is adolescence, yet the development and underlying mechanisms of prosocial learning across adolescence are still unknown. In this functional neuroimaging study we assessed prosocial learning and its neural correlates across adolescence (ages 9-21; N=74; 52.7% female). Participants performed a two-choice probabilistic reinforcement learning task in which one stimulus was associated with a higher probability of reward. Outcomes resulted in monetary consequences for themselves (self condition), for an unknown other participant in the experiment who could not reciprocate (prosocial condition), or for no one. Using computational modeling we show that participants of all ages were able to learn to benefit someone else, but performed better when they could benefit themselves. Prediction errors (PEs) were coded in the striatum and ventral medial prefrontal cortex (vmPFC) across conditions. Only prosocial PE activation in the vmPFC was sensitive to age-related change and individual differences in prosocial learning performance. Learning for self, however, was most strongly related to striatal PE activation across all ages. Together, these results reveal insights into computational mechanisms of prosocial learning across development, and the salience of others on adolescents' learning.

2-D-13 Information about others' choices differentially influences adolescent and young adult decision making

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Recent studies have found increased risk taking under peer influence in adolescence. However, it is unclear what aspects in the social context influence adolescent decision-making. In this study we take a decision science approach to investigate 1) how information about others' choices influences decision making and 2) how peers differentially influence risky and ambiguous choices. Participants (N=99, age range 12-22) completed an economic choice task. Choice options were systematically varied on levels of risk and ambiguity. On each trial a safer choice (low variability in outcome) and a riskier choice (high variability in outcome) were presented. Participants made choices in three conditions: a social information condition in which they saw choices of peers, a non-social information condition in which they saw choices of a computer, and a solo condition. Results showed that participants' choices conform to the choices made by the peers, but not the computer. Furthermore, when peers chose the risky option, especially young adults (19-21 years) were more likely to also make a risky choice. However, adolescents (15-17 years) were more likely to follow safer choices made by the peer. We did not find evidence that peer influence was related to risk or ambiguity level of the gamble. These results show that peer influence on decision-making can both increase risky choices as well as increase safe choices and that the direction is dependent on the age. Furthermore, increased risk taking in the context of peers might be dependent on type of peer influence.

2-D-14 Using diffusion modeling and pupillometric measures to characterize incentive motivational effects on numerosity discrimination in teens and young adults

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The approximate number system (ANS) comprises processes for perceiving, representing and distinguishing numerosities. Its precision undergoes developmental changes and is predictive of school math achievements. Prior research has neither systematically investigated the effect of incentive motivation on the precision of the ANS nor the interplay of such effects with brain development. Here we aimed at (1) enhancing the precision of the ANS using incentive motivation, (2) determining the elementary processes underlying incentive motivation and (3) identifying developmental differences in such modulations. Young adults (age: M=24; n=22) and teens (age: M=14; n=18) performed a dot comparison task to decide which of two numerosities was larger. Incentive motivation was manipulated by a cue at the beginning of each trial, which indicated whether one could collect points for a correct answer to win vouchers at the end of the experiment. A drift diffusion model was used to characterize the decision process, alongside with measures of pupil size to identify developmental differences in neurotransmission during reward anticipation and reaction. First results demonstrate that incentive motivation raises caution and improves the precision of the ANS in both age groups. Further, increased pupil dilation during the incentive trials indicates reward prospect and elevated effort expenditure. This is in line with the incentive-saliency theory (Berridge & Robinsion, 1998) proposing that reward-related mesolimbic dopamine signals can enhance the saliency of stimuli for drawing attention.

2-D-15 Neural correlates of prosocial risk taking during late adolescence

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From adolescence to adulthood, youth increasingly incorporate friends' outcomes into their risky choices. In fact, a recent review suggests that, in some contexts, adolescents may actually be taking risks to help others, a phenomenon known as prosocial risk taking. In this study, we created an experimental paradigm to explicitly measure adolescents' behavior in the context of prosocial risk taking. During functional magnetic resonance imaging (fMRI), 41 late adolescents (18-19 years) completed the Balloon Analog Risk Task, which was adapted so that the outcomes (i.e., gains and losses) of risky decisions differentially affected themselves and their best friend. Behaviorally, adolescents were less willing to incur risks to benefit their best friend (prosocial risk taking) relative to themselves (selfish risk taking). However, differences in risk behavior between these conditions yielded similar levels of rewards in total, suggesting that higher risk taking for the self resulted in more negative (losses) relative to adaptive (gains) outcomes. At the neural level, we plan to employ whole-brain fMRI analyses to examine the neural correlates of risk-taking behavior on the selfish versus prosocial risk taking conditions. We hypothesize that recruitment of brain regions involved in reward-processing and social cognition will be related to individual differences in risk-taking behavior. Our preliminary results provide empirical support for the prosocial risk taking construct, such that positive consequences for close peers can buffer adolescent risk-taking behavior.

2-D-16 The impact of age and puberty on impulse control and sensation seeking in early adolescence in the ABCD study

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During adolescence, the ability to regulate behavior in affectively charged contexts is still maturing, related to dissociable developmental changes in sensation seeking (SS) and impulse control (IC). While SS might be more related to pubertal hormonal changes affecting subcortical reward-related processes, IC might be more related to age dependent frontoparietal control processes. We will examine the joint and independent effects of age and pubertal status on the developmental trajectories of SS and IC, in the first wave of the ABCD study, a US-nationally representative sample (n=4524, 9-10yo). In a first step, we will run cross-sectional analyses on baseline associations in early adolescence between developmental markers (age, self-reported pubertal development, and gonadal hormones in saliva), IC (performance and BOLD signal changes in the Stop Signal Task, and self-report on the UPPS-P Impulsive behaviour scale) and SS (using the Monetary Incentive Delay Task and self-report on the BIS/BAS scale). After identifying underlying components with exploratory factor analyses on questionnaires and tasks, we will run linear mixed effects regressions including age, pubertal status, sex, and task-relevant BOLD signal as predictors of behavioral markers of SS and IC. We hypothesize that SS and lC will exhibit distinct developmental trajectories, related to distinct neural structures. Early maturing reward sensitivity aspects of SS will be more strongly associated with pubertal development while later maturing cognitive aspects of IC will be more strongly associated with age.

2-D-17 Examining the effects of social-emotional contexts on rewarded antisaccade task performance

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Prominent theories of adolescent risk taking implicate asynchronous development in socio-emotional/reward and cognitive control brain systems. In such dual-systems models, the maturational gap between these systems is most prominent during adolescence, exposing this group to possible consequences of behaviors biased by salient rewards. However, less is known about how different social contexts/stressors affect the relation between reward processing and cognitive control. Here, we will present preliminary results of a within-subjects, cross sectional eye tracking study in which children (ages 7-10), adolescents (ages 11-16), and adults (ages 25-40) perform multiple runs of the rewarded antisaccade task under different social/emotional contexts. Participants will perform a standard version of the task as well as the following contexts: in collaboration with a virtual peer, after peer rejection, and during a social stressor (i.e., prior to Trier social stressor test). Behavioral data (correct response rates and reaction times) under these contexts will be presented, coupled with cardiac and electrodermal physiological measures monitoring arousal reactivity to the manipulations. We hypothesize that adolescents' performances will be most affected by context, particularly enhanced with social collaboration and reduced by social rejection, relative to children and adults. Our results from this experiment will be discussed in terms of their implications for within- and between-person differences in normative adolescent development and decision-making contributing to risk taking.

2-D-18 Medial PFC relates to age-related differences in observational reinforcement learning*

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Childhood is considered an important phase in life for social development and learning. An important type of social learning is observational learning (OL) that can be beneficial in addition to learning from own outcomes. OL is thought to occur through neurobiological learning signals signaling the difference between expected and observed outcomes. Until now, the developmental changes in these learning signals remain elusive. In a fMRI experiment we investigated the behavioral and neurobiological changes underlying individual and observational learning in thirty 8-10-year-olds and thirty18-20-year-olds using a probabilistic reward-based OL task. Results showed that learning was more optimal for both age groups in the OL (i.e., other's actions and outcomes observable) than the individual learning condition (i.e., neither other's actions nor their outcomes observable), although adults learned better in general. Reinforcement learning models were used to determine prediction-errors (PE's) to own and other's feedback. Model-based parametric fMRI analyses revealed that activity in the striatum and medial PFC predicts learning from observation and signals an observational PE particularly when other's outcomes are worse than expected. Moreover, children showed a less pronounced observational PE in the medial PFC, which mediated an age-related improvement in OL. Here, we thus reveal a computational mechanism driving OL across development. This framework suggests that regions involved in social cognition may help to beneficially incorporate other's outcomes for own behavior.

2-E-20 Brazil youth exposed to persistent poverty: Differential development of executive functions

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Assessments of executive functions and their development in varied global settings are limited. Institution-rearing can compromise cognitive development, but less is known about species-atypical rearing in contexts of persistent poverty (Bick & Nelson, 2016). The purpose of the current study is to describe the cognitive profile, including IQ, language, and executive functions, of children reared in a little studied global context, using a cross-sectional study design. In the sample (n=77; ages 6-11), the majority of households fall within the lowest income quintile in Brazil (Arnold, 2014). The maternal education of 69.2% of the sample ended during the primary years. IQ was estimated using two representative subtests of the WISC-III (cubes and vocabulary). EF was evaluated using CANTAB subtests, including working memory (Spatial Span -SSP); visual planning (Stockings of Cambridge-SOC); and set shifting and visual attention (Intra/Extra Dimensional -IED) (Luciana & Nelson, 2002). For IQ, 36.92% of the sample scored at least 1 SD below the norm. Two sample t-tests compared our CANTAB results to established norms at each age. On SSP, the sample performed significantly below the norms at ages 6 (p=0.001), 8 (p=0.002), and 9-10 (p=0.0003). On SOC, the sample performed significantly below the norm at ages 7 (p=0.002), 9-10 (p=0.006). On IED, the sample's performance was not different from the established norms. Our findings show children reared in extreme poverty have a differentiated cognitive profile than expected.

2-E-21 Effort versus trait praise differentially influence the neural response to negative feedback during a math task in adolescents

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Objective: Adaptively responding to a teacher's feedback is important for learning. Previous research has demonstrated that praising intelligence as a fixed trait can lead to less adaptive motivational and learning patterns, compared to praising someone's effort. Methods: Here, we used fMRI to investigate adolescent's (N= 34, 11 boys, mean age 16.7 yrs) neural processing of negative feedback during a math task, while manipulating task difficulty and praise context. After a correct response, half of the participants received trait praise ("you are smart!"), the other half received effort praise ("great effort!"). Negative feedback after an incorrect response was identical in both conditions. Results: fMRI analyses revealed between-group (i.e., praise context) effects for processing negative feedback: in several brain regions, including the anterior Medial Prefrontal Cortex (aMPFC) and dorsal striatum, activation to negative feedback was stronger in the trait-praise context vs. the effort-praise context. Higher aMPFC activity may suggest increased self-referential processing after mistakes in the context of being praised for a personal, fixed trait (being smart). Increased striatal activity may indicate differences in prediction error. Ongoing analyses are testing how these differences relate to task-performance during the two difficulty levels, and to the student's academic self-concept. Conclusions: Differential neural processing of negative feedback in the context of praising effort versus being smart underlines the importance of how feedback is provided.

2-F-22 Neural and behavioural impact of WM and self-regulation training in school-aged children

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Aim: previous work indicates the association between working memory (WM) performance, attention and impulsive behaviorsCognitive training programs may enhance the maturation of fronto-parietal networks underlying the age-related increase in cognitive control but their impact on the cognitive and academic dimensions have yet to be investigated. We conducted an fMRI study to investigate the neural and behavioural impact of a school-based WM training on attention and inhibition. Methods: 28 typically developing 7-8 year-old children performed an fMRI N-Back task (baseline: 0-1 back; WM: 2-3 back). The data were analysed using a repeated measures ANOVA 2x2 (group: WM training (N=14)/controls (N=12); task: baseline/WM). Results: The WM training group showed a higher number of correct responses and less commission errors during baseline, together with reduced variability of their responses in both task conditions relative to those of the control group, differences accompanied by significantly increased activation putamen, dlPFC, IFC/insula and anterior cingulate cortex. Furthermore, activation in the caudate/putamen was associated with less commission errors across all subjects. Activity in prefrontal and parietal cortex during the WM task was associated with attention, WM and inhibitory control measures at one-year follow up. Conclusion: The WM training showed a significant impact on behaviour and neural networks, which appear to be strongest for attention and inhibition processes, pre-requisite skills for working memory as well as many other high-level cognitive processes.

2-F-23 Stability and change over 2 years of time: ERP and behavioral correlates of memory retrieval

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The development of episodic memory retrieval in children is far from understood, as comparable behavioral performance can be based on distinct cognitive processes. Developmental progress based on the maturation of critical brain structures or on the gradual use of adult-like retrieval strategies results in larger variability in the cognitive processes underlying task performance in developmental populations, either between or within individuals. Hence, less consistent cognitive processes are presumably associated with smaller and less robust electrophysiological correlates. In a longitudinal study, we investigated the interplay between late-maturing cognitive control abilities guiding efficient memory search and episodic item and feature memory in children attending grade 2 (grade 4 at t2) and grade 5 (grade 7 at t2) and a group of young adults. Age was associated with a decrease in both reaction times and error rates for the cognitive control task, specifically for the most demanding conditions, whereas few age differences were observed with respect to memory performance. ERPs suggest partially distinct routes support task performance for each group. Between t1 and t2, individual waveforms were relatively stable, but differences in the timing and size of ERP components were evident within and between age groups, questioning standard analysis approaches. Hence, Principal Component Analyses were used to guide the selection of time-windows between age groups and time points, validating previously known components as well as identifying potentially relevant new ERP components.

2-F-24 The value of choice facilitates subsequent memory with age

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Control over one's environment is crucial for optimizing outcomes, and has myriad effects on cognition. In this study, we expand upon a recent finding that perceived agency enhances memory in adults. We are interested in how the mnemonic benefit of agency develops, and whether it depends upon the utility of agency in a given context. The present study tested children (ages 8-12), teenagers (ages 13-17), and adults (ages 18-25) in a within-subjects paradigm where we manipulated whether subjects had capacity for control over their environments. On each trial, subjects visited one of three galaxies with the goal of finding treasure. Half the time subjects had agency and could choose which of two planets in the galaxy to visit; in the other half, subjects lacked agency and the planet was chosen for them. The utility of agency varied by context. In one galaxy, the probability of finding treasure was equal for both planets. Thus, having agency was inconsequential. In the other two galaxies, treasure was more frequent in one planet and so having agency in those contexts had utility. Each time a planet is visited, the subject finds an object and learns if it is trash or treasure. We tested recognition memory for those objects after a 24-hour delay. We found that children had better memory overall than adults, but they were not influenced by agency. The mnemonic benefit of agency increased linearly over development, but only in contexts for which agency had utility. This finding suggests that the value of choice facilitates memory, and that this effect emerges over development.

