



Universiteit
Leiden
The Netherlands

Free won't : neurobiological bases of the development of intentional inhibition

Schel, M.A.

Citation

Schel, M. A. (2015, January 22). *Free won't : neurobiological bases of the development of intentional inhibition*. Retrieved from <https://hdl.handle.net/1887/32213>

Version: Corrected Publisher's Version

License: [Licence agreement concerning inclusion of doctoral thesis in the Institutional Repository of the University of Leiden](#)

Downloaded from: <https://hdl.handle.net/1887/32213>

Note: To cite this publication please use the final published version (if applicable).

Cover Page



Universiteit Leiden



The handle <http://hdl.handle.net/1887/32213> holds various files of this Leiden University dissertation.

Author: Schel, Margot Antoinette

Title: Free won't : neurobiological bases of the development of intentional inhibition

Issue Date: 2015-01-22

References

A

- Ainslie, G. (2005). Precis of Breakdown of Will. *Behavioral Brain Sciences*, 28(5), 635-650; discussion 650-673.
- Albert, J., Lopez-Martin, S., & Carretié, L. (2010). Emotional context modulates response inhibition: Neural and behavioral data. *Neuroimage*, 49(1), 914-921.
- Aron, A. R. (2011). From Reactive to Proactive and Selective Control: Developing a Richer Model for Stopping Inappropriate Responses. *Biological Psychiatry*, 69(12), E55-E68.
- Aron, A. R., Behrens, T. E., Smith, S., Frank, M. J., & Poldrack, R. A. (2007). Triangulating a cognitive control network using diffusion-weighted magnetic resonance imaging (MRI) and functional MRI. *Journal of Neuroscience*, 27(14), 3743-3752.
- Aron, A. R., & Poldrack, R. A. (2006). Cortical and subcortical contributions to stop signal response inhibition: Role of the subthalamic nucleus. *Journal of Neuroscience*, 26(9), 2424-2433.
- Aron, A. R., Robbins, T. W., & Poldrack, R. A. (2004). Inhibition and the right inferior frontal cortex. *Trends in Cognitive Sciences*, 8(4), 170-177.

B

- Band, G. P., van der Molen, M. W., & Logan, G. D. (2003). Horse-race model simulations of the stop-signal procedure. *Acta psychologica*, 112(2), 105-142.
- Barkley, R. A., Edwards, G., Laneri, M., Fletcher, K., & Metevia, L. (2001). Executive functioning, temporal discounting, and sense of time in adolescents with attention deficit hyperactivity disorder (ADHD) and oppositional defiant disorder (ODD). *J Abnormal Child Psychology*, 29(6), 541-556.
- Beissner, F., Meissner, K., Bar, K. J., & Napadow, V. (2013). The autonomic brain: an activation likelihood estimation meta-analysis for central processing of autonomic function. *Journal of Neuroscience*, 33(25), 10503-10511.
- Berntson, G. G., Quigley, K. S., & Lozano, D. (2007). Cardiovascular psychophysiology. In J. T. Cacioppo, L. G. Tassinary & G. G. Berntson (Eds.), *Handbook of psychophysiology*. Cambridge: Cambridge University Press.
- Blakemore, S. J. (2008). The social brain in adolescence. *Nature Reviews Neuroscience*, 9(4), 267-277.
- Blakemore, S. J., & Robbins, T. W. (2012). Decision-making in the adolescent brain. *Nature Neuroscience*, 15(9), 1184-1191.
- Booth, J. R., Burman, D. D., Meyer, J. R., Lei, Z., Trommer, B. L., Davenport, N. D., et al. (2003). Neural development of selective attention and response inhibition. *Neuroimage*, 20(2), 737-751.
- Börger, N., & van der Meere, J. (2000). Motor control and state regulation in children with ADHD: a cardiac response study. *Biological Psychology*, 51(2-3), 247-267.

- Bradley, M. M. (2009). Natural selective attention: orienting and emotion. *Psychophysiology*, 46(1), 1-11.
- Brass, M., & Haggard, P. (2007). To do or not to do: The neural signature of self-control. *Journal of Neuroscience*, 27(34), 9141-9145.
- Brass, M., & Haggard, P. (2008). The What, When, Whether model of intentional action. *Neuroscientist*, 14(4), 319-325.
- Brass, M., Lynn, M. T., Demanet, J., & Rigoni, D. (2013). Imaging volition: what the brain can tell us about the will. *Experimental Brain Research*.
- Brett, L., Anton, J. L., Valabregue, R., & Poline, J. B. (2002). Region of interest analysis using an SPM toolbox. *Neuroimage*, 16, 497.
- Britton, J. C., Taylor, S. F., Sudheimer, K. D., & Liberzon, I. (2006). Facial expressions and complex IAPS pictures: Common and differential networks. *Neuroimage*, 31(2), 906-919.
- Brody, A. L., Mandelkern, M. A., Olmstead, R. E., Jou, J., Tiongson, E., Allen, V., et al. (2007). Neural substrates of resisting craving during cigarette cue exposure. *Biological Psychiatry*, 62(6), 642-651.
- Brown, M. R. G., Lebel, R. M., Dolcos, F., Wilman, A. H., Silverstone, P. H., Pazderka, H., et al. (2012). Effects of emotional context on impulse control. *Neuroimage*, 63(1), 434-446.
- Bunge, S. A., Dudukovic, N. M., Thomason, M. E., Vaidya, C. J., & Gabrieli, J. D. E. (2002). Immature frontal lobe contributions to cognitive control in children: Evidence from fMRI. *Neuron*, 33(2), 301-311.
- Bunge, S. A., Hazeltine, E., Scanlon, M. D., Rosen, A. C., & Gabrieli, J. D. E. (2002). Dissociable contributions of prefrontal and parietal cortices to response selection. *Neuroimage*, 17(3), 1562-1571.

