Table S1

Mapping brain regions to cortical segmentation in the Desikan atlas and subcortical segmentation in FreeSurfer

Model	Brain Region	Desikan Atlas / FreeSurfer Region
Cognitive control system	Dorsolateral Prefrontal Cortex (dlPFC)	Middle frontal gyrus
	Anterior Cingulate Cortex (ACC)	Caudal anterior cingulate cortex Rostral anterior cingulate cortex
Socio-emotional system	Orbitofrontal Cortex (OFC)	Medial orbitofrontal cortex Lateral orbitofrontal cortex
	Medial Prefrontal Cortex (mPFC)	Medial orbitofrontal cortex Superior frontal gyrus
	Amygdala	Amygdala
	Ventral Striatum (VS)	Nucleus accumbens
Default Mode Network	Dorsal Medial Prefrontal Cortex (dmPFC)	Superior frontal gyrus (medial)
	Anterior Medial Prefrontal Cortex (amPFC)	Medial orbitofrontal cortex
	Ventral Medial Prefrontal Cortex (vmPFC)	Medial orbitofrontal cortex
	Posterior Cingulate Cortex (PCC)	Posterior cingulate cortex
	Precuneus	Precuneus
	Lateral Temporal Cortex (LTC)	Middle temporal gyrus Superior temporal gyrus
	Inferior Parietal Lobule (IPL)	Inferior parietal cortex Supramarginal gyrus
	Retrosplenial Cortex (Rsp)	Isthmus cingulate cortex
	Hippocampal Formation (HF)	Hippocampus
	Parahippocampal Cortex (PHC)	Parahippocampal gyrus
	Angular Gyrus	Angular gyrus
	Temporal Pole	Temporal pole
	Superior Frontal Gyrus	Superior frontal gyrus
	Inferior Frontal Gyrus	Inferior frontal gyrus (pars triangularis, pars opercularis, pars orbitalis)
	Striatum (Caudate & Posterior Putamen)	Caudate nucleus Putamen)
	Cerebellum	Cerebellum
Salience Network	Anterior Insula (AI)	Insula
	Dorsal Anterior Cingulate Cortex (dACC)	Caudal anterior cingulate cortex
	Right Fronto-Insular Cortex (rFIC)	Insula Inferior frontal gyrus (pars opercularis)
	Ventral Striatum (VS)	Nucleus accumbens
	Thalamus	Thalamus

Table S2

Predictors in neural domains

System	Brain Regions	Domain (Size)
Cognitive Control System	Dorsolateral Prefrontal Cortex (dlPFC) * Anterior Cingulate Cortex (ACC) *	GMV(8) CT(8) rsfMRI (8) fMRI SST (56) fMRI MID (80) fMRI nback (72)
Socio-emotional System	Orbitofrontal Cortex (OFC) * Medial Prefrontal Cortex (mPFC) * Amygdala Ventral Striatum (VS) *	GMV(10) CT(6) rsfMRI (10) fMRI SST (70) fMRI MID (100) fMRI nback (90)
Default Mode Network	Dorsal Medial Prefrontal Cortex (dmPFC) * Anterior Medial Prefrontal Cortex (amPFC) Ventral Medial Prefrontal Cortex (vmPFC) * Posterior Cingulate Cortex (PCC) * Precuneus * Lateral Temporal Cortex (LTC) Inferior Parietal Lobule (IPL) * Retrosplenial Cortex (Rsp) Hippocampal Formation (HF) * Parahippocampal Cortex (PHC) * Angular Gyrus * Temporal Pole * Superior Frontal Gyrus * Inferior Frontal Gyrus * Striatum (Caudate & Posterior Putamen) * Cerebellum	GMV(38) CT(28) rsfMRI (38) fMRI SST (266) fMRI MID (380) fMRI nback (342)
Salience Network	Anterior Insula (AI) * Dorsal Anterior Cingulate Cortex (dACC) * Right fronto-insular cortex (rFIC) * Ventral Striatum (VS) * Thalamus *	GMV(14) CT(10) rsfMRI (14) fMRI SST (98) fMRI MID (140) fMRI nback (126)

Note. The term *size* refers to the number of predictors. *Dual system model*: list of brain regions based on (Steinberg et al., 2008), (Shulman et al., 2016), (Mennigen et al., 2014), & (Luna, Padmanabhan, & O'Hearn, 2010). *Default mode network*: list of brain regions based on (Buckner, Andrews-Hanna, & Schacter, 2008), (Andrews-Hanna, Reidler, Sepulcre, Poulin, & Buckner, 2010; Andrews-Hanna, Smallwood, & Spreng, 2014) , & (Thomas Yeo et al., 2011). *Salience network*: list of brain regions based on (Seeley et al., 2007), (Uddin, 2015; Uddin, Supekar, Ryali, & Menon, 2011). GMV = Gray matter volume, CT = Cortical thickness, rsfMRI = Resting state fMRI, SST = Stop-signal task, MID = Monetary incentive delay, nback = emotional nBack task. The asterix * marks brain regions and other predictors that have been found associated with delayed discounting in previous research.