2-F-25 Developmental recruitment of local prefrontal inhibitory circuitry during safety learning in mice

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Evidence in both humans and animals has indicated that adolescents are sensitive to threat, and that fear is easily acquired, generalized and retained during this developmental stage, consistent with a high prevalence of anxiety disorders. Our research aims to establish the mechanisms by which conditioned safety can be utilized in service of fear regulation, and to apply this in the context of adolescence. We have optimized a conditioned safety paradigm, where mice are exposed to a cue predicting the explicit absence of an aversive outcome. Over time, this cue develops 'safe' properties capable of modulating fear responding. Our findings suggest that exposure to a safety cue can augment the rate of adolescent extinction learning, inducing marked improvements relative to conventional methods. Age differences are also apparent when mice undergo subsequent counterconditioning of the safety cue. Our data indicate that the nature and strength of the representational 'fear' and 'safety' properties inherent to fear and safety cues differs by age. By utilizing techniques that assess brain circuit-specific activity in tandem with behavioral assays, we have also recently begun exploring the mechanism by which safety cues gate the expression of either fear or safety-related behaviors. Our results show an age-differentiated role of a targeted population of prefrontal interneurons for safety cue inhibition of fear. Our data provide evidence that heightened plasticity in the local prefrontal inhibitory system during adolescence may mediate a unique window for safety learning efficacy.

2-F-26 Developmental changes in the use of environmental statistics to strategically modulate memory

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Previous work has revealed that individuals demonstrate enhanced memory for information associated with explicit value signals at the time of learning. However, in the real world, such explicit signals are often absent. Instead, the value of remembering information depends on the structure of the environment. In this experiment, we examined whether individuals could infer the value of remembering information based on the frequency with which such information would be needed in the future and strategically modulate memory encoding accordingly. Specifically, we collected data from 30 children (7 - 12 years old), 30 adolescents (13 - 17 years old), and 30 adults (18 - 25 years old) as they completed three different tasks -- a task in which they learned the frequency with which information would be probed and the total number of points they could earn by remembering it, a task in which they learned the information itself, and a final test of memory for the information presented. Though participants across our age range demonstrated evidence of learning the frequency with which information would be probed, their ability to use this information to influence memory encoding varied. Specifically, we observed an age x IQ x frequency condition interaction effect on memory performance ($p = .04$), which indicated that only the participants in our sample who likely had the greatest capacity for cognitive control -- high-IQ adults -- were able to prioritize memory toward more useful information.

2-G-27 Neural mechanisms of stressor controllability across human development: Preliminary findings

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Animal research on stressor controllability (SC) has highlighted that exposure to controllable stress may sensitize frontostriatal-amygdala circuitry to promote more adaptive biobehavioral reactivity to subsequent stressors (Amat et al., 2006). Dynamic changes in frontostriatal-amygdala circuitry across human development suggest the importance of a neurodevelopmental approach to examining SC. As part of an ongoing study of SC following trauma across human development, the present study examined neural correlates of SC in young adults. Participants (n = 20; mean age = 21.75, range = 18-27 years) were randomized to controllable or uncontrollable stress conditions, and completed two SC tasks during fMRI acquisition. Relative to previous controllable stress exposure, previous uncontrollable stress exposure was associated with higher STG activation during subsequent uncontrollable stress, as well as higher mPFC and dACC activation during anticipation of the subsequent uncontrollable stress. Moreover, a whole brain searchlight classification analysis revealed that patterns of activity in the amygdala, dACC, striatum, anterior insula, and STG during subsequent uncontrollable stress exposure can be used to classify participants' previous group assignment to either controllable or uncontrollable stress with 85-96% accuracy. Findings suggest potential mechanisms by which exposure to uncontrollable stress affects neurobiological and perceptual responses to subsequent environmental stressors. Neuroimaging data from a broader developmental sample of 8-30-year-olds will be presented.

2-G-28 Exploring the effects of emotional enrichment on components of executive functions in children of varying socioeconomic status

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[1]Brown University

Rationale: We examined whether emotional and cognitive enrichment have differential effects on executive functions development and whether socioeconomic status (SES) shapes executive functions independent of home enrichment. Methods: Ninety-four 4- to 9-year-old children completed the Hearts & Flowers Executive Functions Task (Davidson et al., 2006). In the first Congruent block, children were told to press the button on the same side as a Heart icon. In the second Incongruent block, children were told to press the button on the opposite side of a Flower icon (inhibitory control). In the third Mixed rule switch block, children responded using both of the previous rules (working memory, task-switching). Each child's emotional and cognitive enrichment was measured using the Home-SF. Results & Conclusions: Children with high emotional enrichment performed better across all blocks than children with low emotional enrichment, $F(1, 92)=8.34$, $p=.005$, and this interacted with task blocks, $F(2, 184)=7.55$, $p=.001$. There were no effects of Cognitive enrichment. We next divided our sample into four groups (Low SES_High Enrichment N=18, High SES_High Enrichment N=13, Low SES_Low Enrichment N=16, High SES_Low Enrichment N=22). When emotional enrichment was low, there was no difference in performance by SES (all ps=ns). When emotional enrichment was high, there was no difference in task performance by SES (all ps=ns). Within SES, high enrichment groups outperformed low enrichment group on the mixed block ($p=.03$).

2-G-29 Trajectories of parental harshness across childhood predict corticolimbic reactivity to emotional facial expressions in adolescence

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Neural activation within the corticolimbic system is associated with multiple forms of psychopathology. Greater amygdala and lesser ACC activation to angry facial expressions may reflect less efficient top down regulation of subcortical limbic reactivity, thereby leading to the persistence of anxiety-related phenotypes. Environmental adversity contributes to corticolimbic functioning, though much of this research has focused on extreme sources of adversity (e.g., maltreatment) measured at single moments in time. The current study leverages longitudinal data from a population-based birth cohort of families oversampled for environmental risk to investigate the effects of trajectories of harsh parenting from ages 3 to 9 on corticolimbic reactivity to angry facial expressions at age 15. Using data from the national Fragile Families study (N=4,898), we used latent growth curve modeling to estimate an intercept and slope of harsh parenting, characterized by parent-reported physical aggression, from ages 3 to 9. Associations between the intercept (accounting for the slope) and the slope (accounting for the intercept) and corticolimbic reactivity at age 15 were assessed in a neuroimaging subsample of the Fragile Families study (N=162). Higher initial levels and increases in harsh parenting were uniquely associated with lesser amygdala and ACC reactivity to angry versus neutral faces, respectively. Additional analyses will include an examination of harsh parenting effects on task-based functional connectivity during the same implicit emotional faces matching task.

2-G-30 Maternal psychological stress during pregnancy is associated with neonatal amygdala functional connectivity and negative affect development over the first two years of life

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Maternal stress during pregnancy (i.e., pregnancy stress [PS]) is linked to increased risk of psychiatric disorders in offspring. Most studies consider the magnitude of PS. Less is known about how timing and change in PS over gestation (i.e., the trajectory) affect offspring development. This study examined the relationship of PS magnitude and trajectories to newborn amygdala resting state functional connectivity (rsFC) and negative affect development over the first two years of life. Maternal PS was assessed at each trimester and at 1 month postpartum with multiple questionnaires used to form a composite of PS (N=115). Newborn rsFC MRI was acquired at 1 month of age and infant negative affect was assessed serially over the first two years of life with a questionnaire. PS trajectories were created using a novel algorithm, the Functional Random Forest (FRF). The FRF identified 4 distinct PS trajectories. Several maternal PS trajectories were uniquely associated with infant outcomes after accounting for PS magnitude. A PS trajectory characterized by 3rd trimester peak stress predicted greater infant rsFC for amygdala to anterior insula (p=0.02) and amygdala to ventromedial prefrontal cortex (Am-vmPFC) connectivity (p=0.02). A maternal PS trajectory characterized by increasing rate of change over time predicted greater infant rsFC Am-vmPFC (p=0.03) as well as a more static pattern of negative affect development (p=0.04). These data highlight that the trajectory of PS may contribute to offspring brain and affective development beyond the contributions of overall stress level.

2-G-31 Does socioeconomic status impact executive functions similarly in computerized vs. naturalistic testing environments?

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Rationale: Socioeconomic status (SES) effects on executive functions (EF) are mediated by positive practices in a child's environment. It remains unclear whether these effects are laboratory context-specific or are context-independent. Children from higher SES families may have more opportunities to implement rule-guided action in structured settings (i.e. classes, digital technology etc.). These contextual practice effects may transfer to performance in traditional laboratory tasks, but not to ecologically-valid EF tasks. Prediction: SES will impact working memory (WM) to a greater extent in the computerized setting relative to the naturalistic setting. Methods: Eighty-seven 4-6-year-old children (N derived from power analysis) will participate in the repeated measures, two-session design. The task is a 1st and 2nd order WM updating task. The computerized and naturalistic tasks are analogous in WM demand and presented stimuli. The following demographic measures will be collected: income, parent education, parent occupation, BRIEF, HOME-SF, and technology use and structured environments questionnaires. Analysis plan: A GLM will be conducted with: WM condition (1st, 2nd order) and environment (computerized, naturalistic) as within-subjects variables; age and various demographic measures will be modeled as continuous.

2-G-32 Developing the ability to assess control over one's environment

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Control, or the ability to influence an environment through one's actions, is associated with myriad beneficial outcomes. By monitoring when an environment is controllable, one can adaptively leverage proactive behaviors to bring about motivationally significant outcomes. The assessment of control over one's environment has been studied in adults but is not well characterized across development. The present behavioral study will examine the extent to which individuals can distinguish situations in which they have control from those in which they don't. The target sample size for the study is 30 children (aged 8-12), 30 adolescents (aged 13-17), and 30 adults (aged 18-25). Prior to Flux, we aim to have half of the data collected and analyzed. Participants will perform a child-friendly adaptation of a task in which either one's actions determine the next state (the controllable condition), or subsequent states are independent of one's actions (the uncontrollable condition). Uncontrollable and controllable contexts will alternate covertly, requiring participants to dynamically adjust their estimate of control in order to make accurate predictions about the subsequent state. We hypothesize that the ability to detect control might rely on the development of frontostriatal circuitry, which has been implicated in assessing action-outcome contingencies. During adolescence, developmental refinement of this circuitry may promote proactive behaviors through increased sensitivity to the degree of control afforded in one's environment.

2-G-33 Neighborhood impoverishment relates to inhibitory control performance via inhibition-related brain activation

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Familial and contextual socioeconomic status (SES) during childhood predicts health, wealth, and wellbeing in adulthood. Research has indicated that one pathway through which low SES predicts poor outcomes is via its impact on inhibitory control (Hackman & Farah 2009, Moffitt et al. 2011). However, little is known about how neural functioning in inhibitory control regions might mediate SES-behavior relationships. Thus, the goal of the current study was to examine neural mediators of the link between SES and inhibitory control in a sample of twins living in impoverished neighborhoods. We also examined which components of SES (e.g. parental education, family income, neighborhood impoverishment) were most strongly related to brain and behavior. Data came from the Michigan Twins Neurogenetics Study (MTwiNS) and included 216 twins (age 7-18), half of whom were oversampled for neighborhood disadvantage. Results indicated that SES was related to variability in inferior frontal gyrus (IFG) activation during a child-friendly Go/No-Go task. Interestingly, though maternal education and family income were related to behavioral performance during Go/No-Go, only neighborhood impoverishment as measured by census data was related to IFG activation. A model accounting for twin status revealed an indirect path from greater neighborhood poverty to worse inhibitory control performance via less bilateral IFG activation. These results provide some of the first direct evidence that SES-related environments may undermine inhibitory control via their effect on the brain.

2-G-34 Impact of maternal childhood trauma on child behavioral problems: The role of child frontal alpha asymmetry

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Introduction: Maternal childhood maltreatment (MCM) has been associated with behavioral problems in the child. However, the underlying mechanisms are not well understood. This is the first study to identify the role of child frontal alpha asymmetry (FAA) on the association between MCM and child behavioral problems. Method: Mothers filled out the Childhood Trauma Questionnaire and Childhood Behavioral Checklist to assess MCM and child behavioral problems. We extracted FAA values from EEG time series data (M = 304.44 1-second bins, SD = 87.35) in 45 children (M = 4.8 years, SD = 0.26). Results: MCM was significantly associated with child behavioral problems, r = .39, p = .01. Additionally, FAA interacted with MCM on child behavioral problems, â = -4.26, t(24) = -2.57, p = .01. Children with lower FAA show more behavioral problems when exposed to MCM than children with higher FAA. Lower values of FAA indicate less relative left/more relative right frontal activation - an activation pattern related to negative emotions and avoidance behavior. Lastly, FAA did not mediate the effect of MCM and child behavioral problems and was not correlated with either MCM (r = .07, p = .64) nor child behavioral problems (r = -.23, p = .13). Conclusion: Results showed that FAA moderates, but not mediates, the association between MCM and child behavioral problems. Children with more relative right frontal activation are more at risk to develop behavioral problems when exposed to MCM. These results shed light on the role of the child's frontal asymmetry as a potential risk marker.

2-G-35 Recalling positive memories reduces cognitive and biological vulnerability to depression

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An estimated 50% of children and adolescents growing up worldwide experiences childhood adversity at some point in their young lives. Childhood adversity ranges from parental psychopathology, financial difficulties, bullying victimization to abuse and neglect, and negatively impacts learning, memory, emotion and cognition. Childhood adversity is a potent risk factor for psychopathology, potentially through sensitizing stress response system to later negative life events. Improved understanding of the factors that facilitate resilient responses to future stress is thus crucial in order to improve mental wellbeing in children and adolescents with a history of adversity. Here, we used path modelling to show that recalling more specific positive memories leads to lower morning cortisol and lower dysphoria over the course of one year in 14 year old adolescents with a history of adversity (N = 479). We also used moderated mediation to show that positive memory recall lowered later depressive symptoms through lowering self-devaluative thoughts, but only in response to new negative life events. Thus, we show that positive memory recall facilitates resilient responses to future stress through lowering negative self-cognitions in at-risk adolescents. Memory specificity is malleable, therefore our findings suggests that developing methods to improve positive memory specificity in at-risk adolescents may facilitate resilient response to future stress in adolescents with a history of childhood adversity.

2-H-36 Parenting-by-brain development interactions as predictors of adolescent depressive symptoms and well-being: Differential susceptibility or diathesis-stress?