C

- Campbell-Meiklejohn, D. K., Woolrich, M. W., Passingham, R. E., & Rogers, R. D. (2008). Knowing when to stop: the brain mechanisms of chasing losses. *Biological Psychiatry*, 63(3), 293-300.
- Casey, B. J., & Caudle, K. (2013). The Teenage Brain: Self Control. *Current Directions in Psychological Science*, 22(2), 82-87.
- Casey, B. J., Somerville, L. H., Gotlib, I. H., Ayduk, O., Franklin, N. T., Askren, M. K., et al. (2011). Behavioral and neural correlates of delay of gratification 40 years later. *Proceedings of the National Academy of Sciences of the United States of America*, 108(36), 14998-15003.
- Casey, B. J., Thomas, K. M., Davidson, M. C., Kunz, K., & Franzen, P. L. (2002). Dissociating striatal and hippocampal function developmentally with a stimulus-response compatibility task. *Journal of Neuroscience*, 22(19), 8647-8652.
- Casey, B. J., Trainor, R. J., Orendi, J. L., Schubert, A. B., Nystrom, L. E., Giedd, J. N., et al. (1997). A developmental functional MRI study of prefrontal activation during performance of a Go-No-Go task. *Journal of Cognitive Neuroscience*, 9(6), 835-847.

- Chikazoe, J. (2010). Localizing performance of go/no-go tasks to prefrontal cortical subregions. *Current Opinion in Psychiatry*, 23(3), 267-272.
- Chi, P. H., Holmes, A. J., & Pizzagalli, D. A. (2008). Dissociable recruitment of rostral anterior cingulate and inferior frontal cortex in emotional response inhibition. *Psychophysiology*, 45, S115-S116.
- Christakou, A., Brammer, M., & Rubia, K. (2011). Maturation of limbic corticostriatal activation and connectivity associated with developmental changes in temporal discounting. *Neuroimage*, 54(2), 1344-1354.
- Christakou, A., Halari, R., Smith, A. B., Ifkovits, E., Brammer, M., & Rubia, K. (2009). Sex-dependent age modulation of frontostriatal and temporo-parietal activation during cognitive control. *Neuroimage*, 48(1), 223-236.
- Cisek, P. (2007). Cortical mechanisms of action selection: the affordance competition hypothesis. *Philosophical Transactions of the Royal Society B-Biological Sciences*, 362(1485), 1585-1599.
- Cocosco, C. A., Kollokian, V., Kwan, R. K. S., & Evans, A. C. (1997). BrainWeb: online interface to a 3D MRI simulated brain database. *Neuroimage*, 5, S425.
- Cohen-Gilbert, J. E., & Thomas, K. M. (2013). Inhibitory control during emotional distraction across adolescence and early adulthood. *Child Development*, 1-13.
- Cohen, J. R., Asarnow, R. F., Sabb, F. W., Bilder, R. M., Bookheimer, S. Y., Knowlton, B. J., et al. (2010). Decoding developmental differences and individual variability in response inhibition through predictive analyses across individuals. *Frontiers in Human Neuroscience*, 4, 47.
- Cortese, S., Kelly, C., Chabernaud, C., Proal, E., Di Martino, A., Milham, M. P., et al. (2012). Toward systems neuroscience of ADHD: a meta-analysis of 55 fMRI studies. *American Journal of Psychiatry*, 169(10), 1038-1055.
- Crone, E. A., & Dahl, R. E. (2012). Understanding adolescence as a period of social-affective engagement and goal flexibility. *Nature Reviews Neuroscience*, 13(9), 636-650.
- Crone, E. A., Donohue, S. E., Honomichl, R., Wendelken, C., & Bunge, S. A. (2006). Brain regions mediating flexible rule use during development. *Journal of Neuroscience*, 26(43), 11239-11247.
- Crone, E. A., Somsen, R. J. M., Van Beek, B., & Van Der Molen, M. W. (2004). Heart rate and skin conductance analysis of antecedents and consequences of decision making. *Psychophysiology*, 41(4), 531-540.
- Crone, E. A., van der Veen, F. M., van der Molen, M. W., Somsen, R. J. M., van Beek, B., & Jennings, J. R. (2003). Cardiac concomitants of feedback processing. *Biological Psychology*, 64(1-2), 143-156.
- Crone, E. A., Wendelken, C., Donohue, S., van Leijenhorst, L., & Bunge, S. A. (2006). Neurocognitive development of the ability to manipulate information in working memory. *Proceedings of the National Academy of Science of the United States of America*, 103(24), 9315-9320.

D

- de Water, E., Cillessen, A. H., & Scheres, A. (in press). Distinct developmental trajectories of risk-taking and temporal discounting in adolescents and young adults. *Child Development*.
- Demurie, E., Roeyers, H., Baeyens, D., & Sonuga-Barke, E. (2012). Temporal discounting of monetary rewards in children and adolescents with ADHD and autism spectrum disorders. *Developmental Science*, 15(6), 791-800.
- Diamond, A. (2013). Executive functions. *Annual Review Psychology*, 64, 135-168.
- Durston, S., Thomas, K. M., Worden, M. S., Yang, Y., & Casey, B. J. (2002). The effect of preceding context on inhibition: an event-related fMRI study. *Neuroimage*, 16(2), 449-453.
- Durston, S., Thomas, K. M., Yang, Y. H., Ulug, A. M., Zimmerman, R. D., & Casey, B. J. (2002). A neural basis for the development of inhibitory control. *Developmental Science*, 5(4), F9-F16.