Table S3

Predictors in cognitive and sociodemographic domains

	Instrument	Cognitive skill	Measure
Cognitive skills	NIH Toolbox:		
	Pattern Comparison Processing Speed Test	Processing speed	Uncorrected stand. score
	Oral Reading Recognition Task	Reading decoding *	Uncorrected stand. score
	Picture Sequence Memory Test	Episodic memory	Uncorrected stand. score
	Flanker Inhibitory Control & Attention Task	Inhibition & Attention	Uncorrected stand. score
	Picture Vocabulary Test	Language comprehension*	Uncorrected stand. score
	Little Man Task	Visuospatial processing *	Efficiency score
	Rey Auditory Verbal Learning Test	Auditory learning, memory, & recognition	Average number of correctly memorized words across trials
		Characteristic	**Source**
Socio-demographics		Gender	Guardian
		Age	Guardian
		Household income *	Guardian
		Education *	Guardian
		Ethnicity	Guardian
		Marital status *	Guardian
		Gender	Child
		Age *	Child

Note. The asterix denotes cognitive skills or sociodemographic characteristics that were found associated with delay discounting in previous studies. The cognitive skills were reading decoding (Yeh, Myerson, & Green, 2021), language comprehension (Yeh et al., 2021), visuospatial processing (Yeh et al., 2021), and non-verbal reasoning (Shamosh & Gray, 2008; Yeh et al., 2021). The sociodemographics were age (Scheres, Tontsch, Thoeny, & Sumiya, 2014), parental marital status (Sloan, Sanches, Tanabe, & Gowin, 2023), and proxies of SES, such as guardian's household income, education, and ethnicity (Assari, 2020). Gender shows to play no major role for delay discounting behavior in children and adolescent samples where no major disorder is present (Doidge, Flora, & Toplak, 2021)

Table S4

fMRI tasks and their contrasts

Task	Contrasts	**Task description**
Stop-Signal Task (SST)	Any stop versus correct go Correct go versus fixation Correct stop versus correct go Correct stop versus incorrect stop Incorrect go versus correct go Incorrect go versus incorrect stop Incorrect stop versus correct go	The SST assesses impulsivity and impulse control. Participants press a button indicating an arrow's direction unless a 'stop' signal appears, requiring them to suppress their response. The stop signal timing adjusts dynamically to maintain a 50% success rate (Casey et al., 2018).
Monetary Incentive Delay Task (MID)	Anticipation of large loss versus neutral Anticipation of large reward versus neutral Anticipation of large versus small loss Anticipation of large reward versus small reward Anticipation of loss versus neutral Anticipation of reward versus neutral Anticipation of small loss versus neutral Anticipation of small reward versus neutral Loss positive versus negative feedback Reward positive versus negative feedback	The MID task examines reward processing and anticipation. Participants see cues indicating potential monetary gains or losses, followed by an anticipation phase and a task to press a button within a time limit. This is followed by feedback. The target display time adjusts automatically to reach an accuracy rate of 60% (Casey et al., 2018).
Emotional nBack Task	0 back versus all other 2 back versus all other 2 back versus 0 back Emotion versus all other Emotion versus neutral face Negative face versus neutral face Positive face versus neutral face Face versus place Place versus all other	The emotional nBack task engages working memory and emotion regulation. Participants see blocks of pictures showing faces with positive, negative or neutral expressions and places. They then determine whether the current image matches a previously shown image, either from the beginning of the block (0-back) or two trials earlier (2-back), varying the cognitive load (Casey et al., 2018).

