Executive Control of Thought & Action
Psychology 322
Spring 2015
Friday 10:10 a.m. -12:30 p.m.
Olin 309

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Office hours: Tuesday 10:00 – 11:00 a.m., Wednesday 9:00 a.m. – 10:00 a.m., or by appointment

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COURSE DESCRIPTION

This course will investigate the mechanisms that underlie executive control, with a particular focus on executive control in situations where individuals must rapidly switch attention among multiple tasks. Topics will include classic and current computational models, analysis of task-switching and set-switching paradigms, and recent neuroimaging results. Readings will consist primarily of empirical and theoretical articles.

COURSE POLICIES

Weekly Expectations. This class will be conducted as a seminar and is intended to provide a forum where you can express your thoughts and analyses on the material. The only way this can happen effectively is if you complete the reading thoroughly. Generally, you will not be able to read and reflect on all the material if you wait until the last minute. I encourage you to look at the assignments ahead of time and plan accordingly.

Participation and Attendance. Attendance is mandatory. As a seminar, this class is founded on discussion among students, and you cannot contribute if you do not show up for class. Consequently, your participation grade will be lowered for each absence.

Academic Integrity. All students are assumed to have read the Bard College Handbook and to be familiar with the school's policies regarding Plagiarism and Academic Dishonesty. Violations of these policies are taken extremely seriously and will result in a failing grade for the course and a referral to the Dean of Students for further action. Specific violations include (but are not limited to):

-Sharing of writing assignments
-Plagiarism (which includes both the use of **words** and **ideas** without attribution)

REQUIRED READING MATERIAL

+++All reading assignments are available through the course's Moodle website (access code: control). Print or download these readings and bring them to class on the appropriate day.

Assignments

Class Participation (**100 points**). Because this is a seminar, participation from everyone is crucial. If you tend to feel uncomfortable speaking up in classes, please talk to me early in the semester to discuss ways to help you feel more comfortable.

Weekly discussion questions/comments **(90 points)**. You must submit **one** question or comment about the week's readings to me via email (thutcheo@bard.edu) by 9:30 a.m. on the morning of class. These questions/comments are intended to help you think more deeply about the articles and to help organize our in-class discussion. Questions will be graded as 0, 5, or 10 points. There will be a total of 9 submissions throughout the semester.

Article Presentations (**50 points each***)*. On the first day of class, you will be randomly assigned to present during two class periods. For these presentations you will summarize one of the assigned articles. You are welcome to use whatever visual/auditory/printed aides you would like to help us understand your article. You should be prepared to serve as the class expert on that paper (note: this might entail some outside reading). At the end of the class period during which you present, you will meet with me to discuss your performance and to receive your grade.

Task Switching and Aging Proposal (**50 points**)
During week 7 (class on March 13th), we will be reading a paper by Mayr, Spieler, & Hutcheon (in press). This paper represents one aspect of my research program that I am pursuing here at Bard. On that week, you should bring a 1-2 page proposal for an interesting extension of Mayr et al (in press). Your proposal can take advantage of any behavioral neuroscience method (e.g. fMRI, TMS, electrophysiology, etc.) and must contain a clear description of a hypothesis and predicted result.

*Executive Control Experimental Proposal (**260 points***).
In this assignment you will propose an experiment or series of experiments related to the topics covered in this course. This project will be broken down into four parts:

1) An initial 1-page proposal in which you briefly describe the topic and summarize one relevant article (that we have not read as a part of class research (25 points)
2) An initial submission of your full paper (approximately 10-12 pages) (100 points)
3) A detailed review of your classmates' initial submissions (25 points)
4) A revise and resubmission of your paper in which you explicitly respond to the comments of the reviewers (50 points).
5) Presentation to group (50 points).

Additional information about the Experimental Proposal will be provided over the course of the semester.

GRADING

Grading is on a 600-point scale. Grades will be assigned based on total points earned within the following ranges – pluses and minuses will be assigned at the top and bottom of each range.

