

Supplementary Online References

- s1. Locke J. *An Essay Concerning Human Understanding*, by John Locke : B2.7. 1689 Essay 2.7.3. Available from: <https://ebooks.adelaide.edu.au/l/locke/john/181u/B2.7.html>
- s2. Thompson JC, Harris J, Sollom AC, Stopford CL, Howard E, Snowden JS, et al. Longitudinal evaluation of neuropsychiatric symptoms in Huntington's disease. *J Neuropsychiatry Clin Neurosci*. 2012;24(1):53–60. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/22450614>
- s3. Niv Y, Daw ND, Joel D, Dayan P. Tonic dopamine: opportunity costs and the control of response vigor. *Psychopharmacology (Berl)*. 2007 Apr;191(3):507–20.
- s4. Silvetti M, Alexander W, Verguts T, Brown JW. From conflict management to reward-based decision making: Actors and critics in primate medial frontal cortex. *Neurosci Biobehav Rev*. 2014;46(P1):44–57. Available from: <http://dx.doi.org/10.1016/j.neubiorev.2013.11.003>
- s5. Sutton RS, Barto AG. *Reinforcement learning : an introduction*. MIT Press; 1998. 322 p. Available from: <https://mitpress.mit.edu/books/reinforcement-learning>
- s6. Otto AR, Gershman SJ, Markman AB, Daw ND. The Curse of Planning. *Psychol Sci*. 2013 May 4;24(5):751–61. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/23558545>
- s7. Randall PA, Pardo M, Nunes EJ, López Cruz L, Vemuri VK, Makriyannis A, et al. Dopaminergic Modulation of Effort-Related Choice Behavior as Assessed by a Progressive Ratio Chow Feeding Choice Task: Pharmacological Studies and the Role of Individual Differences. Beeler JA, editor. *PLoS One*. 2012 Oct 22;7(10):e47934. Available from: <http://dx.plos.org/10.1371/journal.pone.0047934>
- s8. Cousins MS, Sokolowski JD, Salamone JD. Different effects of nucleus accumbens and ventrolateral striatal dopamine depletions on instrumental response selection in the rat. *Pharmacol Biochem Behav*. 1993 Dec 1;46(4):943–51. Available from: <https://www.sciencedirect.com/science/article/pii/009130579390226J>
- s9. Yohn SE, Santerre JL, Nunes EJ, Kozak R, Podurciel SJ, Correa M, et al. The role of dopamine D1 receptor transmission in effort-related choice behavior: Effects of D1 agonists. *Pharmacol Biochem Behav*. 2015 Aug;135:217–26. Available from: <http://linkinghub.elsevier.com/retrieve/pii/S0091305715001446>
- s10. Floresco SB, Ghods-Sharifi S. Amygdala-Prefrontal Cortical Circuitry Regulates Effort-Based Decision Making. *Cereb Cortex*. 2006 Feb 22;17(2):251–60. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/16495432>
- s11. Manohar SG, Husain M. Reduced pupillary reward sensitivity in Parkinson's disease. *npj Park Dis*. 2015 Dec 17;1(1):15026. Available from: <http://www.nature.com/articles/npjparkd201526>
- s12. Holroyd CB, Umemoto A. The research domain criteria framework: The case for anterior cingulate cortex. *Neurosci Biobehav Rev*. 2016 Dec;71:418–43. Available from: <http://linkinghub.elsevier.com/retrieve/pii/S0149763416303645>
- s13. Stephens DW, Krebs JR (John R. *Foraging theory*. Princeton University Press; 1986. Available from: <http://press.princeton.edu/titles/2453.html>
- s14. Baggio HC, Segura B, Garrido-Millan JL, Marti MJ, Compta Y, Valldeoriola F, et al. Resting-state frontostriatal functional connectivity in Parkinson's disease-related apathy. *Mov Disord*. 2015 Apr 15;30(5):671–9. Available from: <http://doi.wiley.com/10.1002/mds.26137>
- s15. Behrens TEJ, Woolrich MW, Walton ME, Rushworth MFS. Learning the value of information in an uncertain world. *Nat Neurosci*. 2007 Sep 5;10(9):1214–21. Available