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It is unclear how individual differences in parenting and brain development interact to influence adolescent mental health outcomes. This study examined interactions between structural brain development and observed maternal parenting behavior in the prediction of adolescent depressive symptoms and psychological well-being. Whether findings supported diathesis-stress or differential susceptibility frameworks was tested. Participants completed observed interactions with their mothers during early adolescence (age 13) and the frequency of positive and aggressive maternal behavior were coded. Adolescents also completed structural magnetic resonance imaging (MRI) scans at three time points: mean ages 13, 17 and 19. Regression models analyzed interactions between maternal behavior and longitudinal brain development in the prediction of late adolescent (age 19) outcomes. Indices designed to distinguish between diathesis-stress and differential susceptibility effects were employed. Results supported differential susceptibility, whereby less thinning of frontal regions was associated with higher well-being in the context of low levels of aggressive maternal behavior, and lower well-being in the context of high levels of aggressive maternal behavior. Findings suggest that reduced frontal cortical thinning during adolescence may underlie increased sensitivity to maternal aggressive behavior for better and worse and highlight the importance of investigating biological vulnerability versus sensitivity.

2-H-37 Differences in brain development in a high and low economic setting

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INTRODUCTION Through childhood the brain undergoes remarkable change in response to factors like prenatal maternal health, nutrition, sleep, stress, and environmental sanitation. These factors are also associated with physical stunting and wasting - failure to reach age-appropriate height and weight, which are surrogate markers for brain development. Here we compared brain, height, and weight development in children from Rhode Island (RI), USA and a low-resource rural setting in Uttar Pradesh (UP), India. METHODS 838 volumetric datasets were acquired on 486, 0-12.5year old RI children; spatially normalised; and whole-brain white and gray matter calculated. A 6:00 resting-state connectivity acquisition was also performed (TR=2.5ms, 144 volumes), and child height and weight measures were obtained at each scan. Matched data were acquired from UP on 77 children, 7-19 months of age. Quantile regression was used to calculate gender-specific 3rd, 16th, 50th, 84th and 97th percentile growth curves for the RI children with the UP children compared. Functional connectivity was also compared by gender. RESULTS UP children showed volumetric reductions (below 3rd percentile) despite having near-equivalent height. Weight was lower in UP children, and we found a significant relationship between brain volume and weight (p=0.02). Functional differences were found throughout the brain. Results reveal, for the first time, significant brain deficits absent physical stunting, with implication to interventional studies that use physical height to infer cognitive ability.

2-H-38 Volumetric development of the hippocampal sub-fields and hippocampal white matter connectivity: relationship with episodic memory

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The hippocampus is composed of distinct sub-fields: Cornu Ammonis areas 1-4 (CA1-CA4), dentate gyrus (DG), and subiculum, collectively known as the hippocampal formation (HPF). A number of studies that have examined volumetric changes throughout development, but few have explored the volumetric changes of the HPF from early childhood to early adulthood, and the relationship between volume and episodic memory (EM). It is well established that there are substantial volumetric changes within the hippocampus during the first four years of life. However, it is less clear as to whether these developmental trajectories continue into later childhood and beyond. Additionally, it remains unknown whether any changes in volume drive EM performance measured by the NIH Toolbox Picture Sequence Memory Task. Here we examined a large cross-sectional study investigating the volumetric development of the HPF in 830 subjects, aged between 3 and 21 years, from the publicly available Pediatric Imaging, Neurocognition, and Genetics (PING) (http://pingstudy.ucsd.edu) dataset. Using FreeSurfer v6.0 to automatically segment the hippocampus, and controlling for intra-cranial volume (ICV), we found non-linear developmental trajectories for the hippocampal sub-fields within the HPF, which continue to develop until the mid-teen years. Additionally, we found that left CA1, bilateral DG, bilateral hippocampal to cortical ratio, and right CA3, were all significantly related to EM. In summary, the data suggest that hippocampal sub-fields play a critical role in EM throughout development.

2-H-39 Prosocial behavior is linked to cortical development during adolescence and young adulthood: A longitudinal structural MRI study*

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How prosocial behavior relates to cortical development is a largely unstudied question. Prosociality relates to desirable developmental outcomes (e.g. peer acceptance), while lack of prosociality has been associated with several neurodevelopmental disorders (e.g. ADHD). Mapping the biological foundations of prosociality may thus aid understanding of both normal and abnormal development. Here, relations between prosociality, as measured by the Strengths and Difficulties Questionnaire (self-report), and changes in cortical thickness (CT) were examined using mixed-effects models (controlling for sex) in 169 healthy individuals (92 females) aged 12-26 with repeated MRI from up to 3 time points, at approximately 2-year intervals (301 scans). In right temporal cortices, right angular gyrus and frontal regions in both hemispheres, higher overall scores on prosociality (i.e. across time points) were associated with accelerated thinning at younger ages, followed by attenuation of this process at higher ages. Lower scores related to initially slower cortical thinning, which was followed by pronounced protracted thinning into the second decade of life. This study shows that prosociality is related to regional development of CT in adolescence and young adulthood. The results suggest that the rate of cortical thinning in these regions, as well as its timing, are key factors in the development of prosociality. The temporal characteristics of cortical maturation in these regions may also be implicated in the onset of neurodevelopmental disorders.

2-H-40 The neurocognitive architecture of fluid ability in children and adolescents*

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Objective: Fluid ability (gf) is the capacity to solve novel problems in the absence of task-specific knowledge. It is highly predictive of outcomes like educational attainment and psychopathology. Despite years of investigation, our understanding of how gf relates to other cognitive functions and brain structure remains limited. Here, we modeled the association between gf, working memory, processing speed, and white matter microstructure (fractional anisotropy) in two large, publicly available samples: CALM (N=551, aged 5-17) and NKI-RS (N=342, aged 6-17). Methods: We used multivariate Structural Equation Modeling (SEM) and SEM Trees to test a preregistered Watershed model of gf, which predicts a hierarchy of partially-independent effects: White matter is proposed to contribute to working memory capacity and processing speed, which, in turn, contribute to gf. Results: We found that the Watershed model fit the data well for both samples. White matter (particularly the superior longitudinal fasciculus), contributed to working memory and processing speed, which, in turn, contributed to gf (R2(CALM)=51.2%, R2(NKI-RS)=78.8%). SEM Trees showed that the relationship between cognitive abilities and white matter shows a dip in strength around ages 7-12. Speculatively, this age-effect may reflect a reorganization of the neurocognitive architecture in late childhood and early adolescence. Conclusion: These results highlight that gf is not a unitary construct. Instead, gf likely reflects a hierarchical, many-to-one mapping of partially independent neurocognitive building blocks.

2-H-41 Longitudinal development of white matter fibre density and morphology in the peri-pubertal period

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White matter undergoes significant development during the peri-pubertal period, by virtue of increasing axon diameter and myelination. In this study, we applied a novel longitudinal fixel-based analysis (FBA) framework, in order to estimate the longitudinal change in white matter fibre density (FD), which is proportional to intra-axonal volume, fibre cross-section (FC), and fibre density and cross section (FDC). Diffusion-weighted imaging (DWI) data were acquired for 60 typically developing children aged 9-13. Follow-up data were acquired approximately 16 months later. Whole brain FBA comparisons were performed to assess age, sex, and puberty relationships. A follow-up confirmatory analysis was performed using a Bayesian repeated measures approach. We observed a statistically significant increase in FD over time localised to the mid and posterior commissural and association fibres. We report no significant relationship between pubertal stage or progression, with this longitudinal fibre development, suggesting that all children studied were developing at the same rate. Follow-up Bayesian analyses supported the observed null effect of the longitudinal pubertal comparison. Using a novel longitudinal framework, we demonstrate widespread increases in fibre density, irrespective of age, sex, or pubertal progression. The observed increases might be reflected by increasing axon diameter or count. This in hand with previous work suggests that pubertal onset, rather than pubertal progression, may drive axonal development over and above age-related white matter development.

2-H-42 Structural brain network deficits in youth born prematurely

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Prematurity is associated with diverse developmental abnormalities, yet few studies relate cognitive and neurostructural deficits to a dimensional measure of prematurity. Leveraging a large sample of children, adolescents, and young adults (age 8-22 years) studied as part of the Philadelphia Neurodevelopmental Cohort, we examined how variation in gestational age impacted cognition and brain structure later in development. Participants included 72 preterm youth born before 37 weeks' gestation and 206 youth who were born at term (37 weeks or later). Using a previously-validated factor analysis, cognitive performance was assessed in three domains: 1) executive function and complex reasoning, 2) social cognition, and 3) episodic memory. All participants completed T1-weighted neuroimaging at 3T to measure brain volume. Structural covariance networks were delineated using non-negative matrix factorization, an advanced multivariate analysis technique. Lower gestational age was associated with both deficits in executive function and reduced volume within 11 of 26 structural covariance networks, which included orbitofrontal, temporal, and parietal cortices, as well as subcortical regions including the hippocampus. Notably, the relationship between lower gestational age and executive dysfunction was accounted for by structural network deficits. Together, these findings emphasize the durable impact of prematurity on cognition and brain structure, which persists across development.

2-H-43 The development of the neural basis of social interaction perception

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The ability to visually perceive two or more agents interacting is crucial for our understanding of the social world, yet few studies have investigated its neural basis. Previous work from our lab, and others, suggests the posterior superior temporal sulcus (pSTS) is crucially involved in this process in adulthood. The current research investigates how the neural response to visually observed social interactions, as compared to other social information, changes across development. We used fMRI to study the activity of the pSTS in a group of children (n=30, age 6-12 years) and young adults (n=30, age 18-35 years) while observing short videoclips of two interacting human point-light agents. We also used other social cognition and perception tasks to probe the response of the pSTS to other "social" stimuli and to identify other regions in the social brain such as regions selective for face and body perception (e.g., pSTS face area, EBA) and Theory of Mind function (e.g., TPJ). The results show less selectivity of neural response to social interactions of the pSTS in the children group as compared to the adults, suggesting the functional response to interactions is not fully developed in children. These results provide a better understanding of the development of social information processing and may be a starting point for further research investigating this system in adolescence and in disorders that cause atypical development of social information processing and affect individuals' ability to understand and engage in social interactions.

2-H-44 Relating individual differences in white matter pathways to children's arithmetic fluency: A spherical deconvolution study

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In this diffusion MRI (dMRI) study, we investigated associations of white matter and individual differences in children's arithmetic. To date, this had only been investigated through classic tensor modelling (DTI), which is subject to methodological limitations (i.e. estimating only one fiber per voxel, leading to an oversimplification of the underlying anatomy). To resolve this, we used spherical deconvolution, a complex non-tensor imaging method that can characterize the orientation of multiple fibers per voxel, allowing for a fine-grained characterization of the anatomy. Methods Participants were 48 typically developing 4th graders who went through dMRI scanning. All theoretically relevant tracts, associated to mathematics in previous studies, were manually delineated. The HMOA index, providing information on structural integrity, was then derived for each tract to perform correlational analyses (frequentist and Bayesian) with an assessment of arithmetic fluency. Results Our data revealed a strong association between the HMOA of the right inferior longitudinal fasciculus (ILF) and individual differences in arithmetic. Other previously found associations with arithmetic (e.g. arcuate fasciculus) could not be replicated. Conclusion This association of the ILF might reflect the efficiency to process Arabic numerals, or could be associated with the verbal representation of numbers, making it important for exact verbal arithmetic. Being the first to use spherical deconvolution in this field, this study also highlights the importance of dMRI research beyond classic DTI.

2-H-45 Maternal pregnancy-related anxiety is associated with sex-specific alterations in amygdala volume in four-year-old children

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Introduction: Prenatal stress may impact fetal brain development increasing susceptibility for psychiatric disorders in later life. Studies by Buss et al. (2012, 2010) showed that higher maternal cortisol levels and pregnancy-related anxiety in early gestation are associated with changes in brain structure in 6-to-9-year-olds, including significantly higher right amygdala volume in girls. We investigated the association between self-reported maternal pregnancy-related anxiety and children's brain structure. Methods: In 28 four-year-old children (13 female) we probed the association between maternal pregnancy-related anxiety (PRAQ-R2 questionnaire, second and third trimester) and brain gray matter volume, applying voxel based morphometry with an age-matched template in SPM. We conducted whole-brain full factorial (factor sex) and ROI (amygdala) analyses controlling for child's age and total intracranial volume, maternal depression, general anxiety, relevant medication, alcohol, nicotine and drug abuse. Results: In the whole sample no significant associations between maternal PRAQ-R2 scores and children's brain gray matter volume were observed. However, higher PRAQ-R2 scores were related to significantly higher right amygdala volume (ROI analysis) in girls, but no significant associations were found in boys. Discussion: Our results provide further support that maternal prenatal stress is associated with sex-specific amygdala volume alterations in the child.

2-H-46 Differential genetic and environmental influences on social brain structures and prosocial behavior

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Previous studies have shown that aspects of prosocial behavior are related to brain structure in adults, specifically for regions in the social brain network. However, little is known about the relationship between prosocial behavior and structure of the social brain in middle childhood, and to what extent this relationship heritable or environmentally influenced. We studied the relationship between prosocial behavior and social brain structures in a large twin-sample (N = 512, aged 7-9). We used a combination of the prosocial subscales of the Strengths and Difficulties Questionnaire and the My Child questionnaire as a measure of parent-reported prosocial behavior. In a sub-sample (N = 422) MRI scans were collected, and Freesurfer was used to extract estimates of surface area and cortical thickness for a-priori defined regions of interest (TPJ, mPFC, pSTS, precuneus). Our initial results show moderate to high influences of genetics on parent-reported prosocial behavior (ranging from 48-62%). In addition, we found stronger contributions of genetics to mPFC, pSTS and precuneus structure, and contributions of shared environment for TPJ morphometry. Estimation of the heritability of the relationship between prosocial behavior and social brain structure is in progress. To conclude, our findings show different heritability influences for regions in the social brain network, as well as genetic contributions to prosocial behavior. These findings lead to a better understanding of genetic and environmental influences on brain development in relation to prosocial behavior.

2-H-47 Altered developmental trajectories of stress physiology and subcortical neurobiology following early caregiving adversity

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Prior research has identified altered stress physiology and neurobiology following early adversity either in childhood or adolescence cross-sectional samples, often with conflicting results (e.g. hypo vs. hyper-cortisol; larger vs. smaller amygdala). In the current study, we use an accelerated longitudinal design to characterize trajectories of diurnal cortisol and subcortical brain development from early childhood to late adolescence following early institutional care. 227 subjects (140 comparisons, 87 Previously Institutionalized (PI]; ages 4-19) participated in 1-3 waves of diurnal cortisol collection and a sub-sample (N = 165 children; 94 comparisons, 72 PI youth) completed 1-3 MRI scans at two-year intervals. Using piecewise mixed-effects modeling, we identified non-linear age effects in diurnal cortisol within the PI group; such that in childhood, the PI group showed blunted waking cortisol, which changed to heightened waking cortisol during adolescence. Similarly, adversity-related amygdala phenotypes varied by age in the PI group, such that larger amygdala volumes were observed during childhood, which then switched to smaller amygdala volumes by adolescence. In contrast, the PI group had smaller hippocampal volumes relative to comparisons across development. Together, these data suggest that the neurodevelopmental sequela following early caregiving adversity is age-specific, with dynamic changes across childhood and adolescence.

