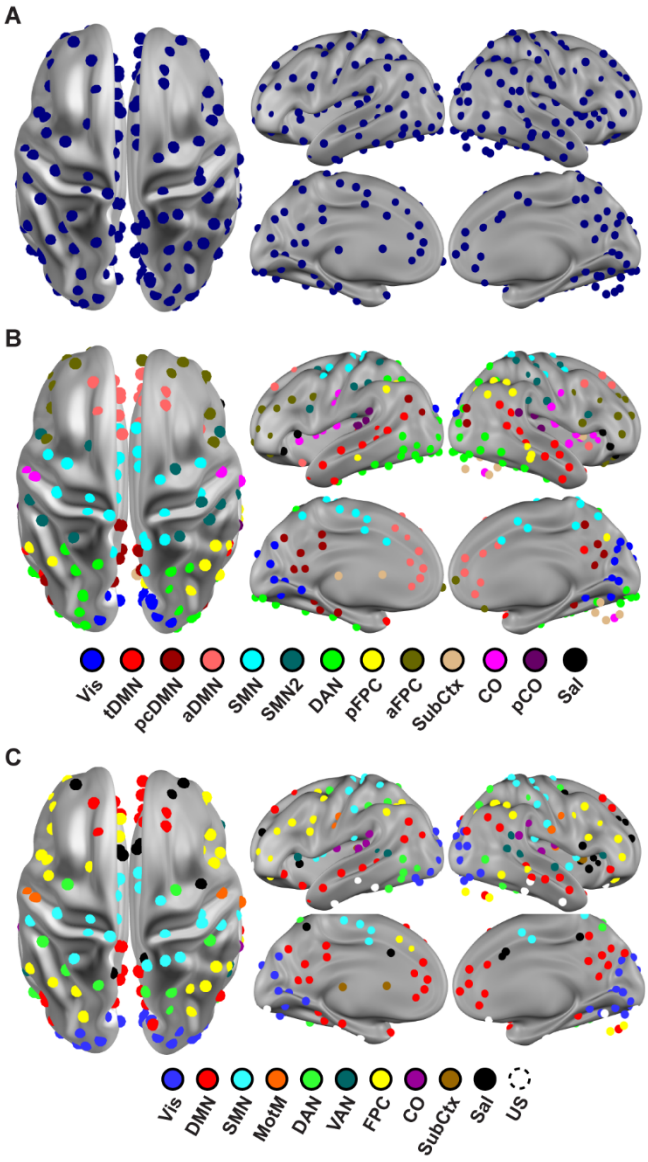
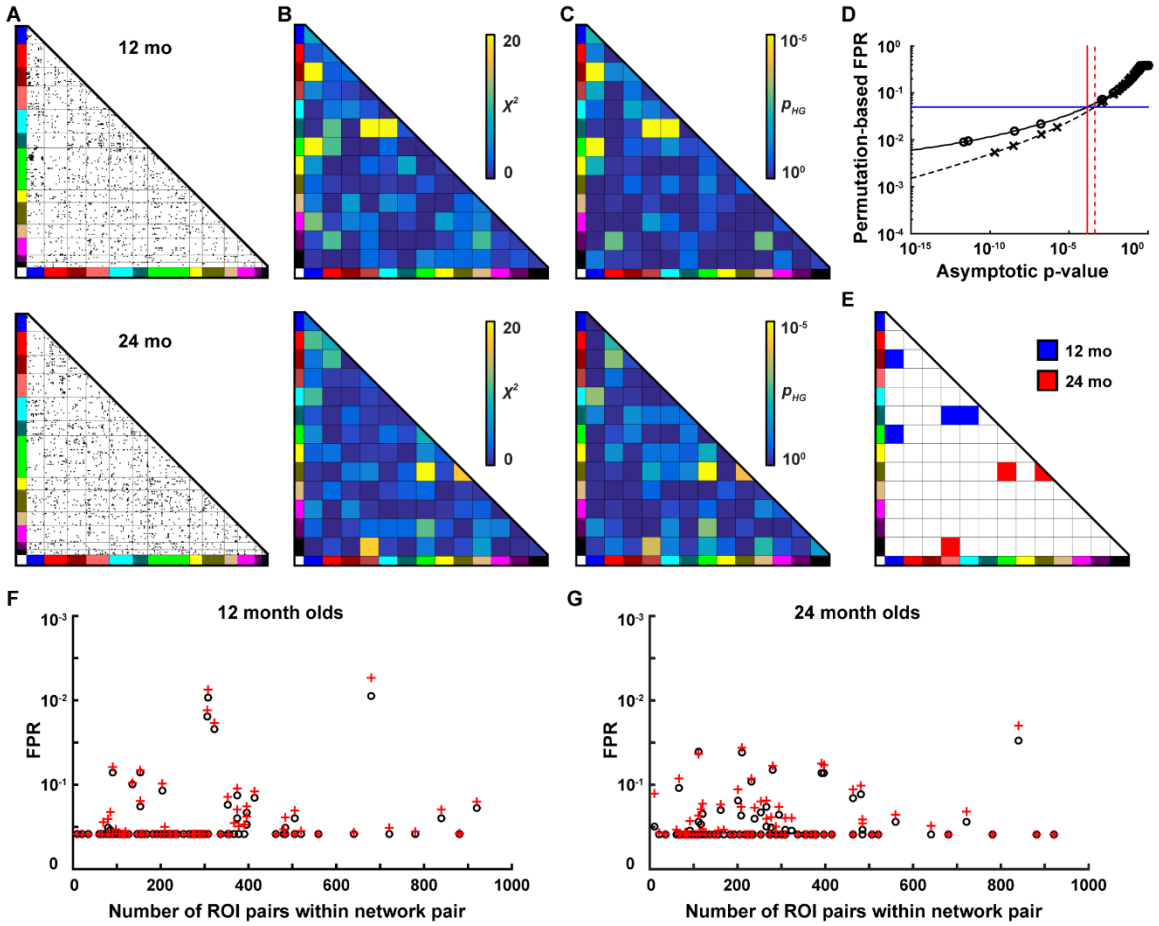
Supplementary Figures and Tables