- from: <http://www.nature.com/articles/nn1954>
- s16. Lanctôt KL, Agüera-Ortiz L, Brodaty H, Francis PT, Geda YE, Ismail Z, et al. Apathy associated with neurocognitive disorders: Recent progress and future directions. *Alzheimer's Dement*. 2017 Jan;13(1):84–100. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/27362291>
 - s17. Ligthart SA, Richard E, Franssen NL, Eurelings LSM, Beem L, Eikelenboom P, et al. Association of vascular factors with apathy in community-dwelling elderly individuals. *Arch Gen Psychiatry*. 2012;69(6):636–42. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/22664551>
 - s18. Hollocks MJ, Lawrence AJ, Brookes RL, Barrick TR, Morris RG, Husain M, et al. Differential relationships between apathy and depression with white matter microstructural changes and functional outcomes. *Brain*. 2015 Dec;138(12):3803–15. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/26490330>
 - s19. Reyes S, Viswanathan A, Godin O, Dufouil C, Benisty S, Hernandez Z, et al. Apathy: A major symptom in Cadasil. *Neurology*. 2009;72(10):905–10.
 - s20. Caeiro L, Ferro JM, Costa J. Apathy secondary to stroke: A systematic review and meta-analysis. *Cerebrovasc Dis*. 2013;35(1):23–39.
 - s21. Lansdall CJ, Coyle-Gilchrist ITS, Jones PS, Vázquez Rodríguez P, Wilcox A, Wehmann E, et al. Apathy and impulsivity in frontotemporal lobar degeneration syndromes. *Brain*. 2017 Jun;140(6):1792–807. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/28486594>
 - s22. Litvan I, Mega MS, Cummings JL, Fairbanks L. Neuropsychiatric aspects of progressive supranuclear palsy. *Neurology*. 1996 Nov;47(5):1184–9. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/8909427>
 - s23. Litvan I, Cummings JL, Mega M. Neuropsychiatric features of corticobasal degeneration. *J Neurol Neurosurg Psychiatry*. 1998 Nov;65(5):717–21. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/9810944>
 - s24. Lillo P, Mioshi E, Zoing MC, Kiernan MC, Hodges JR. How common are behavioural changes in amyotrophic lateral sclerosis? *Amyotroph Lateral Scler*. 2011 Jan 19;12(1):45–51. Available from: <http://www.tandfonline.com/doi/full/10.3109/17482968.2010.520718>
 - s25. Arnould A, Rochat L, Azouvi P, Van der Linden M. A Multidimensional Approach to Apathy after Traumatic Brain Injury. *Neuropsychol Rev*. 2013 Sep 7;23(3):210–33. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/23921453>
 - s26. Hoare J, Fouche J-P, Spottiswoode B, Joska JA, Schoeman R, Stein DJ, et al. White matter correlates of apathy in HIV-positive subjects: a diffusion tensor imaging study. *J Neuropsychiatry Clin Neurosci*. 2010 Aug 1;22(3):313–20. Available from: <http://neuro.psychiatryonline.org/cgi/doi/10.1176/appi.neuropsych.22.3.313>
 - s27. Paul RH, Brickman AM, Navia B, Hinkin C, Malloy PF, Jefferson AL, et al. Apathy is Associated With Volume of the Nucleus Accumbens in Patients Infected With HIV. *J Neuropsychiatry Clin Neurosci*. 2005 May;17(2):167–71. Available from: <http://psychiatryonline.org/doi/abs/10.1176/jnp.17.2.167>
 - s28. Rosti-Otajärvi E, Hämäläinen P. Behavioural symptoms and impairments in multiple sclerosis: a systematic review and meta-analysis. *Mult Scler J*. 2013 Jan;19(1):31–45. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/22383231>
 - s29. Rubinsztein JS, Rubinsztein DC, Goodburn S, Holland AJ. Apathy and hypersomnia are common features of myotonic dystrophy. *J Neurol Neurosurg Psychiatry* 1998 Apr;64(4):510–5. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/9576545>
 - s30. Svetel M, Potrebić A, Pekmezović T, Tomić A, Kresojević N, Jesić R, et al. Neuropsychiatric aspects of treated Wilson's disease. *Parkinsonism Relat Disord*. 2009

- Dec;15(10):772–5. Available from:
<http://linkinghub.elsevier.com/retrieve/pii/S1353802009001448>
- s31. Treadway MT, Zald DH. Reconsidering anhedonia in depression: lessons from translational neuroscience. *Neurosci Biobehav Rev*. 2011 Jan;35(3):537–55. Available from: <http://linkinghub.elsevier.com/retrieve/pii/S0149763410001120>
- s32. Foussias G, Remington G. Negative symptoms in schizophrenia: avolition and Occam’s razor. *Schizophr Bull*. 2010 Mar;36(2):359–69. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/18644851>
- s33. Aberman JE & Salamone JD. Nucleus accumbens dopamine depletions make rats more sensitive to high ratio requirements but do not impair primary food reinforcement. *Neuroscience*. 1999;92(2):545-52.
- s34. Robert G, Le Jeune F, Lozachmeur C et al. Preoperative factors of apathy in subthalamic stimulated Parkinson disease. A PET study. *Neurology*. 2014 83:1620-26.
- s35. Schroeter M, Vogt B, Frisch S et al. Dissociated behavioral disorders in early dementia – An FDG-PET study. *Psychiatry Research: Neuroimaging*. 2011 194: 235-244.