2-I-48 The development of structure-function coupling in human brain networks during adolescence

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It remains imperative to elucidate developmental patterns of structure-function coupling in youth, as ongoing brain maturational processes underlying cognitive and behavioral development may enhance vulnerability to debilitating neuropsychiatric disorders. Here, we leverage resting-state functional connectivity (rs-FC) and diffusion-weighted imaging (DWI) data acquired as part of the Philadelphia Neurodevelopmental Cohort (n=909, ages 8-23 years). Structure-function coupling was measured by the Spearman correlation between regional structural and functional connectivity profiles. Age-related increases in structure-function coupling were observed primarily in the inferior parietal lobule (IPL), precuneus, posterior cingulate (PCC), and medial prefrontal cortex (PFC). Critically, higher structure-function coupling in the lateral PFC, PCC, and frontal eye fields was associated with higher accuracy on complex reasoning tasks from the Penn Computerized Cognitive Battery. Further, we leveraged a longitudinal sub-sample of 69 participants with follow-up neuroimaging approximately 1.5 years after baseline to demonstrate that longitudinal changes in structure-function coupling were significantly driven by changes in functional connectivity strength in the precuneus, IPL, and medial/dorsal PFC. Together, these findings delineate a novel dimension of adolescent brain development whereby regional patterns of structural and functional connectivity become increasingly coupled to support efficient information processing and complex reasoning ability.

2-I-50 Precision functional network mapping of a pediatric patient with a left thalamic lesion

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Functional brain networks estimated using high-fidelity resting-state functional connectivity (RSFC) data (several hours per individual) in healthy adults have shown these networks exhibit common organizational principles, as well as stable, reproducible individual features. It has been suggested that thalamic lesions disrupt cerebral cortical functional network organization due to anatomical and functional loops between the thalamus and cerebral cortex. We collected high-fidelity RSFC data (4.5 hours) on an individual child (11 years, female) with a unilateral thalamic lesion. The patient had a left thalamic arteriovenous malformation that ruptured at 7 years and was treated with gamma knife radiation, which led to delayed radiation injury and dense hemiparesis. Results demonstrated expected block network structure of strong within-network correlations and low between-network correlations. Comparing the patient's functional network organization to typically developing children with high-fidelity maps revealed organization that was largely preserved, in addition to individual-specific variants (e.g., absent ventral attention network). The retention of common functional network organization in a thalamic lesion patient suggests cortical networks are resilient to unilateral thalamic injury during childhood. More high-fidelity, individual functional connectomes in TD children and those with brain lesions are necessary to further examine the organization of typical and injured pediatric brains.

2-I-51 Functional connectivity of IPS predicts distance effects in symbolic fraction magnitude comparison task

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Although previous studies have shown a positive relationship between fronto-parietal functional connectivity and children's basic whole number skills (e.g., Emerson & Cantlon, 2012), similar questions have not been explored with fractions. We tested whether symbolic fractions skill depend on similar fronto-parietal networks, as predicted by recent theoretical accounts (Lewis, Matthews & Hubbard, 2015). We tested whether individual differences in resting-state functional connectivity between the intraparietal sulcus (IPS) and other number processing areas were related to fractions skills. Twenty-five typically developing 5th graders (10-11 y.o) participated in 10 minutes of resting-state (RS) scan and a fraction magnitude comparison task. Overall, participants were faster and more accurate with greater differences (distances) between fractions, but individual performance varied substantially. Stronger distance effects are typically treated as evidence of less precise number representations. We calculated RS-behavioral correlations using the left IPS as a seed and classic number regions as targets, including the inferior temporal gyrus (ITG), supramarginal gyrus (SMG), inferior (IFG) and superior frontal gyrus (SFG) and contralateral (R)IPS. We found that greater IPS connectivity predicted more precise representations of fraction magnitude in the behavioral task (ITG: r = -.59**; SFG: r = -.57*; right IPS: r = -.59***). Second graders performed the task at similar levels, but did not show the same patterns of connectivity or relationships between connectivity and behavior.

2-I-52 Precision functional mapping of an individual child brain*

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Recent studies collecting large quantities of resting state functional connectivity (RSFC) fMRI data (precision functional mapping) have discovered that functional brain networks are dominated by both common organizational principles across individuals, as well as stable individual-specific features, which are obfuscated in group-average studies. Importantly, standard 5-15 minute RSFC data acquisition results in low levels of reliability within individuals, obscuring these stable individual features. Thus, large group-average developmental studies collecting small quantities of data per individual cannot reveal stable individual features of RSFC development. To test feasibility of this precision functional mapping approach in children, and to elucidate similarities and differences in RSFC in development compared to adulthood, we collected 6 hours of RSFC data (12, 30-minute sessions; 3,10 minute runs per session) in a 9yr. old boy. The Midnight Scan Club (MSC) dataset was used as an adult benchmark (n=10 healthy adults, 5 hours of RSFC data per individual). We found reliable, adult-like functional brain networks in an individual child, as well as individual variants. Child RSFC shared common variability with adult RSFC, as well as measurable individual specificity. Accurate characterization of reliable individual RSFC is critical to furthering our understanding of the contribution of functional brain networks to typical and atypical cognitive development.

2-I-54 Resting-state functional networks are impacted by ethanol self-administration in the rhesus macaque

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Alcohol is one of the leading preventable causes of death; yet, how alcohol affects the interactions of large-scale brain systems is largely unknown. Resting-state functional MRI is often used to characterize brain organization on a regional or network basis. Differences in functional network configurations can be attributed to individual or population differences associated with a predisposition to or a consequence of various disorders. The current study aims to investigate the functional network organization in sex-matched rhesus macaques before and after undergoing 6-months of a well characterized ethanol self-administration procedure.. Using a published parcellation, scans were investigated on a network level using a two factor repeated measures analysis of variance with time (pre and post ethanol) and group (drinkers and controls) as factors. We aimed to gain insight into how network communication would be impacted by ethanol intake. Our findings indicated that connectivity within the limbic network and limbic-somatomotor connectivity were most significantly impacted by ethanol intake. Interaction effects indicated that drinkers were more likely to have increased connectivity within the limbic network, but decreased connectivity between the limbic and somatomotor networks. Alcohol is known to influence sensory motor systems, as well as key aspects of the limbic system e.g. emotional processing, reward and memory. These findings give insight into an imbalance in network relationships that may be studied in future translational alcohol research throughout development

2-I-55 Thalamocortical networks and their relation to cognitive outcome in pediatric stroke patients

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Background: Paediatric arterial ischemic stroke (AIS) often induces widespread changes in functional connectivity (FC) networks which have extensive connections with the thalamus. These changes in thalamocortical connections are sought to influence cognitive performance. Participants: Children and adolescents who suffered from AIS before the age of 16 years were recruited from the Swiss Neuropediatric Stroke Registry. Exclusion criteria were active epilepsy, neurological disorder not attributable to stroke and behavioral problems. A final sample of 28 patients (aged 5-23, mean 14.6 years) and 50 age- and gender-matched healthy controls were examined. Experimental design: Cognitive performance was assessed using neuropsychological tests (IQ, executive functions, learning, memory). Furthermore, high-resolution T1-weighted MR structural images and rsfMRI were recorded. Anatomical and functional preprocessing is going to be performed using SPM12. Group-level differences in FC will be obtained using voxel to voxel analyses of the thalamocortical network, which will be further analyzed in relation to cognitive measures. Hypotheses: The aim is to assess the reorganization of thalamocortical network after paediatric AIS and their possible association with cognitive measures. It is hypothesized that FC within the thalamocortical network differ between patients and controls and that altered FC

measures correlate with individual cognitive measures. Furthermore, age at stroke, time since stroke, lesion location and lesion laterality are expected to influence thalamocortical network.

2-I-56 Maternal prenatal anxiety associates to infant orbitofrontal cortex functional synchrony

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Objective: Prenatal early-life stress has been linked to many adverse health outcomes. Regional Homogeneity (ReHo) is a voxel-based measure that provides a measure for local synchronization of brain activity. As a part of the FinnBrain Birth Cohort Study (www.finnbrain.fi), we studied the associations between maternal depressive (EPDS, Edinburgh prenatal depression scale) and anxiety (PRAQ-R2, pregnancy-related anxiety questionnaire) symptoms at gestational week 24 and ReHo of infant brain. Methods: 21 infants (mean age from gestation 26 d, SD 5.9; 12 males) were scanned with a Siemens Verio 3T scanner, 6 minute resting-state fMRI (140 volumes, voxel size 3 mm^3, TR 2500 ms. Data was preprocessed (motion correction, regression of white and gray matter signals and 24 motion parameters, scrubbing, 0.01-0.08 Hz band-pass filtering) before computing ReHo (27 voxels), then smoothed (6 mm FWHM) and normalized to UNC infant template for group analysis. Multiple regression model investigated associations between maternal EPDS and PRAQ-R2 scores and infant ReHo while controlling for infant sex and age. We used $p < 0.005$ as a cluster forming threshold and FDR-correction for multiple comparisons. Results: We found a strong linear association between maternal anxiety and infant ReHo in bilateral orbitofrontal cortex ($r > 0.60$, $p < 0.001$). No associations were found between ReHo and depressive symptoms. Conclusions: Maternal anxiety associates strongly with offspring's regional synchronization of brain activity on bilateral orbitofrontal cortices.

2-J-57 Adrenarcheal timing predicts the development of anxiety symptoms via amygdala functional connectivity during emotion processing: A longitudinal study

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The transition from childhood to adolescence is a vulnerable period for the development of anxiety symptoms. Hormonal processes during adrenarche, an early pubertal phase, might play a role in this increased vulnerability. Little is known about the brain mechanisms underlying these links. The current study aimed to longitudinally examine how adrenarcheal hormone levels were associated with amygdala functional connectivity, and how this in turn related to anxiety levels in early adolescence. 64 children (M age 9.5 years at Time 1, 12.2 years at Time 2) completed the Spence Children's Anxiety Scale, and saliva collections to measure levels of dehydroepiandrosterone (DHEA) and its sulphate (DHEAS). They also viewed fearful and calm facial expressions while undergoing a functional MRI scan at both timepoints. Amygdala functional connectivity was analyzed with Psycho-physiological interaction (PPI). Controlling for age, higher DHEAS at Time 1 was related to an increase in amygdala to inferior frontal gyrus (IFG) connectivity in boys, but the opposite in girls. DHEA at Time 1 showed a positive association with amygdala connectivity to several lateral frontal areas and the anterior cingulate across time. Higher DHEA at Time 1 was indirectly related to more anxiety symptoms at Time 2 (controlling for symptoms at Time 1), via more positive amygdala to IFG connectivity. The results show that amygdala to frontal

cortex connectivity may be a mechanism through which early adrenarcheal timing (i.e. high hormone levels controlling for age) predicts the development of anxiety symptoms.

2-J-58 Cumulative poverty exposure and the moderating role of cortisol on child internalizing problems in preschool

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Children growing up in poverty are at increased risk for socioemotional and adjustment problems that can persist throughout the lifespan. A growing literature suggests that altered levels of stress hormones, and their effects on brain structure and function, may be one pathway through which poverty adversely affects socioemotional development. Using data from the Family Life Project (N = 1,292), a prospective longitudinal sample of children in predominately low-income and rural communities, this study explored the extent to which stress physiology (as indicated by child cortisol levels adjusted for time of day) operates independently and interactively with years spent below the poverty line to predict anxiety and internalizing symptoms in preschool (M age = 3.5, SD = .5). Main effects analyses indicated that cumulative time in poverty as well covariates including early temperament (distress to novelty) and maternal depression were each uniquely associated with preschool anxiety and internalizing as rated by mothers. There were no statistically significant main effects between cortisol levels and anxiety or internalizing symptoms. Time spent in poverty statistically interacted with cortisol such that children experiencing more years below the poverty line in combination with higher levels of baseline cortisol displayed significantly more internalizing and anxiety problems in preschool. The results highlight how cumulative exposure to poverty gets under the skin to alter physiological functioning in ways that may lead to a heightened risk for child psychopathology.

2-J-59 : Structural connectivity of the striatum during adolescence: a longitudinal DTI connectivity study

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This study sought to investigate how structural connectivity between the striatum and key regions of interest (ROIs) including the amygdala, hippocampus, medial prefrontal cortex (mPFC), orbitofrontal cortex (OFC), dorsal anterior cingulate cortex (dACC) and lateral prefrontal cortex (lPFC) develops during adolescence in relation to both age and testosterone, utilising 3T diffusion tensor imaging data from a large longitudinal study of 299 participants aged 8-29 years. Participant-specific anatomical ROIs were generated using Freesurfer 5.3.0 and probabilistic tractography was performed using FSL. Structural connectivity between striatum and all the ROIs increased during adolescence except the dACC which showed no relationship with age or testosterone. Striatum connectivity with the amygdala and OFC in both sexes, the hippocampus in males and lPFC in females showed a quadratic trajectory with age. In males, mPFC and lPFC showed linear increasing trajectories with age, while amygdala in females followed a cubic pattern. When modelled against testosterone, striatum connectivity in males with amygdala, hippocampus and mPFC followed a linear trajectory, while for OFC and lPFC quadratic trajectories were seen. Testosterone was not related to striatum connectivity in females. The results show increasing connectivity between the striatum and key target regions during adolescence, with different developmental trajectories across ROIs. The data support the hypothesis that testosterone is associated with structural connectivity in males, but not in females.

2-J-60 MRI tissue-iron and PET as indicators of the development of striatal dopamine neurobiology

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Animal models suggest that dopamine (DA) concentration and D2 receptor (D2R) density continue to mature during adolescence in the striatum. However, direct evidence in humans is limited. PET studies can assess aspects of striatal DA neurobiology, though only in adults due to its invasiveness. Tissue-iron, can be non-invasively quantified with MRI and has been linked with many aspects of the DA system, including DA synthesis and D2R, potentially serving as an indicator of striatal DA anatomy. We quantified striatal tissue-iron concentration using R2' in 140 12-30 year-olds and acquired PET data in the adult portion of the sample (ages 18-30; n = 78) using [C11]Dihydrotetrabenazine (DTBZ), an indicator of presynaptic DA, and [C11]Raclopride (RAC), an indicator of D2R. We collected follow-up data for all measures 1.5y later (R2': n = 88; PET: n = 60). We found that R2' increased with age throughout the striatum through adolescence. In the adult sample, RAC decreased with age while DTBZ was developmentally stable through adulthood, supporting findings from rodent models. Critically, after controlling for age in all measures, individual differences in R2' were positively associated with individual differences in DTBZ in the nucleus accumbens (NAcc)--an effect that was replicated at both visits. Together, these results suggest that presynaptic DA may mature prior to adulthood while D2R continue to decrease through young adulthood indicating specialization. Importantly, results suggest that R2' tissue-iron may function as a non-invasive indicator of striatal DA in the NAcc.