E

- Eigsti, I. M., Zayas, V., Mischel, W., Shoda, Y., Ayduk, O., Dadlani, M. B., et al. (2006). Predicting cognitive control from preschool to late adolescence and young adulthood. *Psychological Science*, 17(6), 478-484.
- Evans, F. J. (1978). Monitoring attention deployment by random number generation - Index to measure subjective randomness. *Bulletin of the Psychonomic Society*, 12(1), 35-38.

F

- Fergusson, D. M., Boden, J. M., & Horwood, L. J. (2013). Childhood self-control and adult outcomes: results from a 30-year longitudinal study. *Journal of the American Academy of Child and Adolescent Psychiatry*, 52(7), 709-717 e701.
- Filevich, E., Kühn, S., & Haggard, P. (2012). Intentional inhibition in human action: The power of 'no'. *Neuroscience and biobehavioral reviews*, 36(4), 1107-1118.
- Finn, A. S., Sheridan, M. A., Kam, C. L., Hinshaw, S., & D'Esposito, M. (2010). Longitudinal evidence for functional specialization of the neural circuit supporting working memory in the human brain. *Journal of Neuroscience*, 30(33), 11062-11067.
- Forstmann, B. U., Anwander, A., Schafer, A., Neumann, J., Brown, S., Wagenmakers, E. J., et al. (2010). Cortico-striatal connections predict control over speed and accuracy in perceptual decision making. *Proceedings of the National Academy of Sciences of the United States of America*, 107(36), 15916-15920.

- Forstmann, B. U., Keuken, M. C., Jahfari, S., Bazin, P. L., Neumann, J., Schafer, A., et al. (2012). Cortico-subthalamic white matter tract strength predicts interindividual efficacy in stopping a motor response. *Neuroimage*, 60(1), 370-375.
- Forstmann, B. U., van den Wildenberg, W. P. M., & Ridderinkhof, K. R. (2008). Neural mechanisms, temporal dynamics, and individual differences in interference control. *Journal of Cognitive Neuroscience*, 20(10), 1854-1865.

G

- Giedd, J. N. (2004). Structural magnetic resonance imaging of the adolescent brain. *Annals of the New York Academy of Sciences*, 1021, 77-85.
- Goldberg, G. (1985). Supplementary Motor Area Structure and Function - Review and Hypotheses. *Behavioral and Brain Sciences*, 8(4), 567-588.
- Green, L., Fry, A. F., & Myerson, J. (1994). Discounting of Delayed Rewards - a Life-Span Comparison. *Psychological Science*, 5(1), 33-36.
- Groom, M. J., Scerif, G., Liddle, P. F., Batty, M. J., Liddle, E. B., Roberts, K. L., et al. (2010). Effects of Motivation and Medication on Electrophysiological Markers of Response Inhibition in Children with Attention-Deficit/Hyperactivity Disorder. *Biological Psychiatry*, 67(7), 624-631.
- Gunther Moor, B., Guroglu, B., Op de Macks, Z. A., Rombouts, S. A., Van der Molen, M. W., & Crone, E. A. (2012). Social exclusion and punishment of excluders: neural correlates and developmental trajectories. *Neuroimage*, 59(1), 708-717.

H

- Haggard, P. (2008). Human volition: towards a neuroscience of will. *Nature Reviews Neuroscience*, 9(12), 934-946.
- Hart, H., Radua, J., Nakao, T., Mataix-Cols, D., & Rubia, K. (2013). Meta-analysis of functional magnetic resonance imaging studies of inhibition and attention in attention-deficit/hyperactivity disorder: exploring task-specific, stimulant medication, and age effects. *JAMA Psychiatry*, 70(2), 185-198.
- Hartikainen, K. M., Siiskonen, A. R., & Ogawa, K. H. (2012). Threat interferes with response inhibition. *Neuroreport*, 23(7), 447-450.
- Huizinga, M., Dolan, C. V., & van der Molen, M. W. (2006). Age-related change in executive function: Developmental trends and a latent variable analysis. *Neuropsychologia*, 44(11), 2017-2036.
- Hurst, R. M., Kepley, H. O., McCalla, M. K., & Livermore, M. K. (2011). Internal consistency and discriminant validity of a delay-discounting task with an adult self-reported ADHD sample. *Journal of Attention Disorders*, 15(5), 412-422.