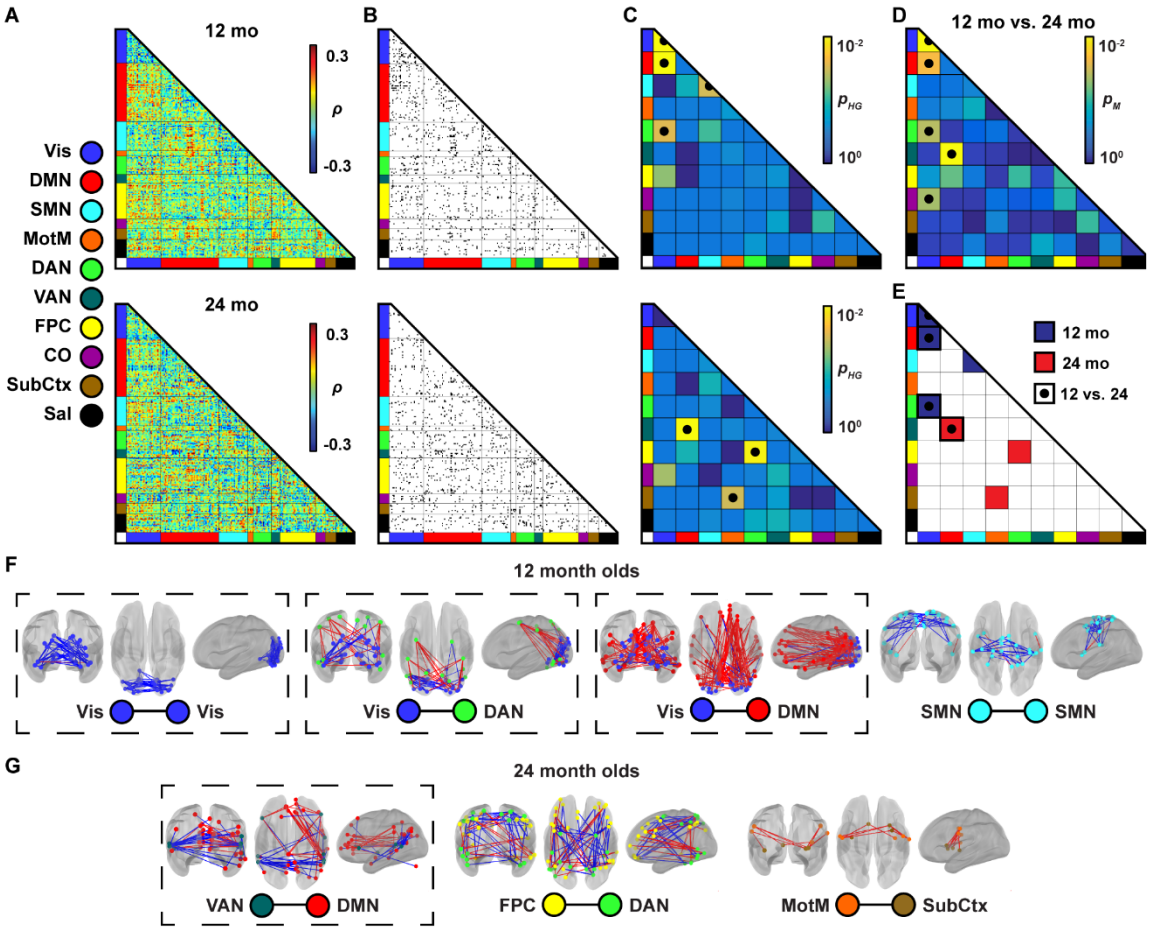


Supplementary Figure 1. Defining the infant – toddler brain functional network structure. **(A)** The 230 ROIs used in the current study. **(B)** Consensus Infomap model of the network structure using fcMRI data from 48 children with fcMRI data at both the 12 mo and 24 mo time points (network abbreviations are given in the Materials and Methods). **(C)** Adapted model of adult functional networks (Power et al. 2011).



Supplementary Figure 2. Enrichment analysis detail. (A) To quantify the relative clustering of strong brain-behavior correlations (black dots reflect an uncorrected Spearman correlation *p*-value ≤ 0.05) within specific network pairs, enrichment is assessed using both **(B)** χ^2 and **(C)** hypergeometric statistics. **(D)** Significance was determined via a permutation-based false positive rate (FPR). The asymptotic *p*-value reflects the probability of the measured statistic assuming infinitely many samples. Data for 12 mo is shown as an example. (Black lines: the brain-wide FPR represents the frequency of a given asymptotic *p*-value occurring in any network-pair in the randomization. Blue line: 0.05 significance threshold in the FPR. Red lines: threshold in asymptotic values. Solid lines - χ^2; Dotted lines - hypergeometric. Black circles: network-pair specific χ^2. Black x's: network-pair specific hypergeometric statistics.) **(E)** Significantly enriched network pairs are unique to each age group; blue - 12 mo., red - 24 mo. **(F,G)** Permutation based false positive rate (FPR) is independent of the number of ROI-pairs

within a given network pair for both **(F)** 12 month olds and **(G)** 24 month olds. Red '+' denote χ^2. Black circles denote hypergeometric.



Supplementary Figure 3. Brain-behavior analyses using adult-based functional networks. **(A)** Brain-behavior correlation matrices with groupings based on adult functional network structure. **(B)** Brain-behavior correlations with $p \leq 0.05$. **(C)** Hypergeometric statistic calculated for each network block reveals a differing set of implicated pairs at each age. **(D)** Significant differences in the brain-behavior relationships between age groups are observed in a minority of possible network pairs, as seen with the infant-toddler networks. **(E)** Three functional network pairs significantly enriched at 12 mo (■) and one at 24 mo (■) also exhibit significant differences across age groups (◙). **(F)** At 12 mo, ROI pairs within implicated functional network pairs reveal negative brain-behavior correlations in intra-network connections (Vis-Vis and SMN-SMN) and mixed positive and negative correlations in connections between the Vis-DAN and Vis-DMN networks. **(G)** At 24 mo, mixed correlations are in connections between VAN-DMN and FPC-DMN and positive correlations are seen in connections between MotM-

SubCtx. Boxes represent those network pairs both significantly enriched and different across age in their brain-behavior relationships.