References

Andrews-Hanna, J. R., Reidler, J. S., Sepulcre, J., Poulin, R., & Buckner, R. L. (2010). Functional-anatomic fractionation of the brain's default network. *Neuron*, *65*(4), 550–562. doi: 10.1016/j.neuron.2010.02.005

Andrews-Hanna, J. R., Smallwood, J., & Spreng, R. N. (2014). The default network and self-generated thought: Component processes, dynamic control, and clinical relevance. *Annals of the New York Academy of Sciences*, *1316*(1), 29–52. doi: 10.1111/nyas.12360

Assari, S. (2020). Social determinants of delayed gratification among american children. *Caspian Journal of Neurological Sciences*, *6*(3), 181-189. doi: 10.32598/CJNS.6.22.2

Buckner, R. L., Andrews-Hanna, J. R., & Schacter, D. L. (2008). The brain's default network: Anatomy, function, and relevance to disease. *Annals of the New York Academy of Sciences*, *1124*, 1–38. doi: 10.1196/annals.1440.011

Casey, B., Cannonier, T., Conley, M. I., Cohen, A. O., Barch, D. M., Heitzeg, M. M., ... the ABCD Imaging Acquisition Workgroup (2018). The adolescent brain cognitive development (abcd) study: Imaging acquisition across 21 sites. *Developmental Cognitive Neuroscience*, *32*, 43-54. doi: 10.1016/j.dcn.2018.03.001

Doidge, J. L., Flora, D. B., & Toplak, M. E. (2021). A meta-analytic review of sex differences on delay of gratification and temporal discounting tasks in adhd and typically developing samples. *Journal of Attention Disorders*, *25*(4), 540-561. doi: 10.1177/1087054718815588

Luna, B., Padmanabhan, A., & O'Hearn, K. (2010). What has fmri told us about the development of cognitive control through adolescence? *Brain and cognition*, *72*(1), 101-113.

Mennigen, E., Rodehacke, S., Müller, K. U., Ripke, S., Goschke, T., & Smolka, M. N. (2014). Exploring adolescent cognitive control in a combined interference switching task. *Neuropsychologia*, *61*, 175-189.

Scheres, A., Tontsch, C., Thoeny, A. L., & Sumiya, M. (2014). Temporal reward discounting in children, adolescents, and emerging adults during an experiential task. *Frontiers in Psychology*, *5*, 711. doi: 10.3389/fpsyg.2014.00711

Seeley, W. W., Menon, V., Schatzberg, A. F., Keller, J., Glover, G. H., Kenna, H., ... Greicius, M. D. (2007). Dissociable intrinsic connectivity networks for salience processing and executive control. *The Journal of neuroscience*, *27*(9), 2349-2356.

Shamosh, N. A., & Gray, J. R. (2008). Delay discounting and intelligence: A meta-analysis. *Intelligence*, *36*, 289-305. doi: 10.1016/j.intell.2007.09.004

Shulman, E. P., Smith, A. R., Silva, K., Icenogle, G., Duell, N., Chein, J., & Steinberg, L. (2016). The dual systems model: Review, reappraisal, and reaffirmation. *Developmental Cognitive Neuroscience*, *17*, 103–117.

Sloan, M. E., Sanches, M., Tanabe, J., & Gowin, J. L. (2023). Delay discounting and family history of psychopathology in children ages 9–11. *Scientific Reports*, *13*, 21977. doi: 10.1038/s41598-023-49148-4

Steinberg, L., Albert, D., Cauffman, E., Banich, M., Graham, S., & Woolard, J. (2008). Age differences in sensation seeking and impulsivity as indexed by behavior and self-report: Evidence for a dual systems model. *Developmental Psychology*, *44*(6), 1764–1778. doi: 10.1037/a0012955

Thomas Yeo, B. T., Krienen, F. M., Sepulcre, J., Sabuncu, M. R., Lashkari, D., Hollinshead, M., ... Buckner, R. L. (2011). The organization of the human cerebral cortex estimated by intrinsic functional connectivity. *Journal of neurophysiology*, *106*(3), 1125-1165.

Uddin, L. Q. (2015). Salience processing and insular cortical function and dysfunction. *Nature Reviews Neuroscience*, *16*, 55–61. doi: 10.1038/nrn3857

Uddin, L. Q., Supekar, K. S., Ryali, S., & Menon, V. (2011). Dynamic reconfiguration of structural and functional connectivity across core neurocognitive brain networks with development. *The Journal of neuroscience*, *31*(50), 18578-18589.

Yeh, Y.-H., Myerson, J., & Green, L. (2021). Delay discounting, cognitive ability, and personality: What matters? *Psychonomic Bulletin & Review*, *28*, 686-694. doi: 10.3758/s13423-020-01777-w