A range: 540 points and higher
B range: 480 - 539 points
C range: 420 - 479 points
D range: 360- 419 points
F range: less than 360 points

Readings and Assignment Schedule

Schedule of readings is subject to change. Students will be given at least one-week notice prior to any changes.

January 30th: Introduction to the course

No assignments or readings

February 6th: How are control processes organized in the brain?

Assignment

Weekly discussion question/comment #1

Readings

Luria, A. R. (1966). Higher Cortical functions in man. pp 5-38.

Miller, E. K., & Cohen, J. D. (2001). An integrative theory of prefrontal cortex function. *Annual Review of Neuroscience*, 24, 167-202.

Duncan, J. (2010). The multiple-demand (MD) system of the primate brain: Mental programs for intelligent behavior. *Trends in Cognitive Science, 14,* 172-79.

Greicius, M. D., Supekar, K., Menon, V., & Dougherty, R. F. (2009). Resting-state functional Connectivity reflects structural connectivity in the default mode network. *Cerebral Cortex, 19*, 72-78.

February 13th: How is control maintained over time? (part 1 of 3)

Assignment

Weekly discussion question/comment #2

Readings

Gehring, W. J., Goss, B., Coles, M. G. H., Meyer, D. E., & Donchin, E. (1993). A neural system for error detection and compensation. *Psychological Review, 4*, 385-390.

Carter, C. S., Braver, T. S., Barch, D. M., Botvinick, M. M., Noll, D. & Cohen, J. D. (1998). Anterior cingulate cortex, error detection, and the online monitoring of performance. *Science, 280*, 747-749.

Carter, C. S., MacDonald., A. M., Botvinick, M. M., Ross, L. L., Stenger, V. A.,…Cohen, J. D. (2000). Parsing executive processes: Strategic vs. evaluation functions of the anterior cingulate cortex. *PNAS, 97*, 1944-1948.

Botvinick, M. M., Braver, T. S., Barch, D. M., Carter, C. S., & Cohen, J. D. (2001). Conflict monitoring and cognitive control. Psychological Review, 108, 624-652.

February 20th: How is control maintained over time? (Part 2 of 3)

Assignment

Weekly discussion question/comment #3

Readings

Scheffers, M. K., & Coles, M. G. H. (2000). Performance monitoring in a confusing world: Error-related brain activity, judgments of response accuracy, and types of errors. *Journal of Experimental Psychology: Human Perception and Performance, 26*, 141-151.

Gehring, W. J., & Fencsik, D. E. (2001). Functions of the medial frontal cortex in the processing of conflict and errors. *The Journal of Neuroscience, 21*, 9430-9437.

Kerns, J. G., Cohen, J. D., MacDonald, A. W., Cho, R. Y., Stenger, V. A., & Carter, C. S. (2004) Anterior cingulate conflict monitoring and adjustments in control. *Science, 303*, 1023-1026.

Yeung, N., Botvinick, M. M., & Cohen, J. D. (2004). The neural basis of error-detection: Conflict monitoring and the error-related negativity. Psychological Review, 111, 931-959.

February 27th: How is control maintained over time? (Part 3 of 3)

Assignment

Weekly discussion question/comment #4
Initial 1-page proposal for final paper due.

Readings

Rushworth, M. F. S., & Behrens, T. E. J. (2008). Choice, uncertainty and value in prefrontal and cingulate cortex. *Nature Neuroscience, 11*, 389-397.

Alexander, W. H., & Brown, J. W. (2011). Medial prefrontal cortex as an action-outcome predictor. *Nature Neuroscience, 14*, 1338-1334.

Cavanagh, J. F., & Frank, M. J. (2014). Frontal theta as a mechanism for cognitive control. *Trends in Cognitive Sciences, 18*, 414-420.