2-J-61 Limb constraint drives dramatic reorganization of human brain networks

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Objective: Little is known about how brain networks are shaped by activity and experience. Many have argued that resting-state functional connectivity (RSFC) in brain networks arises through repeated coactivation of brain regions during behavior. Methods: We induced a drastic change in behavior in two adult participants by constraining the dominant upper extremity in a fiberglass cast for two weeks. We tracked spontaneous activity before, during and after casting by acquiring 30 minutes of resting-state fMRI data every day for 48-64 consecutive days in each participant. Results: Participants showed a dramatic reduction in dominant limb use, loss of grip strength and a progressive weakening of functional connectivity between the left and right M1. Additionally, after 1-2 days of casting, the disused M1 began to exhibit numerous spontaneous pulses of activity. These pulses were large (>1% BOLD signal change), occurred often (dozens of pulses during peak sessions), had time courses typical of hemodynamic responses to discrete bursts of neural activity, and spanned the entire disused motor system, including the cerebellum, putamen and thalamus. Conclusions: Reduced RSFC between left and right M1 is consistent with the hypothesis that RSFC arises through repeated coactivation. Pulses of spontaneous activity in the setting of adult plasticity ("plasticity pulses") could serve as a non-invasive biomarker of ongoing network reorganization.

2-J-63 Affective reactivity during adolescence: Differential associations with age, puberty and testosterone*

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Early childhood is a time of rapid, significant change in episodic memory abilities. Prior research has linked gains in memory to the hippocampus (HPC), a heterogeneous subcortical structure within the medial temporal lobe consisting of the dentate gyrus (DG), cornu ammonis (CA) 1-4, and the subiculum (Sub). Yet, currently lacking is a detailed understanding of the developmental trajectory of these heterogenous subfields during early childhood, which could elucidate the neural substrates of memory development. The proposed work seeks to describe developmental changes in HPC subfields between the ages of 4 and 8 years, by collecting ultra-high-resolution MRI data from 80 participants across three time-points using a cohort-sequential design. Cohort 1 was recruited at age 4, providing data at ages 4, 5, and 6. Cohort 2 was recruited at age 6, providing data at ages 6, 7, and 8. Data collection will be completed by early July, allowing ample time for analyses to be conducted. Six subfields per participant (CA1, CA2-4/DG, and Sub in HPC head and body) will be identified using a reliable study-specific mask in combination with the Automated Segmentation of Hippocampal Subfields tool. To delineate the developmental trajectory of these subfields, we will use multi-cohort latent change score models, allowing us to characterize the developmental course of each subfield from age 4- to 8-years. Ultimately, this will help inform our understanding of the dynamic changes in cognitive ability that occur during this important developmental period.

2-K-64 Longitudinal development of hippocampal subfields during early to mid-childhood

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Along with the biological changes triggered by puberty, adolescence is characterized by significant changes in affective processes and related brain function. The current study is the first in the field to examine nonlinear relationships between puberty and neural responses to affective facial stimuli using a longitudinal sample, with up to three repeated assessments, between early and late adolescence (N=83, Age=9-18 years). At each of the assessments (mean ages: 10, 13 and 16 years), participants completed a fMRI task of passively viewing affective facial stimuli, the Pubertal Development Scale and provided a sample of saliva, which was assayed for testosterone. Changes in neural response were related to age, pubertal stage and testosterone using multilevel modelling. Sex differences in development were examined. We found extensive inverted-U shaped changes in subcortical (amygdala and hippocampus) and prefrontal reactivity with pubertal maturation. Sex differences in age- and puberty-related development were prevalent in regions subserving social and self-evaluative processes. In females, testosterone-related changes exhibited minimal overlap with puberty- and age-related changes. In males, considerable similarities between the three indices were present in motor and occipital cortices, but contrary to hypotheses, testosterone did not appear to drive extensive limbic and prefrontal changes. These findings highlight differential roles of age and puberty on socioemotional development in males and females, suggesting potentially unique biological and environment influences.

2-K-65 Characterizing heterogeneity across ASD and ADHD using machine learning and fMRI

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ASD and ADHD are highly comorbid; overlapping executive function (EF) deficits may provide clues to an improved nosology. Newer computational methods could help resolve these heterogeneous features. Therefore, we characterized ADHD symptom heterogeneity in adolescents with ASD and/or ADHD and identified putative subgroups using a functional random forest (FRF) algorithm. 130 adolescents received an ADHD diagnosis (N = 72) or an ASD diagnosis +/-ADHD (ASD- = 26; ASD+ = 32.) First, our FRF algorithm was used to predict the participant's ADHD inattentive symptom total (ADHD-IST) from a standard clinical interview (KSADS) using both parent ratings and in-lab measures of EF. The FRF model produced a proximity matrix representing the similarity between every pair of participants. The second part of the approach identified subgroups from the proximity matrix using the infomap algorithm. Subgroups were validated by examining differences in resting state functional MRI connectivity and a permuted chi-squared test. The FRF successfully predicted ADHD-IST (MAE = 2.0, SD = .28, permuted MAE = 2.3, SD = .36; t(64) = -3.5, p<.001) and two distinct subgroups were identified. Using the chi-squared test, the two subgroups showed significant functional connectivity differences between regions related to visual attention and alertness (visual and cingulo-opercular networks.) These results support the hypothesis of unique combinations of EF symptoms contributing to the heterogeneity of ADHD across ADHD and ASD. Future studies will further validate findings via an independent dataset.

2-K-66 Automated detection of motion artifacts in fMRI data

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Motion is a pernicious problem in pediatric neuroimaging. However, task-based neuroimagers have not yet developed best practices for dealing with motion. Beyond heterogeneity in terms of which/how many motion indicators are included as nuisance regressors, there is no standard for determining which volumes should be included in a "trash" regressor or what threshold should be used to exclude subjects or runs. Trash regressors are commonly created by manually coding volumes for motion artifacts, which is labor intensive, particularly as sample size increases. To improve this process, we propose to develop a machine learning classifier that detects whether or not functional volumes contain motion artifacts. Once developed, this classifier can be applied to new data, yielding a prediction of motion (or not) for each volume. This information can in turn be used to create trash regressors and exclude subjects/runs. To do this, we will manually code 185,845 volumes from two studies (N=244) and divide the data into training (50%), testing (25%), and hold-out (25%) sets. Motion indicators generated from fmriprep will be used as features. In the training set, we will test a variety of machine learning algorithms and tune hyperparameters to achieve the highest accuracy in the testing set. Generalizability will be assessed in the hold-out set. We are currently coding the data (20% are coded) and developing the classifier. Ultimately, we hope to build a tool that will help standardize the process for modeling motion, as well as save labs a great deal of time and effort.

2-K-67 Mutualistic coupling supports development of reasoning, vocabulary and mathematical abilities: Findings from two longitudinal cohorts

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A striking feature of individual differences in cognitive abilities is that they are universally positively correlated - a phenomenon known as the positive manifold. The traditional method of analysis yields a g-factor, a single summary metric with considerable predictive power. However, this summary metric ignores the developmental origin of the positive manifold. One developmental mechanism that may explain the positive manifold is mutualism: reciprocal, positive interactions between cognitive abilities during development. Here we present findings from two independent cohorts that suggest mutualism may help explain cognitive development. In an N=227, 3-wave cohort (age 6-8) we found that the mutualism model outperformed competing developmental accounts: children with higher scores in vocabulary showed greater gains in matrix reasoning and vice versa. We replicate these findings in a large longitudinal data set (N≈12.000) on basic (counting ↔ addition) and more advanced (multiplication ↔ division math skills. These dynamic coupling pathways are not predicted by other accounts, provide a novel window into cognitive development, and suggest a cognitive mechanism for processes such as gene- environment interactions: Coupling may allow small genetic differences between individuals to amplify during development, reconciling findings of high heritability on the one hand with environmental influences on the other.

2-K-68 Model-based network discovery of developmental and performance-related differences during risky decision-making

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Theories of adolescent neurodevelopment have largely focused on group-level descriptions of neural changes that help explain increases in risk behavior that are stereotypical of the teen years. However, because these models are concerned with describing the "average" individual, they can fail to account for important individual or within-group variability. New methodological developments now offer the possibility of accounting for both group trends and individual differences within the same modeling framework. Here we apply GIMME, a model-based approach which uses both group and individual-level information to construct functional connectivity maps, to investigate risky behavior and neural changes across development. Adolescents (N=30, Mage=13.22), young adults (N=23, Mage=19.19), and adults (N=31, Mage=43.93) completed a risky decision-making task during an fMRI scan, and functional networks were constructed for each individual. We took two subgrouping approaches: 1) a confirmatory approach where we searched for functional connections that distinguished between our a priori age categories, and 2) an exploratory approach where we allowed an unsupervised algorithm to sort individuals freely. Contrary to expectations, we show that age is not the most influence contributing to network configurations. The implications for developmental theories and methodologies are discussed.

2-L-69 Probing theory of mind in typical development and autism spectrum disorder using a socially interactive fMRI task

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Theory of mind (ToM) is considered a core deficit in autism spectrum disorder (ASD), yet neural evidence for this is mixed, with some studies reporting hypoactivation in ASD of ToM-related regions like the temporoparietal junction (TPJ) and others showing no differences or hyperactivation. Most prior studies used non-interactive tasks that may not reflect ToM during real-time social interactions, and few fMRI studies have examined ToM in typically developing (TD) children and those with ASD in middle-to-late childhood, a crucial period of social development. We address these gaps using an fMRI task that manipulates ToM within a social interaction. In a 2x2 design, for half the trials children believe they are interacting with a live partner (Peer); in the other half they reason about a fictional character (Character). Meanwhile, half the trials require ToM (Mental) and the other half do not (Non-Mental). In 28 TD children (8-12 years, M=10.41), we found activation of ToM regions for the main effects of mentalizing (Mental > Non-Mental) and social interaction (Peer > Character). We found a similar pattern in a slightly older group of 13 children with ASD (9-14 years, M=12.95), but an age-matched TD group (n=13, 10-14 years, M=12.36) showed less activation of ToM regions for both contrasts, with the ASD group showing significantly more activation of left TPJ for Mental > Non-Mental and of medial occipitotemporal regions for Peer > Character. These results suggest age-dependent differences in the brain bases of ToM and social interaction in children with and without ASD.

2-L-70 Early childhood depression, emotion regulation, episodic memory and hippocampal development

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A consistent body of work demonstrates that depression is associated with deficits in a number of cognitive domains. There is evidence that such cognitive deficits are present in children and adolescents with depression, but less is known about how this varies with current or cumulative depression severity. Further, it has been suggested that the presence of some cognitive deficits, such as episodic memory, may reflect hippocampal abnormalities linked to both depression and episodic memory. We examined these questions in adolescents participating in a longitudinal study of preschool onset depression. We measured cognitive function using the NIH toolbox (vocabulary, processing speed, executive function, working memory and episodic memory). We examined whether clinical and self-report assessments of depression and emotion regulation from parents and children starting at preschool age were associated with intercepts and slopes of hippocampal volume over three imaging assessments starting at school age. Youths with either current and past depression showed deficits in episodic memory, but not in other cognitive domains, even controlling for internalizing and externalizing disorders and family income. Both current and cumulative depression severity predicted episodic memory impairment, as did smaller hippocampal intercepts and slopes of hippocampal growth over time. However, there were only modest relationships of depression to hippocampal volume. We also found strong relationships between parent-reported emotion regulation and both episodic memory and hippocampal volume. These

2-L-71 Response inhibition deficits in adolescents showing early signs of borderline personality disorder

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Adults with Borderline Personality Disorder (BPD) - a psychiatric illness that begins in adolescence - show impaired saccadic control in response inhibition tasks. To test whether this pattern exists in adolescents showing early signs of BPD, we measured saccade performance in female adolescents with BPD traits and age-matched female healthy controls while they performed an interleaved pro- and anti-saccade task. Participants generated anti-saccades (voluntary saccade away from salient target) or pro-saccades (automatic saccade toward target) depending upon a central color instruction. We show that BPD adolescents generated more anticipatory saccades (saccade reaction time (SRT): <90 ms) on anti-saccade trials compared to controls, indicating dysfunction of saccadic preparatory suppression signals within the oculomotor network. Direction errors, express saccades (SRT: 91-139 ms), and regular latency saccades (SRT: >140 ms) did not differ between groups, suggesting intact functioning of visually-guided oculomotor signaling in BPD patients. These results are similar to adults with BPD, suggesting that inhibitory dysfunction - specifically a failure to adequately prepare for an inhibitory command - develops early in disease progression. This result is distinct from other psychiatric disorders characterized by impulsivity in youth (i.e., ADHD) where dysfunction is observed during the propagation of erroneous visually-guided saccades. We hypothesize that impulsivity across youth disorders may correspond to distinct impaired signaling circuits within the frontoparietal network.

2-L-72 Parsing heterogeneity in autism and attention-deficit/hyperactivity disorder with individual connectome mapping

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Children with autism spectrum disorder (ASD) and attention-deficit/hyperactivity disorder (ADHD) exhibit significant heterogeneity with respect to executive functions (EF). We aim to create an alternative psychiatric nosology grounded in neurobiology. Resting-state fMRI data from typically developing children and children with ADHD and ASD (ages 8-13 years, N=132) were subjected to a novel clustering algorithm, group iterative multiple model estimation (GIMME), to identify subgroups of children who have similar functional brain network configurations. Averaged time series were derived from regions-of-interest (ROIs) activated during a cognitive flexibility task performed by neurotypical adults (inferior parietal lobule, inferior frontal junction, anterior insula [aI)], dorsolateral prefrontal cortex and dorsal anterior cingulate cortex [dACC]). Two subgroups emerged based on differential ROI-ROI connectivity. Subgroup 1 (n=67) only exhibited connectivity between two hemispheric homologs: IPL and IFJ. Subgroup 2 (n=65) contained 7 additional paths compared to Subgroup 1, including aIdACC. Subgroups did not differ in age, the distribution of the diagnostic categories, nor in parent-reported cognitive flexibility skills (p's > .05) but did differ on measures of in-scanner motion (p=.04). This suggests that motion may be driving subgroup classification, therefore future work will control for motion in the GIMME analyses. Ultimately, we expect this work to aid in understanding how various functional brain network profiles contribute to heterogeneity in EF transdiagnostically.