Supplementary Table 1. Demographics.

Age group	Sample size with CSBS, clean fcMRI, and both	Number of LR-, HR-, HR+ participants*	Number of males*	Mean IJA score* (SD)	Mean Mullen early learning composite score* (SD)	Age in months* (mean, SD)
12 mo	429, 135, 116	28, 71, 11	75	1.6 (1.5)	99.8 (14.1)	12.6 (0.6)
24 mo	384, 107, 98	21, 63, 14	56	3.5 (1.8)	100.9 (20.2)	24.6 (0.7)

* Numbers reflect the group of participants providing both CSBS and clean fcMRI data

CSBS: Communication and Symbolic Behavioral Scales

fcMRI: functional connectivity Magnetic Resonance Imaging

IJA: Initiation of Joint Attention

LR-: Low-risk, negative ASD diagnosis

HR-: High-risk, negative ASD diagnosis

HR+: High-risk, positive ASD diagnosis

SD: Standard deviation

Supplementary Table 2. Significant network pair statistics.

Network pair	Age group	χ^2 statistic	χ^2 asymp. *p*	χ^2 FPR *p*	HG asymp. *p*	HG FPR *p*	MN χ^2	MN asymp. *p*	MN FPR *p*
Vis-pcDMN	12 mo	34.9	$3.5x10^{-9}$	$1.6x10^{-2}$	$1.8x10^{-7}$	$1.3x10^{-2}$	17.9	$1.2x10^{-5}$	$2.2x10^{-2}$
Vis-DAN	12 mo	49.3	$2.2x10^{-12}$	$8.9x10^{-3}$	$1.9x10^{-10}$	$5.4x10^{-3}$	27.6	$7.5x10^{-8}$	$6.5x10^{-3}$
SMN2-aDMN	12 mo	48.1	$4.1x10^{-12}$	$9.4x10^{-3}$	$3.0x10^{-9}$	$7.5x10^{-3}$	7.7	$2.7x10^{-3}$	$1.1x10^{-1}$
SMN2-SMN	12 mo	27.4	$1.7x10^{-7}$	$2.2x10^{-2}$	$1.8x10^{-6}$	$1.9x10^{-2}$	4.3	$2.0x10^{-2}$	$2.1x10^{-1}$
aFPC-DAN	24 mo	22.2	$2.5x10^{-6}$	$3.0x10^{-2}$	$2.4x10^{-6}$	$2.0x10^{-2}$	5.9	$7.5x10^{-3}$	$1.5x10^{-1}$
aFPC-aFPC	24 mo	17.3	$3.2x10^{-5}$	$4.1x10^{-2}$	$8.4x10^{-5}$	$3.6x10^{-2}$	4.6	$1.6x10^{-2}$	$2.0x10^{-1}$
Sal-aDMN	24 mo	17.6	$2.7x10^{-5}$	$4.0x10^{-2}$	$1.9x10^{-4}$	$4.3x10^{-2}$	12.3	$5.8x10^{-4}$	$6.6x10^{-2}$
tDMN-tDMN	12 mo 24 mo	4.3 8.2	$9.9x10^{-1}$ $4.3x10^{-3}$	$3.9x10^{-1}$ $9.1x10^{-2}$	$9.9x10^{-1}$ $4.0x10^{-3}$	$3.9x10^{-1}$ $8.4x10^{-2}$	12.5	$2.1x10^{-4}$	$5.0x10^{-2}$

HG: Hypergeometric

MN: McNemar

FPR: False positive rate

Asymp.: Asymptotic

Vis: Visual Network

pcDMN: posterior cingulate Default Mode Network

DAN: Dorsal Attention Network

SMN2: Somato Motor Network 2

SMN: Somato Motor Network

aFPC: anterior Fronto-Parietal Control network

Sal: Salience network

aDMN: anterior DMN

tDMN: temporal DMN