J

- Jahfari, S., Verbruggen, F., Frank, M. J., Waldorp, L. J., Colzato, L., Ridderinkhof, K. R., et al. (2012). How Preparation Changes the Need for Top-Down Control of the Basal Ganglia When Inhibiting Premature Actions. *Journal of Neuroscience*, 32(32), 10870-10878.
- Jahfari, S., Waldorp, L., van den Wildenberg, W. P. M., Scholte, H. S., Ridderinkhof, K. R., & Forstmann, B. U. (2011). Effective Connectivity Reveals Important Roles for Both the Hyperdirect (Fronto-Subthalamic) and the Indirect (Fronto-Striatal-Pallidal) Fronto-Basal Ganglia Pathways during Response Inhibition. *Journal of Neuroscience*, 31(18), 6891-6899.
- Jennings, J. R. (1987). Editorial policy on analyses of variance with repeated measures. *Psychophysiology*, 24(4), 474-475.
- Jennings, J. R., Brock, K., van der Molen, M. W., & Somsen, R. J. M. (1992). On the synchrony of stopping motor-responses and delaying heartbeats. *Journal of Experimental Psychology-Human Perception and Performance*, 18(2), 422-436.
- Jennings, J. R., & van der Molen, M. W. (2002). Cardiac timing and the central regulation of action. *Psychological Research-Psychologische Forschung*, 66(4), 337-349.
- Jennings, J. R., & van der Molen, M. W. (2005). Preparation for speeded action as a psychophysiological concept. *Psychological Bulletin*, 131(3), 434-459.
- Jennings, J. R., Van der Molen, M. W., & Debski, K. (2003). Mental rotation delays the heart beat: Probing the central processing bottleneck. *Psychophysiology*, 40(5), 666-674.
- Jennings, J. R., van der Molen, M. W., Pelham, W., Debski, K. B., & Hoza, B. (1997). Inhibition in boys with attention deficit hyperactivity disorder as indexed by heart rate change. *Developmental Psychology*, 33(2), 308-318.
- Jennings, J. R., van der Molen, M. W., Somsen, R. J., & Terezis, C. (1990). On the shift from anticipatory heart rate deceleration to acceleratory recovery: revisiting the role of response factors. *Psychophysiology*, 27(4), 385-395.
- Jennings, J. R., van der Molen, M. W., & Stenger, V. A. (2008). Preparation for speeded action activates cortical motor and autonomic response selection areas. *Psychophysiology*, 45, S98-S99.
- Jennings, J. R., & Wood, C. C. (1977). Cardiac Cycle Time Effects on Performance, Phasic Cardiac Responses, and Their Intercorrelation in Choice Reaction-Time. *Psychophysiology*, 14(3), 297-307.
- Johnson, M. H. (2011). Interactive specialization: a domain-general framework for human functional brain development? *Developmental Cognitive Neuroscience*, 1(1), 7-21.
- Jolles, D. D., Kleibeuker, S. W., Rombouts, S. A., & Crone, E. A. (2011). Developmental differences in prefrontal activation during working memory maintenance and manipulation for different memory loads. *Developmental Science*, 14(4), 713-724.

K

- Karch, S., Mulert, C., Thalmeier, T., Lutz, J., Leicht, G., Meindl, T., et al. (2009). The Free Choice Whether or Not to Respond After Stimulus Presentation. *Human Brain Mapping*, 30(9), 2971-2985.
- King, A. V., Linke, J., Gass, A., Hennerici, M. G., Tost, H., Poupon, C., et al. (2012). Microstructure of a three-way anatomical network predicts individual differences in response inhibition: a tractography study. *Neuroimage*, 59(2), 1949-1959.
- Krieghoff, V., Waszak, F., Prinz, W., & Brass, M. (2011). Neural and behavioral correlates of intentional actions. *Neuropsychologia*, 49(5), 767-776.
- Kühn, S., & Brass, M. (2009). When doing nothing is an option: the neural correlates of deciding whether to act or not. *Neuroimage*, 46(4), 1187-1193.
- Kühn, S., Haggard, P., & Brass, M. (2009). Intentional Inhibition: How the "Veto-Area" Exerts Control. *Human Brain Mapping*, 30(9), 2834-2843.

L

- Lamm, C., White, L. K., McDermott, J. M., & Fox, N. A. (2012). Neural activation underlying cognitive control in the context of neutral and affectively charged pictures in children. *Brain and Cognition*, 79(3), 181-187.
- Lang, P. J., Bradley, M. M., & Cuthbert, B. N. (2008). *International Affective Picture System (IAPS): Affective ratings of pictures and instruction manual*. Gainesville: University of Florida.
- Langner, O., Dotsch, R., Bijlstra, G., Wigboldus, D. H. J., Hawk, S. T., & van Knippenberg, A. (2010). Presentation and validation of the Radboud Faces Database. *Cognition & Emotion*, 24(8), 1377-1388.
- Lappin, J. S., & Eriksen, C. W. (1966). Use of a Delayed Signal to Stop a Visual Reaction-Time Response. *Journal of Experimental Psychology*, 72(6), 805-&.
- Lau, H. C., Rogers, R. D., Haggard, P., & Passingham, R. E. (2004). Attention to intention. *Science*, 303(5661), 1208-1210.
- Lau, H. C., Rogers, R. D., & Passingham, R. E. (2006). Dissociating response selection and conflict in the medial frontal surface. *Neuroimage*, 29(2), 446-451.
- Lee, N. C., de Groot, R. H., Boschloo, A., Dekker, S., Krabbendam, L., & Jolles, J. (2013). Age and educational track influence adolescent discounting of delayed rewards. *Frontiers in Psychology*, 4, 993.
- Leotti, L. A., & Wager, T. D. (2010). Motivational Influences on Response Inhibition Measures. *Journal of Experimental Psychology-Human Perception and Performance*, 36(2), 430-447.
- Leung, H. C., & Cai, W. D. (2007). Common and differential ventrolateral prefrontal activity during inhibition of hand and eye movements. *Journal of Neuroscience*, 27(37), 9893-9900.