2-L-73 Restricted and repetitive behavior and brain functional connectivity in infants and toddlers at risk for developing autism spectrum disorder*

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Restricted and repetitive behaviors (RRBs) are detectable by 12 months (mo) in many infants later diagnosed with autism spectrum disorder (ASD). The aim of this study was to elucidate the brain functional connectivity (fc) underlying the emergence of these key behaviors. Behavioral and resting-state fcMRI data were collected from 167 children at high and low familial risk for ASD at 12 and 24 mo (15 met criteria for ASD at 24 mo). We divided RRBs into four subcategories (restricted, stereotyped, ritualistic/sameness, and self-injurious behavior) and identified functional brain networks associated with the development of each RRB subcategory. Severity of ritualistic/sameness behavior was associated with reduced fc between visual and control networks at both 12 and 24 mo. Ritualistic/sameness and stereotyped behaviors were associated with reduced fc between visual and default mode networks at 12 mo. At 24 mo: 1) stereotyped behavior was associated with increased fc between dorsal attention and subcortical networks; 2) stereotyped and restricted behaviors were each associated with increased fc between default mode and control networks; and 3) restricted behavior was associated with increased fc between default mode and dorsal attention networks. No significant brain-behavior relationships were observed for self-injurious behavior. These observations mark the earliest known description of functional brain systems underlying RRBs, reinforce the construct validity of RRB subcategories in infants, and implicate specific neural substrates for future interventions targeting RRBs.

2-L-74 Altered neuronal responses during affective Stroop task performance in adolescents with conduct disorder

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Objective: Conduct disorder (CD) is a psychiatric disorder of childhood and adolescence characterized by emotion processing and regulation difficulties. Past research has shown that adolescents with conduct problems are impaired in integrating emotion and cognitive processing possibly due to failure in top-down attention. First evidence has related dysfunctional emotion-cognition interaction in adolescents with conduct problems to altered brain activation within the ventromedial prefrontal cortex and amygdala. Methods: We employed whole-brain fMRI using an affective Stroop task in 39 adolescents with CD and 39 typically developing (TD) youths. Each trial consisted of an aversive or neutral image followed by a number Stroop task. Group (CD/TD) x emotion (neg/neu) x task (neutral/congruent/incongruent) ANOVAs were conducted. Results: Behaviorally, overall task accuracy was significantly decreased in CD compared to TD, however, no differences in reaction times existed. Neuronally, we observed a lack of downregulation of left amygdala during incongruent task trials (ROI),

as well as increased anterior/decreased posterior insula activity as a main effect of group in CD (cluster-level FWE-corrected (p<.05)). Conclusions: While we did not observe a three-way interaction (group x emotion x task), our results still support prior findings of altered emotion-cognition interaction in CD. Future studies may further focus on investigating emotion-cognition in CD subgroups, e.g., variations in callous-unemotional traits, anxiety, or impulsivity.

2-L-75 Neurophysiological deficits in the delay period of a Delayed-Match-to-Sample test in children diagnosed of ADHD

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Since attentional and Working Memory (WM) impairments have been suggested as an important feature of the Attention Deficit Disorder (ADHD), differences in ERPs amplitude of ADHD and control subjects are expected during the encoding, retention and/or matching phases of the Delayed-match-to-sample_task (DMTS). Specifically, the amplitude of ERPs, as the slow wave which is present during the retention period, would probably show different amplitude in controls compared to ADHD subjects. Twenty nine ADHD subjects were included in the study (62.1% combined, 34.5% inattentive and 3.4% impulsive) diagnosed by means of a structured interview and the duPaul questionnaire. Control subjects were recruited from public schools and selected to match by age (between 6 and 17 years of age (mean = 10.8 years old, SD = 3.01)) and gender (35 subjects: 24 males / 11 females) the ADHD group. EEG of both groups was recorded while performing the DMTS task. WM Behavioral parameters, including the Working Memory Test Battery for Children, were impaired in ADHD children. The cluster mass permutation test showed a statistically significant difference in the slow wave amplitude during the retention phase in both groups. The results suggest that WM impairment in ADHD children would be related to a poor neurophysiological activity during the retention period.

2-L-76 Remapping the cognitive and neural profiles of struggling learners

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Cognitive-related learning difficulties affect up to 10% of the school population. Not all who struggle receive a diagnosis, yet their problems are sufficient to warrant additional support. Understanding the causes of learning difficulties is the key to developing effective prevention and intervention strategies. This project uses data-driven methods to discover the underpinning mechanisms of learning problems. Children (n=550) with problems in attention, learning and/memory, identified by a practitioner, completed cognitive tasks and underwent an MRI brain scan. Machine learning was used to map the multi-dimensional space of the cognitive measures and identify groups of children with shared cognitive profiles. Four groups were identified. One had across-the-board poor cognitive function and learning. A second had both age-typical cognitive and learning. The remaining groups had intermediate profiles. Both had moderate IQ problems, but one had more severe problems in visuo-spatial skills while the other was characterised by more severe phonological difficulties. Despite highly contrasting cognitive profiles, the groups had equivalently poor learning. The four clusters of children had distinct neural correlates. This study represents a novel move towards identifying data-driven cognitive dimensions underlying learning-related difficulties in a representative sample of poor learners. Crucially, the data suggest that children who present with similar learning difficulties may have dissimilar underlying cognitive profiles that in turn have distinct neural correlates.

2-L-77 Early detection of motor and participation deficits in children

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Objective:In children, motor deficits can be the first observable sign of developmental delay and may be the first easily measurable indicator of cognitive deficits. The purpose of this study was to measure upper extremity accelerometry values to describe real-world movement in typically developing(TD) children. We then collected a sample of children with unilateral motor impairment(MI), to test whether accelerometry data alone can detect subtle motor asymmetries. Methods: Data were collected using a prospective, observational design. Two cohorts of children, TD and MI, between 0-17 years were recruited. Children wore accelerometers bilaterally for 4x25 hours. Parents completed surveys of behavior and motor. Children with MI completed standardized motor testing.Total accelerometry activity and use ratio between upper limb were used to describe TD. We developed the mono arm use index (MAUI) to discriminate TD from MI using the magnitude of unilateral movement.Results: Participants were 156 TD children equally distributed by gender/age, and 25 with MI. Total activity was highest in middle childhood (t=-5.54, p<.001).The mean use ratio of the youngest children was 1 and declined rapidly to reach adult norms by adolescence (t=-4.3, p<.001). With our cohort, MAUI has 87% sensitivity and a positive predictive value of 1.0 (F1=0.93). All children with MI had deficits in daily routines. Using a binary classification model we found that with a threshold of 0.54, MAUI had 98% accuracy. Significance:We report the first pediatric normative accelerometry dataset and a new metric,MAUI.

2-L-78 Functional connectivity indicates distinct development of brain systems supporting motor function and inhibitory control in Tourette syndrome

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Tourette syndrome (TS) is a developmental disorder characterized by motor and vocal tics, indicative of impaired motor function and inhibitory control. Tic symptoms improve with age in many, but not all patients, suggesting that the brain systems underlying childhood TS and adulthood TS may differ. To test how different brain systems - particularly those involved in motor function and inhibitory control - are differentially affected across developmental stages in TS, we examined resting-state fMRI from 39 TS and 39 matched control children, 39 TS and 39 matched control adults. We used machine learning to identify functional systems with functional connectivity (FC) that distinguishes TS from controls, separately in children and adults. We tested if these diagnostic classifiers could accurately identify TS in the other age group and identify systems that are similarly or differentially affected across development in TS. We found that only the classifier using somatomotor FC accurately distinguished individuals across age groups, suggesting that somatomotor differences are shared across children and adults with TS. Conversely, classifiers using FC from brain systems involved in inhibitory control systematically failed to generalize across children and adults. Some systems exhibited patterns consistent with pseudo-maturity in childhood TS, some exhibited immaturity in adulthood TS, and others were uniquely affected in adulthood TS. Overall, these findings demonstrate that the brain systems involved in motor and control functions have distinct developmental trajectories in TS.

2-L-79 Internalizing symptoms during adolescence differentially modulate amygdala functional connectivity in neurotypical males and females

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Amygdala functional connectivity is altered in adolescents with mood disorders, though it is unclear whether these functional differences are also evident in typically developing (TD) adolescents who show elevated internalizing symptoms. We examined whether bilateral amygdala resting-state functional connectivity in 110 TD adolescents (57 female, 8.3-18.0 years old (M=13.1); 53 male, 8.3-17.9 years old (M=13.7)) was modulated across a continuum of internalizing symptomatology based on the Child Behavior Checklist internalizing scale, and its subscales: anxiety-depression, withdrawn, and somatic complaints. Due to gender differences in the prevalence of mood disorders, we examined amygdala connectivity in males and females separately. Unlike males, females showed increased amygdala to mid-cingulate connectivity as a function of increased internalizing, anxiety-depression, somatic, and withdrawn symptoms. Females also showed increased amygdala connectivity with the left insula, somatosensory cortex, and superior temporal gyrus as a function of somatic complaints specifically. Males showed decreased amygdala connectivity with the right superior, middle, and inferior temporal gyri as a function of increased anxiety-depression symptoms. These results are consistent with reports linking disrupted amygdala connectivity to internalizing symptoms in clinical populations. These findings also indicate that examining internalizing symptomatology from a dimensional rather than categorical framework can help elucidate the neural underpinnings of subclinical symptomatology.

2-L-80 Childhood and current depression symptoms predict blunted corticostriatal response to monetary reward cues in adolescence

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Blunted corticostriatal circuit activity to monetary rewards is a consistent correlate of depression in adolescence and adulthood, and has been seen in individuals at risk for depression. We aimed to determine whether a developmental history of depression since preschool has similar consequences for the processing of rewards in adolescence. We examined neural reactivity to monetary reward cues and feedback using a modified fMRI card-guessing task that assesses response to both cues that predict rewards and the receipt of rewards in 111 13-19-year-old adolescents (M=16.31, SD=1.15) who had been annually assessed for symptoms of psychopathology since they were 3-5 years old. Mean activation weights to reward cues across a priori regions of interest (ROIs) in a corticostriatal network known to be activated by the anticipation and/or receipt of reward were extracted. Current depression symptoms predicted blunted response to a reward cue (relative to a loss cue) only in the ventral striatum (VS). However, cumulative depression symptoms since preschool predicted blunted responses across the corticostriatal network, including reductions in the activity of the caudate, putamen, VS, insula, and anterior cingulate cortex to reward cues. Interestingly, neither current nor cumulative depression symptoms predicted neural responses to reward receipt. These findings suggest that acute depression may be particularly important for the functional role of the VS, while chronic depression may result in long-term altered response of the corticostriatal circuit to monetary rewards.

2-L-81 Atypical neural correlates and eye gaze behavior during emotional face processing in youths with conduct disorder

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Objective: Conduct disorder (CD) is characterized by severe aggressive and antisocial behavior and associated with emotion processing deficits. Impaired eye gaze behavior has likewise been reported, however, both concepts are rarely studied simultaneously. We aimed to assess the neural correlates of emotional face processing in CD and typically developing (TD) youths using concurrent fMRI and eye-tracking. Methods: 58 youths (23CD, according to DSM-IV guidelines/35TD; average age = 16years) underwent an emotional (fearful, anger, neutral) face processing fMRI/eye-tracking task and clinical interviews/questionnaires. Neuroimaging analyses included standard SPM12 pre-processing, first-level regressors for each emotion and whole-brain/ROI random effects group analyses for contrasts of interest (fearful>neutral / anger>neutral). Group analyses (incl. age/ gender covariates; $p<0.05$ FWE-corrected) were computed with and without first-level correction for eye gaze behavior. Results: CD compared to TD youths showed significant hypo-activations during emotional face processing in prefrontal/limbic regions, particularly anterior insula for fearful faces. Eye-tracking revealed a reduced allocation to the eyes for fearful, but not anger/neutral faces. Correcting for eye-gaze attenuated neuronal group differences. Conclusion: We demonstrate atypical neuronal correlates during emotional face processing in CD which may partly be explained by reduced attention to the eyes. This furthers our understanding of the neural basis of CD, ultimately impacting diagnosis and treatment.

2-L-82 Childhood cancer and its effects on working memory network characteristics

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Long-term sequelae of cancer and its treatments put children at risk of cognitive impairment including low working memory (WM) capacity. WM capacity represents a core cognitive function needed to succeed in daily life and academic tasks. Aim of this study is to examine characteristics of the visuo-spatial WM network of school-aged children and to evaluate effects of cancer and its treatment on the neural network characteristics. We expect lower WM performance and altered WM network activity in children after cancer than controls. Influence of age, sex, central nervous system (CNS) involvement and age at diagnosis on the WM network will be considered. The fronto-parietal network, defined as region of interest (ROI), is specified according to Mürner-Lavanchy et al. (2013) using the same WM task. For former patients with CNS involvement, the asymmetry of activation is assessed using a lateralization index. Within the study, 46 children after cancer (with and without CNS involvement) and 48 healthy controls (aged 7-16 years) perform a visuo-spatial WM task inside the MRI scanner. Brain activation is measured by using fMRI. Preprocessing was done in the following order: 1) realignment, 2) slice timing, 3) coregistration, 4) segmentation, 5) normalization, and 6) smoothing. All preprocessing steps, including first and second level analysis will be conducted by the use of statistical parametric mapping (SPM12) software running in Matlab 8.3. The findings of this study will extend our knowledge about the impact of cancer and its treatment on WM network characteristics.

2-L-83 Thalamic volume and posterior default-mode cortical thickness predict poor sleep quality in youth

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Poor subjective sleep quality (SQ) is a prominent risk factor for most forms of psychiatric illness, yet objective biomarkers of SQ have remained elusive. Our goal was to identify neural markers of SQ in a transdiagnostic youth sample using a combination of structural and functional neuroimaging measures. Forty youth offspring of parents with bipolar disorder (OBP;N=19) and community comparison parents (OCP;N=21) aged 8-17 years-old completed an MRI assessment and rated past-week SQ with a modified Pittsburgh Sleep Quality Index (PSQI). Of these youth, N=22 had good SQ (PSQI≤5; 9 OBP) and N=18 had poor SQ (PSQI>5; 9 OBP). Group-lasso logistic regression was used to identify non-zero predictors of SQ from cortical thickness indices; subcortical grey matter volumes; BOLD response to reward and emotion fMRI tasks; and demographic/clinical features (symptom scales excluded sleep items). Lasso modeling selected higher depression severity (OR=1.73), higher anxiety severity (OR=1.03), lower right thalamus volume (OR=0.68) and higher right isthmus cingulate cortical thickness (OR=1.03) as correlates of poor SQ. Lasso-selected predictors, except anxiety severity, were significant at $p<.05$ in a bootstrapped logistic regression. Predictors explained 52.9% of the variance in SQ and correctly classified 85% of cases. Internalizing symptoms along with grey matter structure in regions supporting arousal and conscious awareness were useful classifiers of SQ. A combination of clinical and neuroimaging measures may be key for understanding the basis of poor SQ.