- Lieberman, M. D., & Cunningham, W. A. (2009). Type I and Type II error concerns in fMRI research: re-balancing the scale. *Social Cognitive and Affective Neuroscience*, 4(4), 423-428.
- Lijffijt, M., Kenemans, J. L., Verbaten, M. N., & van Engeland, H. (2005). A meta-analytic review of stopping performance in attention-deficit/hyperactivity disorder: deficient inhibitory motor control? *Journal of Abnormal Psychology*, 114(2), 216-222.
- Lindstrom, B. R., & Bohlin, G. (2012). Threat-Relevance Impairs Executive Functions: Negative Impact on Working Memory and Response Inhibition. *Emotion*, 12(2), 384-393.
- Logan, G. D., & Cowan, W. B. (1984). On the ability to inhibit thought and action - A theory of an act of control. *Psychological Review*, 91(3), 295-327.
- Luman, M., Oosterlaan, J., & Sergeant, J. A. (2005). The impact of reinforcement contingencies on AD/HD: a review and theoretical appraisal. *Clinical Psychology Review*, 25(2), 183-213.
- 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.

M

- Marco, R., Miranda, A., Schlotz, W., Melia, A., Mulligan, A., Muller, U., et al. (2009). Delay and reward choice in ADHD: an experimental test of the role of delay aversion. *Neuropsychology*, 23(3), 367-380.
- Mischel, W., Shoda, Y., & Rodriguez, M. L. (1989). Delay of Gratification in Children. *Science*, 244(4907), 933-938.
- Moffitt, T. E., Arseneault, L., Belsky, D., Dickson, N., Hancox, R. J., Harrington, H., et al. (2011). A gradient of childhood self-control predicts health, wealth, and public safety. *Proceedings of the National Academy of Sciences of the United States of America*, 108(7), 2693-2698.
- Monsell, S., Sumner, P., & Waters, H. (2003). Task-set reconfiguration with predictable and unpredictable task switches. *Memory & Cognition*, 31(3), 327-342.
- Mostofsky, S. H., & Simmonds, D. J. (2008). Response inhibition and response selection: Two sides of the same coin. *Journal of Cognitive Neuroscience*, 20(5), 751-761.

N

- Neuringer, A. (1986). Can people behave randomly - The role of feedback. *Journal of Experimental Psychology-General*, 115(1), 62-75.

- Nichols, T., Brett, M., Andersson, J., Wager, T., & Poline, J. B. (2005). Valid conjunction inference with the minimum statistic. *Neuroimage*, 25(3), 653-660.
- Nigg, J. T. (2003). Response inhibition and disruptive behaviors: toward a multiprocess conception of etiological heterogeneity for ADHD combined type and conduct disorder early-onset type. *Annals of the New York Academy of Sciences*, 1008, 170-182.
- Nigg, J. T., Willcutt, E. G., Doyle, A. E., & Sonuga-Barke, E. J. (2005). Causal heterogeneity in attention-deficit/hyperactivity disorder: do we need neuropsychologically impaired subtypes? *Biological Psychiatry*, 57(11), 1224-1230.
- Norman, D. A., & Shallice, T. (1986). Attention to action. In R. J. Davidson, G. E. Schwartz & D. Shapiro (Eds.), *Consciousness and self-regulation* (pp. 1-18). New York: Plenum Press.
- Norton, K. N., Luchyshyn, T. A., & Kevin Shoemaker, J. (2013). Evidence for a medial prefrontal cortex-hippocampal axis associated with heart rate control in conscious humans. *Brain Research*, 1538, 104-115.

O

- Olson, E. A., Hooper, C. J., Collins, P., & Luciana, M. (2007). Adolescents' performance on delay and probability discounting tasks: contributions of age, intelligence, executive functioning, and self-reported externalizing behavior. *Personality and Individual Differences*, 43(7), 1886-1897.
- Ordaz, S. J., Foran, W., Velanova, K., & Luna, B. (2013). Longitudinal growth curves of brain function underlying inhibitory control through adolescence. *Journal of Neuroscience*, 33(46), 18109-18124.
- Orr, J. M., & Banich, M. T. (2014). The neural mechanisms underlying internally and externally guided task selection. *Neuroimage*, 84, 191-205.

P

- Paloyelis, Y., Asherson, P., Mehta, M. A., Faraone, S. V., & Kuntsi, J. (2010). DAT1 and COMT effects on delay discounting and trait impulsivity in male adolescents with attention deficit/hyperactivity disorder and healthy controls. *Neuropsychopharmacology*, 35(12), 2414-2426.
- Patton, J. H., Stanford, M. S., & Barratt, E. S. (1995). Factor structure of the Barratt Impulsiveness Scale. *Journal of Clinical Psychology*, 51(6), 768-774.
- Paus, T. (2010). Growth of white matter in the adolescent brain: myelin or axon? *Brain and Cognition*, 72(1), 26-35.
- Paus, T., Collins, D. L., Evans, A. C., Leonard, G., Pike, B., & Zijdenbos, A. (2001). Maturation of white matter in the human brain: a review of magnetic resonance studies. *Brain Research Bulletin*, 54(3), 255-266.

- Perruchet, P., Cleeremans, A., & Destrebecqz, A. (2006). Dissociating the effects of automatic activation and explicit expectancy on reaction times in a simple associative learning task. *Journal of Experimental Psychology-Learning Memory and Cognition*, 32(5), 955-965.
- Plichta, M. M., Vasic, N., Wolf, R. C., Lesch, K. P., Brummer, D., Jacob, C., et al. (2009). Neural hyporesponsiveness and hyperresponsiveness during immediate and delayed reward processing in adult attention-deficit/hyperactivity disorder. *Biological Psychiatry*, 65(1), 7-14.
- Prencipe, A., Kesek, A., Cohen, J., Lamm, C., Lewis, M. D., & Zelazo, P. D. (2011). Development of hot and cool executive function during the transition to adolescence. *Journal of Experimental Child Psychology*, 108(3), 621-637.