2-L-84 Gray matter concentrations in never-depressed children at risk for depression

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Voxel-based morphometry (VBM) has been widely used to understand neural structures related to major depressive disorder (MDD), showing that MDD is associated with decreased grey matter (GM) concentration in the prefrontal cortex (PFC) and limbic system (Arnone et al., 2016; Bora et al., 2012). However, it is unclear whether structural abnormalities precede the onset of depression, potentially marking risk. We therefore used VBM to look at GM concentration via whole-brain and a priori region of interest (ROI; e.g., PFC, anterior cingulate [ACC], amygdala, hippocampus) analyses in 84 never-depressed children (47 boys; Mage = 11.1 years) at high (n = 28) and low (n = 56) risk based on maternal MDD history. We also examined whether GM was related to child depressive symptoms, as even subthreshold depressive symptoms predict future disorder (Lewinsohn et al., 2000). All pre-processing and VBM analyses used CAT12 toolbox (http://www.neuro.uni-jena.de/cat/) and SPM12 (Ashburner et al., 2014). While maternal depression history was unrelated to GM concentration based on whole-brain and ROI analyses, child self-reported depressive symptoms were negatively associated with GM concentration in the ventromedial PFC/orbitofrontal cortex during both whole-brain analysis and small-

volume ROI analyses ($p < .05$, FDR-corrected). Given the putative role of these regions in emotion regulation, these results point to a putative structural mechanism underlying risk for MDD.

2-L-85 Altered cortical morphology in pure and comorbid adolescent ADHD with conduct disorder

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Attention-deficit hyperactivity disorder (ADHD) is a major psychiatric childhood disorder affecting 3 to 9% of children and adolescents. About 50% of ADHD patients suffer from comorbidity with conduct disorder/oppositional defiant disorder (CD/ODD). Previous studies did not differentiate between pure and comorbid ADHD with CD/ODD and only focused on specific measures (e.g. cortical volume, CV). Therefore, the aim of our study was to compare the cortical structural profile between pure and comorbid ADHD vs. typically developing controls (TD) examining different measures of cortical morphology, i.e. cortical thickness (CT), CV, and surface area (SA). We acquired T1 weighted images from participants aged 11 to 17 including 36 adolescents with ADHD and no comorbidities, 26 with ADHD and comorbid CD/ODD, and 30 TD, all matched regarding age, pubertal status, and IQ. Using FreeSurfer's surface-based processing stream we analyzed CT, CV, and SA. A thicker cortex in the right middle frontal gyrus emerged for comorbid ADHD vs. TD and for comorbid ADHD vs. pure ADHD. No differences were found in CV or SA for these comparisons. Pure ADHD vs. TD revealed a lower CV and SA in the medial prefrontal cortex but no difference in CT. For pure ADHD the reduction in frontal volume was most likely driven by a reduction in SA rather than CT. Comorbid ADHD did not show the same pattern of results but a thicker cortex in the right middle frontal gyrus. Results indicate distinct morphology of the two ADHD subgroups of comorbid and pure ADHD with specific patterns of affected morphological measures.

2-M-86 Beyond clinical classification: Insight into the visual attentional processes underpinning autistic-like traits in fragile X and Down Syndrome

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Genetic syndrome groups that feature high rates of autism comorbidity, like Down syndrome (DS) and fragile X syndrome (FXS), have been presented as useful models for understanding the risk and protective factors involved in the emergence of autistic traits. Yet despite reaching clinical thresholds, these 'syndromic' forms of autism appear to differ in important ways from the idiopathic or 'non-syndromic' autism phenotype. To uncover the true nature of these comorbidities, it is necessary to move beyond clinical classification and to consider the neurocognitive characteristics underpinning these syndromic autism presentations. The current study employs a variety of well-established eye tracking paradigms to assess key visual attentional abilities in children with DS and FXS who reach thresholds for autism on standardised clinical measures. It investigates whether autism profiles in these children are accompanied by visual orienting difficulties, decreased social attention and enhanced visual search performance, all of which are characteristic of the idiopathic autism phenotype. Data is collected from children with DS and FXS aged between 6 and 10 years, in addition to two control groups matched on age and intellectual ability (i.e., children with idiopathic autism and neurotypical controls). Significant group differences are hypothesised. This study provides insight into the complex heterogeneity

associated with syndromic autism presentations and autism per se, with clinical implications for the utility of autism intervention programmes in DS and FXS populations.

2-M-87 Naturalistic measures of sustained attention moderate the relation between behavioral inhibition and internalizing symptoms in kindergarteners.

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Behavioral Inhibition (BI), a temperament type, is a risk factor for internalizing problems (Chronis-Tuscano et al., 2009). However, not all BI children develop internalizing problems, such as anxiety. Low levels of sustained attention (SA) may increase internalizing risk in BI children (Perez-Edgar et al., 2010). In an ongoing sample enriched for BI (N-to-Date: 69, 18 BI; Mage = 5.97) children wore a mobile eye-tracker while completing the Stranger Working episode of the Laboratory Temperament Assessment Battery, designed to elicit social fear (Goldsmith et al., 1995). We collected a novel measure of naturalistic SA by coding the number of gaze shifts between situation-relevant areas of interest (toy, stranger body, stranger head). Increased shifts were conceptualized as lower SA. To date, we have coded eye-tracking recordings from 16 participants (8 BI, Mage = 5.97). Exploratory analyses found that attention shifts positively predicted parent report of internalizing symptoms in BI children, but negatively predicted symptoms in non-BI children, b = 0.04, p = .07. There was a trending main effect of number of shifts in predicting internalizing symptoms, b = -0.04, p = .08. BI children made more attention shifts than non-BI children, t(14) = -1.60, p = .13, and BI children had significantly higher parent report of internalizing problems, t(14) = -2.39, p = .03. Continued coding and analyses will present further opportunities to examine BI-related individual differences in SA, and suggest the importance of considering naturalistic measures of threat-related attention.

2-M-88 Anticipating Touch: Mu Desynchronization during Bodily Attention relates to Executive Function in Children

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The ability to direct attention selectively is a key neurocognitive skill. One important facet of selective attention is anticipation, a core biological construct that bridges basic perceptual processes and higher-order cognition. The current study focuses on the neural correlates of anticipation in 6- to 8-year-old children during anticipation of upcoming tactile stimulation of one of their hands. Electroencephalographic (EEG) activity over sensorimotor cortex was measured after a visual cue directed children to monitor their right or left hand in anticipation of tactile stimulation. Prior to delivery of the tactile stimulus, a regionally-specific desynchronization of the alpha-range mu rhythm occurred over central electrode sites (C3/C4) contralateral to the cue direction. The magnitude of anticipatory mu rhythm desynchronization was associated with children's executive function abilities on flanker and card sort tasks. Supplementary analyses concerning family income indicate that individual differences in neural indicators of bodily attention are further related to contextual factors. Compared with children from higher-income families, children from lower-income families exhibited less pronounced modulation of mu rhythm activity. Taken together, findings suggest that anticipatory mu desynchronization may be a useful neural marker of attention focusing processes that underlie children's executive function abilities.

2-M-89 A consistent context facilitates infants' orienting in natural scenes

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The visual context in which an object resides can provide useful top-down information for guiding attention orienting, object recognition, and visual search. Recently we found that 6- and 10-month-olds infants demonstrated more efficient visual search in simple arrays of shapes that co-varied with target locations. Here we investigate whether infants' sensitivity to visual context scales up to busier and more distracting visual environments, such as natural scenes. In an eye-tracking task, 8-month-old infants searched for a target toy arranged among distracter toys in colorful photographs of everyday environments (e.g., playrooms, kitchens, backyards). Consistent contexts co-varied with target location, such that the target toys appeared in the same location each time the scenes repeated, while variable contexts presented the target toys in different counter-balanced locations across the scenes. Infants successfully distinguished between consistent and variable contexts, exhibiting faster search times and more anticipation of targets that appeared in repeated scenes. Infants also looked longer at targets that appeared in repeated scenes, suggesting deeper processing. Following the cueing trials, a preferential looking post-test showed that infants were more likely to extend a novel label to targets that had appeared in consistent contexts, rather than variable contexts. These results indicate that contextual information is available to infants in natural scenes and may facilitate both orienting attention and learning of new features.

2-M-90 Taking attention back to school: Multisensory processes influence developing visual attention control

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We investigated if children's visual attention is involuntarily sensitive to multisensory processes, and if schooling experience impacts this sensitivity. While attentional control over visual stimuli is known to impact educational outcomes, multisensory processes (typical for classrooms) alter neurocognitive functions, including attention. dEEG was recorded from Swiss 1st-grade (age: 4-5) and 3rd-grade (age: 6-7) children, and adults searching for colour-defined targets where colour and colour-sound distractors preceded the search array. Spatial-cueing effects and N2pc component (analysed canonically, and within electrical neuroimaging [EN] framework) served as behavioural and EEG markers of attention. Only older children (and adults) showed top-down control over visual stimuli and bottom-up multisensory enhancement of visual attention. Reliable adult-like N2pc (183-282ms) was not found in 3rd-graders. EN analyses revealed that 3rd-graders lacked one stable configuration of brain sources that dominated adult N2pc's. First-graders showed no attentional effects. Our results are the first demonstration that children can have adult-like control over visual attention already after 2 years of schooling but multisensory processes influence visual attention around the same time. Our work showcases how adapting rigorous adult paradigms (and associated behavioural and EEG measures) can inform how

attention develops in naturalistic, multisensory settings, enriched by robust mechanistic insights into developmental change offered by electrical neuroimaging of traditional EEG correlates

2-M-91 Affect-biased attention moderates the relation between neural sensitivity to rejection and internalizing problems in young children

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Internalizing problems during early childhood are related to lower social competence in later childhood (Letcher et al., 2009), making it important to identify early risk markers. Enhanced neural sensitivity to rejection (NSR; Harrewijn et al., 2018) and attention to threat (ABT; Bar-Haim et al., 2007) are also related to internalizing problems. We examined if hypervigilance to social threat (ABT) may potentiate the relation between sensitivity to social feedback (NSR) and internalizing problems in young children. 64 children (Mage = 6.08 years) viewed pictures of "peers" and sorted them into groups--peers they did or did not wish to play with. EEG data were recorded as children received "peer" feedback either accepting or rejecting the child's bid. Theta power was extracted for both acceptance and rejection trials as measures of neural sensitivity to feedback (Van der Molen et al., 2017). Children completed the dot-probe task. Mean reaction times to congruent and incongruent threat trials were used to measure ABT. Parents reported children's internalizing. Using Poisson regression, we found that NSR, but not ABT, independently related to greater levels of internalizing problems (b = 0.33, < .01, model pseudo-R2 = .14). Additionally, we found that ABT significantly moderated the relation (b = 0.18, p < .01, model pseudo-R2 = .17), such that children with greater NSR and ABT exhibited more internalizing. The current results suggest vigilance to social threat may exacerbate the impact of NSR, increasing risk for internalizing behaviors.

2-M-92 Altered brain-behavior relationships underlie attention impairments in very preterm children

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Despite increased rates of ADHD in very preterm (VPT) children, the neural correlates underlying these attention problems remain poorly understood. We performed concurrent neuroimaging and behavioral assessments in a longitudinal sample of 123 children, including 58 VPT (mean gestational age=28 wks, scan age=12.3 yrs) and 64 full-term (FT; mean gestational age=39 wks, scan age=12.2 yrs) children. Resting state-functional MRI data were acquired on a 3T GE scanner (TR/TE=2500/35ms; voxels 3.75×3.75×4mm3). Data were motion scrubbed (FD<.2mm), with 5 minutes of low-motion data required. Selective, sustained and executive attention were assessed with the Test of Everyday Attention-Children (TEACh). VPT children obtained poorer sustained and executive attention scores than FT children (p<.05). Associations between attentional performance and functional connectivity (FC) were assessed within and between groups using permutations of correlation values, enrichment, and McNemar statistics. Enrichment analyses of rs-fMRI data revealed that FT, but not VPT children, demonstrated expected brain-attention associations involving frontoparietal (FPN), dorsal attention (DAN), and cingulo opercular (CO) FC networks. In contrast, VPT children exhibited stronger clustering of brain-behavior relationships than FT children between ventral attention and visual networks. These results highlight the role of FPN, DAN, and CO networks in regulating attentional abilities in typically

developing children, as well as key functional brain systems underlying atypical attention development in VPT children.

2-N-93 Reading-induced shifts of cortical speech representations in dyslexic and typically reading children

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Developmental dyslexia is a common learning difficulty characterised by impaired reading fluency and spelling despite adequate schooling opportunities. One of the proposed underlying mechanisms is impaired mapping of visual to auditory speech representations. Here we investigate these mappings in 8-10 year-old typically reading and dyslexic children using fMRI and text-based recalibration. In this paradigm, an ambiguous speech sound between /aba/ and /ada/ is combined with disambiguating text to recalibrate the perception of the speech sound in subsequent auditory-only post-test trials. Previous research in adults shows this shift in the perception of ambiguous speech in typical, but not in dyslexic readers. Our current findings intriguingly show that both typical and dyslexic children do show a behavioural recalibration effect. Preliminary fMRI results point to differences in cortical activation patterns mediating this effect. Whereas typical readers show more activation within the auditory cortex and occipito-temporal areas, dyslexic readers appear to exhibit more activation in parietal and frontal areas. Furthermore, cortical activation within the auditory cortex and superior temporal sulcus scales with reading fluency and accuracy measures across groups. These results not only suggest different mechanisms of reading-related audiovisual learning in developmental dyslexia but also highlight the importance of considering the dynamic nature of reading development when investigating group differences between typical and dyslexic readers.

2-N-94 Brain responses to speech sound changes are associated with familial risk of dyslexia and communication skills in six-month-old infants

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Developmental dyslexia is a heritable difficulty in achieving age-appropriate literacy skills and it hampers the academic success and everyday life of many. Atypical neural auditory processing and difficulties in oral language development are common in children who later develop dyslexia. The early developmental mechanisms of dyslexia need to be understood in order to enable early detection of those at highest risk and to advance preventive interventions. The aim of this study was to investigate the relations between neural speech sound processing, prelinguistic communication skills, and familial risk of dyslexia in infants. We studied six-month-old infants with or without familial risk of dyslexia using electroencephalography (EEG). We investigated cortical discrimination of frequency, duration, and vowel changes in natural speech sounds by recording mismatch responses (MMRs) to a pseudoword and its variants. Prelinguistic communication skills at six months of age were assessed with a parental questionnaire. The preliminary results suggested diminished MMRs to vowel changes and enhanced responses to duration changes in six-month-olds at risk of dyslexia. Furthermore, the MMRs were associated with prelinguistic skills measured at the same age. Overall, our results suggest that neural auditory processing of speech sounds differs between infants with vs. without a familial risk of dyslexia and is associated with prelinguistic communication skills. Neural auditory processing could therefore be a promising neural marker for language development and its disorders.