R

- Raven, J., Raven, J. C., & Court, J. H. (1998). *Manual for raven's progressive matrices and vocabulary scales. Section 1: General overview*. San Antonia TX: Harcourt Assessment.
- Reynolds, D. M., & Jeeves, M. A. (1978). A developmental study of hemisphere specialization for recognition of faces in normal subjects. *Cortex*, 14(4), 511-520.
- Ridderinkhof, K. R., Band, G. P. H., & Logan, G. D. (1999). A study of adaptive behavior: effects of age and irrelevant information on the ability to inhibit one's actions. *Acta Psychologica*, 101(2-3), 315-337.
- Ridderinkhof, K. R., Forstmann, B. U., Wylie, S. A., Burle, B., & van den Wildenberg, W. P. M. (2011). Neurocognitive mechanisms of action control: resisting the call of the Sirens. *Wiley Interdisciplinary Reviews-Cognitive Science*, 2(2), 174-192.
- Rubia, K., Smith, A. B., Taylor, E., & Brammer, M. (2007). Linear age-correlated functional development of right inferior fronto-striato-cerebellar networks during response inhibition and anterior cingulate during error-related processes. *Human Brain Mapping*, 28(11), 1163-1177.

S

- Sagapé, P., Schwartz, S., & Vuilleumier, P. (2011). Fear and stop: A role for the amygdala in motor inhibition by emotional signals. *Neuroimage*, 55(4), 1825-1835.
- Schel, M. A., & Crone, E. A. (2013). Development of response inhibition in the context of relevant versus irrelevant emotions. *Frontiers in Psychology*, 4, 383.
- Schel, M. A., Kuhn, S., Brass, M., Haggard, P., Ridderinkhof, K. R., & Crone, E. A. (2014). Neural correlates of intentional and stimulus-driven inhibition: a comparison. *Frontiers in Human Neuroscience*, 8, 27.

- Schel, M. A., Peper, J. S., & Crone, E. A. (in prep). The role of the fronto-basal ganglia circuit in the development of self-control: a combined fMRI and DTI study.
- Schel, M. A., Windhorst, D. A., van der Molen, M. W., & Crone, E. A. (2013). Developmental change in intentional action and inhibition: a heart rate analysis. *Psychophysiology*, 50(8), 812-819.
- Scheres, A., de Water, E., & Mies, G. W. (2013). The neural correlates of temporal reward discounting. *Wiley Interdisciplinary Reviews-Cognitive Science*, 4(5), 523-545.
- Scheres, A., Dijkstra, M., Ainslie, E., Balkan, J., Reynolds, B., Sonuga-Barke, E., et al. (2006). Temporal and probabilistic discounting of rewards in children and adolescents: Effects of age and ADHD symptoms. *Neuropsychologia*, 44(11), 2092-2103.
- Scheres, A., Sumiya, M., & Thoeny, A. L. (2010). Studying the relation between temporal reward discounting tasks used in populations with ADHD: A factor analysis. *International Journal of Methods in Psychiatric Research*, 19(3), 167-176.
- Scheres, A., Tontsch, C., Thoeny, A. L., & Kaczkurkin, A. (2010). Temporal reward discounting in attention-deficit/hyperactivity disorder: the contribution of symptom domains, reward magnitude, and session length. *Biological Psychiatry*, 67(7), 641-648.
- Schulz, K. P., Fan, J., Magidina, O., Marks, D. J., Hahn, B., & Halperin, J. M. (2007). Does the emotional go/no-go task really measure behavioral inhibition? Convergence with measures on a non-emotional analog. *Archives of Clinical Neuropsychology*, 22(2), 151-160.
- Serrano-Troncoso, E., Guidi, M., & Alda-Diez, J. A. (2013). Is psychological treatment efficacious for attention deficit hyperactivity disorder (ADHD)? Review of non-pharmacological treatments in children and adolescents with ADHD. *Actas Esp Psiquiatr*, 41(1), 44-51.
- Shaw, P., Kabani, N. J., Lerch, J. P., Eckstrand, K., Lenroot, R., Gogtay, N., et al. (2008). Neurodevelopmental trajectories of the human cerebral cortex. *Journal of Neuroscience*, 28(14), 3586-3594.
- Sinopoli, K. J., Schachar, R., & Dennis, M. (2011). Reward Improves Cancellation and Restraint Inhibition Across Childhood and Adolescence. *Developmental Psychology*, 47(5), 1479-1489.
- Smith, A. B., Halari, R., Giampetro, V., Brammer, M., & Rubia, K. (2011). Developmental effects of reward on sustained attention networks. *Neuroimage*, 56(3), 1693-1704.
- Solanto, M. V., Abikoff, H., Sonuga-Barke, E., Schachar, R., Logan, G. D., Wigal, T., et al. (2001). The ecological validity of delay aversion and response inhibition as measures of impulsivity in AD/HD: a supplement to the NIMH multimodal treatment study of AD/HD. *Journal of Abnormal Child Psychology*, 29(3), 215-228.
- Somerville, L. H., Hare, T., & Casey, B. J. (2011). Frontostriatal Maturation Predicts Cognitive Control Failure to Appetitive Cues in Adolescents. *Journal of Cognitive Neuroscience*, 23(9), 2123-2134.