2-N-95 Inter-symptom relationships between executive function-related behavioural problems and communication skills

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Objective: Converging evidence suggests that children's abilities to use language in social contexts (i.e. pragmatics) is positively related to their social success and negatively related to behavioural problems such as hyperactivity. One possibility is that pragmatic skills and the ability to regulate impulsive behaviours may both rely on executive functions (EF). Alternatively, difficult behaviour might directly limit opportunities for social interaction, thereby impairing the development of communication skills. Here we apply a network analysis approach to explore the inter-relationships between behavioural control, language skills, and EF-related behaviours. Method: The sample consisted of 472 (Mage=9.16, SD =2.17, 70% male) children identified by health and educational professionals as struggling with attention, learning, and/or memory. The partial correlation network of the sub-scales of three parental behavioural reports of EF-related behaviours and language skills was estimated. Results: A clustering coefficient identified three clusters of symptoms broadly corresponding to (1) structural language and learning; (2) emotional aspects of EF and social communication; and (3) cool cognitive EF. Social and pragmatic skills clustered together (cluster 2), with multiple links to both clusters 1 and 3. Clusters 1 and 3 were weakly inter-related, but both were linked to learning. Discussion: These data suggest that cool executive skills are weakly related to structural language, but strongly related to emotional EF, which in turn have direct links with communication skills.

2-N-96 The poor do poorer: how coming from a low-income home impacts brain and language development

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A childhood in poverty negatively impacts brain and cognitive development, with vocabulary being one of the most impacted domains. These differences result in life-long academic and economic implications. Resting state EEG provides insights into how a childhood in poverty may influence brain development. To date, little work has addressed the relationship between poverty, resting state EEG and vocabulary for children raised in the US. Here we study how coming from a low-income home in the US impacts resting state EEG and vocabulary. Participants were 45 low-income and 45 age- and gender-matched higher-income children (ages 8-14 years). Participants' EEG was recorded while alternating between eyes open and closed (resting state). We quantified power changes in alpha (9-12 Hz) and theta (4-8 Hz) during eyes-closed trials. Significantly greater alpha decreases and theta increases were present during resting state for low-income children ($p<.05$). A multiple regression revealed maternal education predicted vocabulary ($\beta=5.3$, $p<.02$), as did the interaction between income and alpha ($\beta=3.78$, $p<.05$), when controlling for bilingualism and age. There was a positive relationship between alpha and vocabulary for low-income children ($\beta=.6.56$, $p<.02$), but not high-income children ($\beta=-1.00$, $p=.71$). We postulate that, when low-income children also demonstrate less alpha activation, which has been linked to delays in the development of executive function skills, word learning from context may become more difficult, hindering vocabulary growth.

2-N-97 Neonatal white matter integrity predicts infant language development

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Background: Infants obtain language skills at an impressive rate, with speech perception measurable by 6-mo age and meaningful speech production by 10-18 mo. We examined if neonatal integrity of fiber tracts implicated in language processing (corpus callosum [CC] and arcuate fasciculus [AF]) is a meaningful predictor of language development at 12-mo. Methods: Diffusion tensor imaging (DTI) was performed in 78 infants at 26.6 days ± 12.2 days post birth. Receptive language development was assessed via the MacArthur-Bates Communicative Development Inventory at 12-mo age. Tract-based fractional anisotropy (FA) was determined using the NA-MIC atlas-based fiber analysis toolkit and corrected for gestational age at birth and age at scan. Associations between regional FA and language development were identified using linear regression models. Results: After multiple comparisons correction, higher neonatal FA was positively associated with receptive language at 12-mo within the genu ($p<0.001$), rostrum ($p<0.001$), and tapetum ($p<0.001$) of the CC and the fronto-parietal left AF ($p=0.008$). Associations were unchanged after adjustment for potentially confounding infant, maternal and environmental characteristics. Conclusions: Newborn CC and AF maturity predicts receptive language at 12-mo. The early emergence of the neural basis for acquiring language skills suggests that origins of impaired language development may lie in the intrauterine period of life.

2-O-98 Do children conserve or estimate quantities in Piagets conservation task? A systematic review and meta-analysis.

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In a typical conservation task, two identical quantities (e.g. glasses of water) are presented to an observing child, and then one of the quantities is transformed (e.g. poured into a wider glass). Young children's failure to understand that certain changes to the appearance of objects do not influence quantity, has long fascinated psychologists (Piaget, 1941). This review tested whether children can pass conservation tasks by directly estimating quantity, as opposed to the prevailing assumption that children need to remember that the amounts were initially equivalent. Using meta-analysis, controlled trials were synthesised comparing children's performance in a standard conservation task to a static conservation task where children only see the post-transformation quantities; such as two equal amounts of water in differently sized glasses. Additionally, correlational studies were synthesised examining associations between conservation and visual quantity estimation tasks. Across 11 studies (1205 participants), children in the standard conservation group were only 11% (95%CI [.01, .23]) more likely to succeed than children in the static conservation group, and this effect decreased in older children. Furthermore, we found that group performance on static conservation tasks predicted mean sample age, and with individual standard conservation performance. These results suggest that visual estimation abilities develop with age and play a significant role in conservation, corroborating hypotheses linking conservation to contemporary number estimation tasks (Gebuis et al., 2016).

2-O-99 The impact of depression on post-stroke recovery and disability: A systematic review and meta-analysis of longitudinal studies

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The brain's adaptive capacity becomes immensely important in the recovery from damage, such as stroke. Following stroke, recovery allows patients to return to life as much as possible by regaining and relearning the skills of everyday living; it occurs primarily during the first months after stroke and can be augmented by rehabilitation. Depression during the phase of stroke recovery has been hypothesised to interfere with learning and plasticity, thereby leading to poor recovery and disability. We systematically summarized longitudinal studies on the effect of post-stroke depression on indicators of recovery of activities to assess evidence for this hypothesis. In total, 27 longitudinal studies examining the impact of depression on recovery during stroke rehabilitation (n = 11), subsequent changes (n = 3) or long-term disability (n = 13) were identified. Results indicate that depression does not hamper improvements during rehabilitation but is consistently associated with disability. In contrast, depression after stroke might contribute to poor long-term outcomes (logOR 0.73, 95% CI [0.51, 0.94], $p < 0.001$), although results of bias assessments suggest that publication bias and limitations in study quality led to an overestimation of this effect. These results suggest that depression might not hamper plasticity and change during stroke recovery per se, but might assert a negative long-term effect, potentially via accelerating functional decline. To further examine these complex temporal dynamics during stroke recovery, high-quality longitudinal studies are desirable.

2-O-100 Pubertal testosterone correlates with adolescent impatience and dorsal striatal activity

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Recent self-report and behavioral studies have demonstrated that pubertal testosterone is related to an increase in risky and impulsive behavior. Yet, the mechanisms underlying such a relationship are poorly understood. Findings from both human and rodent studies point towards distinct striatal pathways including the ventral and dorsal striatum as key target regions for pubertal hormones. In this study we investigated task-related impatience of boys between 10 and 15 years of age (N = 75), using an intertemporal choice task combined with measures of functional magnetic resonance imaging and hormonal assessment. Increased levels of testosterone were associated with a greater response bias towards choosing the smaller sooner option. Furthermore, our results show that testosterone specifically modulates dorsal, not ventral, striatal function. These results provide novel insights into our understanding of adolescent impulsive and risky behaviors and how pubertal hormones impact neural processes.

2-O-101 Persistent structural differences in developmental dyscalculia: a longitudinal morphometry study

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Developmental dyscalculia (DD) is a learning disability affecting the acquisition of arithmetical skills. Studies reveal persistent deficits in number processing and differences in the structural brain of DD subjects. Reduced grey matter (GM) has been reported in DD for the posterior parietal cortex, intraparietal sulcus (IPS), but also the frontal and the occipito-temporal cortex. To date, the longitudinal development of these structural differences is unknown. Therefore, we investigated the developmental trajectory of GM volumes in children with and without DD. In this longitudinal study, behavioural measures and structural images were collected twice with an interval of 4y from 15 DD and 11 typically developing (TD) children (8-10y). Voxel-wise estimation of GM volumes was assessed by means of voxel-based morphometry. DD children show persistently reduced GM in the left (pre)cuneus, left inferior parietal lobe, right superior occipital gyrus/IPS, the anterior cingulate cortex and right insula. Over developmental, a general decrease in the left precuneus and superior parietal lobe was revealed for TD and DD children. Our results are in line with evidence showing reduced GM in the fronto-parietal regions for DD children. Our study further sheds light on the trajectory of brain development, revealing a decrease in GM that resembles the development of TD children. However, GM differences persist in children with DD from childhood into adolescence. In summary, our results show that DD is a persistent learning disorder accompanied by reduced GM in number-related brain areas.

2-O-102 Functional brain connectivity study in children who differ in temperamental self-regulation*

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This study addresses the functional brain connectivity differences in children who differ in temperamental self-regulation. Parents of 71 children (38 boys; age = 9 ± 1.2) reported self-regulatory and reactivity (reversed) scales from the Temperament in the Middle Childhood Questionnaire (Simonds & Rothbart, 2006), and according to their scores children were classified as high or low in self-regulation (SR) skills. Echo-planar neuroimaging at rest was performed within a 1.5 T magnetic scanner. Age-corrected group differences in functional connectivity were observed within two self-regulation related networks: the Orbitofrontal Cortex (OFC), and the anterior default mode network (aDMN). The anterior cingulate cortex (aDMN) and the frontal pole (OFC) clusters resulted more disconnected in low- compared to high-SR children. Seed based functional connectivity analyses showed that the well-stablished anti-correlation between aDMN and task-related areas was reduced in low-SR children. Moreover, low-SR children showed a reduced connectivity between the OFC cluster and secondary visual areas. The results revealed that children who differed in SR showed differences in functional connectivity in areas related to executive attention. The reduced anti-correlation between aDMN cluster and task-related areas in children with poorer SR abilities might be interpreted as a biological marker of their difficulty to control their attention and their behavior. These findings contribute to our knowledge of the neural basis underlying individual differences in temperamental self-regulation.

2-P-102 Different developmental trajectories for working memory and reinforcement learning contributions to learning in adolescence

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Multiple neurocognitive systems contribute simultaneously to human decision making and learning. For example, the striatum uses dopamine signaling to slowly learn from rewards which choices are most valuable, a form of reinforcement learning. Prefrontal cortex (PFC) executive functions contribute other computations, such as actively maintaining single trial information in working memory or signaling a need to switch strategy. How the systems work together is not well understood. We investigate the developmental trajectory of their contributions to learning across adolescence. We predicted that behaviors dependent on striatal function would stabilize earlier than those dependent on PFC. We collected measures of learning in 180 youth (ages 8-17 years) and 53 adults (ages 25-30) using four reward learning tasks, including a task designed to separate out contributions of working memory from reinforcement learning. We used computational modeling to identify individual markers of working memory and reinforcement learning. Contrary to our prediction, we found no effect of age on working memory. However, we found strong effects of age on reinforcement learning processes: learning rates increased linearly with age. Furthermore, younger participants were also significantly more likely to neglect negative feedback. These results shed new light on the developmental science of learning in adolescence: children showed adult level of working-memory contributions to learning, and their weaker overall performance was linked to reinforcement learning, rather than executive processes.

2-P-103 Neural signatures of probabilistic reversal learning: a developmental computational modeling approach

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Cognitive flexibility is essential to navigate through an ever-changing environment and can be examined using reversal learning (RL) tasks. Although computational modeling is increasingly used to infer psychological mechanisms in cognitive neuroscience, developmental approaches are still scarce. We investigated 18 typically developing (TD) children (8 - 12 years of age) and 18 TD adolescents (13 - 18 years of age) using a probabilistic reversal learning task with either social or individualized feedback during fMRI scanning, and additional runs outside the scanner. Behavioral responses were modeled in two variants of a Hierarchical Gaussian Filter (HGF) model and a simple Rescorla-Wagner learning model. The results suggest that children make more overall and regressive errors, while less perseverative errors than adolescents. Behavioral responses were best explained by an HGF model containing the volatility parameter omega (which was significantly smaller in children than in adolescents). This may indicate that children have a bias towards updating their estimation of the prediction strength for a rewarding outcome slower than adolescents, resulting in less efficient learning in the context of an unstable, switching environment. The decision parameter β was correlated with an index of stereotypical behavior (SRS-RBB), suggesting a relation between inflexible behavioral patterns and reduced exploration behavior. Analysis of the fMRI data are currently conducted and will be presented and discussed at the meeting.

2-P-104 Emerging functional specialisation in the ventral occipital cortex of prereaders: An EEG-fMRI study on visual character processing

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The ventral occipitotemporal (vOT) cortex serves as a core region for visual processing. Distinct patches show preferential activation for processing different visual categories such as faces, print, or numbers. The emergence of such functional specialization in the human cortex represents a pivotal developmental process, which sets the basis for targeted and efficient information processing. However, it remains largely unclear, how such functional specialisation in the human cortex emerges during child development. Methods Neural correlates of print processing were tracked with simultaneous high-density electroencephalography and functional magnetic resonance imaging in 18 pre-reading children (aged 6.7±0.36y). The effect of varying expertise to characters on neural activation was examined, firstly, by training false font-speech sound associations, and secondly, by comparing characters differing in the expertise acquired through abundant exposure in the everyday environment (digits, letters, false fonts). Results We found a training performance and expertise dependent activation of the visual event-related potential around 220ms (N1) and of the corresponding vOT BOLD response. Furthermore, functional connectivity between the vOT and left inferior parietal regions was increased with regard to better training performance. Conclusion To summarize, our results demonstrate that learning enhances preferential activation for characters in the vOT and emphasize the critical role of the rapidly emerging connectivity during specialisation.

2-P-105 Lifespan developmental differences in the effects of opportunity costs on cognitive effort

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Previous work suggests that lifespan developmental differences in cognitive control abilities might be due to maturational and aging-related changes in prefrontal cortex functioning. However, there are also alternative explanations: For example, it could be that children and older adults differ from younger adults in how they balance the effort of engaging in control against its potential benefits. In this work we assume that the degree of engagement in cognitive effort depends on the opportunity cost of time (average reward rate per unit time). If the average reward rate is high, subjects should speed up responding whereas if it is low, they should respond more slowly. Developmental changes in opportunity cost assessments may lead to differences in the sensitivity to changes in reward rate. To examine this hypothesis in children, younger and older adults, we use two well-established cognitive control tasks, an Erikson Flanker and a task-switching paradigm with a reward rate manipulation. Descriptive analyses show impairments in cognitive control in children and older adults compared to younger adults during task switching, but not during conflict monitoring. In both tasks reward magnitude modulates cognitive control. That is, subjects respond faster and are more error-prone when reward is high compared to when it is low. However, these effects don't differ as a function of age. In future computational analyses we will focus on the effects of average reward rate rather than reward magnitude on lifespan age differences in cognitive control engagement.

**denotes Flash Talk presentation as well as poster presentation*