- Somerville, L. H., Jones, R. M., & Casey, B. J. (2010). A time of change: behavioral and neural correlates of adolescent sensitivity to appetitive and aversive environmental cues. *Brain and Cognition*, 72(1), 124-133.
- Somsen, R., Jennings, J. R., & van der Molen, M. (2002). Human vagal heart rate responses in warned reaction time tasks: a cross-validation with simulated vagus-sino-atrial node interactions. *Journal of electrocardiology*, 35 Suppl, 231-237.
- Sonuga-Barke, E. J., Taylor, E., Sembra, S., & Smith, J. (1992). Hyperactivity and delay aversion--I. The effect of delay on choice. *Journal of Child Psychology and Psychiatry*, 33(2), 387-398.
- Sowell, E. R., Thompson, P. M., Leonard, C. M., Welcome, S. E., Kan, E., & Toga, A. W. (2004). Longitudinal mapping of cortical thickness and brain growth in normal children. *Journal of Neuroscience*, 24(38), 8223-8231.
- Steinberg, L., Graham, S., O'Brien, L., Woolard, J., Cauffman, E., & Banich, M. (2009). Age differences in future orientation and delay discounting. *Child Development*, 80(1), 28-44.
- Swick, D., Ashley, V., & Turken, U. (2008). Left inferior frontal gyrus is critical for response inhibition. *Bmc Neuroscience*, 9.

T

- Talairach, J., & Tournoux, P. (1988). *Co-planar stereotaxic atlas of the human brain. 3-Dimensional proportional system: an approach to cerebral imaging*. New York: Thieme.
- Tamnes, C. K., Fjell, A. M., Westlye, L. T., Ostby, Y., & Walhovd, K. B. (2012). Becoming Consistent: Developmental Reductions in Intraindividual Variability in Reaction Time Are Related to White Matter Integrity. *Journal of Neuroscience*, 32(3), 972-982.
- Thayer, J. F., & Lane, R. D. (2009). Claude Bernard and the heart-brain connection: further elaboration of a model of neurovisceral integration. *Neuroscience and Biobehavioral Reviews*, 33(2), 81-88.
- Todd, R. M., Lee, W., Evans, J. W., Lewis, M. D., & Taylor, M. J. (2012). Withholding response in the face of a smile: age-related differences in prefrontal sensitivity to Nogo cues following happy and angry faces. *Developmental cognitive neuroscience*, 2(3), 340-350.
- Tottenham, N., Hare, T. A., & Casey, B. J. (2011). Behavioral assessment of emotion discrimination, emotion regulation, and cognitive control in childhood, adolescence, and adulthood. *Frontiers in psychology*, 2, 39.
- Towse, J. N., & McLachlan, A. (1999). An exploration of random generation among children. *British Journal of Developmental Psychology*, 17, 363-380.
- Towse, J. N., & Neil, D. (1998). Analyzing human random generation behavior: A review of methods used and a computer program for describing performance. *Behavior Research Methods Instruments & Computers*, 30(4), 583-591.

V

- van Boxtel, G. J. M., van der Molen, M. W., Jennings, J. R., & Brunia, C. H. M. (2001). A psychophysiological analysis of inhibitory motor control in the stop-signal paradigm. *Biological Psychology*, 58(3), 229-262.
- van de Laar, M. C., van den Wildenberg, W. P., van Boxtel, G. J., & van der Molen, M. W. (2011). Lifespan changes in global and selective stopping and performance adjustments. *Frontiers in psychology*, 2, 357.
- van den Bos, W., van Dijk, E., Westenberg, M., Rombouts, S. A., & Crone, E. A. (2011). Changing brains, changing perspectives: the neurocognitive development of reciprocity. *Psychological Science*, 22(1), 60-70.
- van den Wildenberg, W. P., & van der Molen, M. W. (2004). Developmental trends in simple and selective inhibition of compatible and incompatible responses. *Journal of experimental child psychology*, 87(3), 201-220.
- van der Molen, M. W. (2000). Developmental changes in inhibitory processing: evidence from psychophysiological measures. *Biological Psychology*, 54(1-3), 207-239.
- Van der Veen, F. M., Van der Molen, M. W., & Jennings, J. R. (2000). Selective inhibition is indexed by heart rate slowing. *Psychophysiology*, 37(5), 607-613.
- van Eimeren, T., Wolbers, T., Munchau, A., Buchel, C., Weiller, C., & Siebner, H. R. (2006). Implementation of visuospatial cues in response selection. [Research Support, Non-U.S. Gov't]. *Neuroimage*, 29(1), 286-294.
- Vasey, M. W., & Thayer, J. F. (1987). The continuing problem of false positives in repeated measures ANOVA in psychophysiology - A multivariate solution. *Psychophysiology*, 24(4), 479-486.
- Velanova, K., Wheeler, M. E., & Luna, B. (2008). Maturational changes in anterior cingulate and frontoparietal recruitment support the development of error processing and inhibitory control. *Cereb Cortex*, 18(11), 2505-2522.
- Verbruggen, F., Aron, A. R., Stevens, M. A., & Chambers, C. D. (2010). Theta burst stimulation dissociates attention and action updating in human inferior frontal cortex. *Proceeding of the National Academy of Science of the United States of America*, 107(31), 13966-13971.
- Verbruggen, F., & Logan, G. D. (2008). Response inhibition in the stop-signal paradigm. *Trends in Cognitive Sciences*, 12(11), 418-424.

W

- Wechsler, D. (1981a). *Wechsler adult intelligence scale - Revised*. New York: The Psychological Corporation.
- Wechsler, D. (1981b). *Wechsler Intelligence Scale for Children - Third Edition*. San Antonio: The Psychological Corporation.

- Willcutt, E. G., Doyle, A. E., Nigg, J. T., Faraone, S. V., & Pennington, B. F. (2005). Validity of the executive function theory of attention-deficit/hyperactivity disorder: a meta-analytic review. *Biological Psychiatry*, 57(11), 1336-1346.
- Williams, B. R., Ponesse, J. S., Schachar, R. J., Logan, G. D., & Tannock, R. (1999). Development of inhibitory control across the life span. *Developmental Psychology*, 35(1), 205-213.
- Wills, T. A., & Stoolmiller, M. (2002). The role of self-control in early escalation of substance use: a time-varying analysis. *Journal of Consulting and Clinical Psychology*, 70(4), 986-997.
- Wilson, V. B., Mitchell, S. H., Musser, E. D., Schmitt, C. F., & Nigg, J. T. (2011). Delay discounting of reward in ADHD: application in young children. *Journal of Child Psychology and Psychiatry*, 52(3), 256-264.
- Wong, S. W., Masse, N., Kimmerly, D. S., Menon, R. S., & Shoemaker, J. K. (2007). Ventral medial prefrontal cortex and cardiovagal control in conscious humans. *Neuroimage*, 35(2), 698-708.

Z

- Zelazo, P. D., Muller, U., Frye, D., Marcovitch, S., Argitis, G., Boseovski, J., et al. (2003). The development of executive function in early childhood. *Monographs of the Society for Research in Child Development*, 68(3), vii-137.

Curriculum Vitae

Margot Schel was born on November 8th 1986 in Uden, the Netherlands. She graduated from the Udens College in 2005. In 2010 she received her Research Master's degree (cum laude) in developmental psychology from Leiden University. During her studies Margot has worked on several research projects in the Brain and Development Lab, which she joined as an Honours bachelor student in 2007. In October 2012, Margot started her PhD research in the Brain and Development Lab on the neurobiological bases of the development of intentional inhibition, which was supervised by Prof. Dr. Eveline Crone. This research project was part of a European Collaborative Research Project focused on intentional inhibition of human action. In September 2014, Margot started as a postdoctoral researcher in Prof. Dr. Torkel Klingberg's Developmental Cognitive Neuroscience Lab at the Karolinska Institute in Stockholm, Sweden.

Dankwoord

De weg van het begin van mijn promotietraject tot het schrijven en verdedigen van mijn proefschrift heb ik gelukkig niet alleen af hoeven leggen. Onderweg zijn er veel mensen geweest die mij hebben geholpen en geïnspireerd en daar wil ik hen graag voor bedanken.

Allereerst wil ik graag mijn promotor bedanken. Eveline, bedankt dat je me 7 jaar geleden als Honours bachelor student in het Brain & Development Lab hebt verwelkomd en mij een kijkje in de keuken van het developmental cognitieve neurosciene onderzoek hebt gegeven. Hiermee werd mijn passie voor het wetenschappelijk onderzoek gevoed en was de basis voor onze samenwerking gelegd. Ik ben heel blij dat ik de afgelopen jaren met jou heb mogen samen werken en zoveel van jou heb mogen leren. Ik wil je graag bedanken voor het vertrouwen dat je altijd in me stelt en de vele kansen die je me hebt geboden. Ik hoop van harte dat we in de toekomst blijven samenwerken.

Richard, bedankt voor alle interessante discussies over intentionele inhibitie. Ook bedankt dat je me liet aanschuiven bij de ACACIA meetings waar ik extra inspiratie voor mijn onderzoek kon opdoen.

Maurits, bedankt voor de samenwerking bij de hartslagstudies. Jouw kennis van de hartslagliteratuur heeft mij ontzettend geholpen om deze studies tot een succes te maken.

Anouk, bedankt voor de fijne samenwerking bij het schrijven van het reviewpaper.

I also want to thank the researchers involved in the Euroveto project. Patrick, Marcel, and Alex thank you for the all the inspiring project meetings. It was a great opportunity to work on this European Collaborative Research Project.

Ik had al het werk voor deze studies niet kunnen doen zonder de hulp van mijn bachelor en researchmaster studenten. In het bijzonder wil ik Dafna en Anita bedanken voor hun fantastische inzet voor de verschillende onderzoeken.

Daarnaast wil ik natuurlijk alle leden en oud-leden van het Brain & Development Lab bedanken voor de samenwerking en support. Jullie waren de beste collega's die ik kon wensen.

Natuurlijk wil ik ook mijn paranimfen bedanken. Geert-Jan, je was de beste kamergenoot die ik kon hebben tijdens mijn promotie. Bedankt voor alle gesprekken over onderzoek, alle gezelligheid en natuurlijk ook voor je steun tijdens mijn promotie. Carina, bedankt voor de vele Skype-gesprekken over onze promoties en natuurlijk ook voor je steun tijdens mijn promotie.

Lieve familie, natuurlijk wil ik ook jullie bedanken. Opa, bedankt voor alle steun en vertrouwen. Papa en Mama, zonder jullie had ik hier niet gestaan. Ontzettend bedankt voor jullie geloof in mijn kunnen en jullie grote betrokkenheid.

Lieve Bart, jij bent de allerbeste. Bedankt dat je er altijd voor mij bent. Het maakt niet uit of je dichtbij bent, zoals tijdens mijn promotie, of ver weg, zoals nu tijdens mijn Zweedse avontuur. Jij bent er altijd.