March 6th: The role of control in switching among multiple tasks

Assignment

Weekly discussion question/comment #5

Readings

Dosenbach, N. U. F., Visscher, K. M., Palmer, E. D., Miezen, F. M., Wenger, K. W., Kang, H.C., et al. (2006). A core system for the implementation of task sets. *Neuron, 50*, 799-812.

Yeung, N., Nystrom, L. E., Aronson, J. A., & Cohen, J. D. (2006). Between task competition and cognitive control in task switching. *The Journal of Neuroscience, 26*, 1429-1438.

Hyafil, A., Summerfield, C., & Koechlin, E. (2009). Two mechanisms for task-switching in the prefrontal cortex. *The Journal of Neuroscience, 29*, 5135-5142.

March 13th: Deficits in control: Aging and task switching

Assignment

Task switching and Aging Proposal Due

Readings

Spieler, D. H., Mayr, U., & La Grone, S. (2006). Outsourcing of cognitive control to the environment: Adult age differences in the use of task cues. Psychonomic Bulletin & Review, 13, 787-793.

Lindenberger, U. & Mayr, U. (2014). Cognitive aging: Is there a dark side to environmental support? *Trends in Cogntiive Sciences, 18*, 7-15.

Mayr, U., Spieler, D. H., & Hutcheon, T. G. (in press). When and why do old adults outsource control to the environment? *Psychology and Aging*.

March 20th: SPRING BREAK/NO CLASS

March 27th: Fast and flexibly control: evidence for multiple control settings within a single task.

Assignment

Weekly discussion question/comment #6

Readings

Crump, M. J. C., & Milliken, B. (2009). The flexibility of context-specific control: Evidence for context-driven generalization of item-specific control settings. *The Quarterly Journal of Experimental Psychology, 62*, 1523-1532.

King, J. A., Korb, F. M., & Egner, T. (2012). Priming of control: Implicit contextual cuing of top-down attentional set. *The Journal of Neuroscience, 32*, 8192-8200.

Bugg, J. M. (2014). Conflict-triggered top-down control: Default mode, last resort, or no such thing? *Journal of Experimental Psychology: Learning, Memory, and Cognition, 40*, 567-587.

Verguts, T. & Notebaert, W. (2009). Adaptation by binding: A learning account of cognitive control. *Trends in Cognitive Science, 13*, 252-257.

April 3rd: Do bilinguals have more efficient control processes ?

Assignment

Weekly discussion question/comment #7

Readings

Costa, A., Hernández, M., Costa-Faidella, J., & Sebastián-Gallés, . (2009). On the bilingual advantage in conflict processing: Now you see it, now you don't. *Cognition, 113*, 135-149.

Gold, B. T., Kim, C., Johnson, N. F., Kryscio, R. J., & Smith, C. D. (2013). Lifelong bilingualism maintains neural efficiency for cognitive control in aging. *The Journal of Neuroscience, 33*, 387-396.

de Bruin, A. Treccani, B., & Della Salla, S. (2015). Cognitive advantage in bilinguialism: An example of publication bias?

April 10th: Other Theories of control

Assignment

First draft of experimental proposal due

Braver, T. S., Paxton, J. L., Locke, H. S., & Barch, D. M. (2009). Flexible mechanisms of cognitive control within human prefrontal cortex. *PNAS, 106*, 7351-7356.

Braver, T. S. (2012). The variable nature of cognitive control: A dual mechanisms framework. *Trends in Cognitive Sciences*, 16, 106-113.

Duncan, J. (1995). Attention, intelligence, and the frontal lobes. In M. S. Gazzaniga (Ed.), The cognitive neurosciences. Cambridge, MA: MIT Press.

April 17th: Proposal Reviews

Assignment

Reviews Due

Assigned Readings

None

April 24th: Cognitive control and motivation

Assignment

Weekly discussion question/comment #8

Assigned Readings

Pochon, J. B., Levy, R., Fossati, P., Lehericy, S., Poline, J. B., Pillon, B….& Dubois, B. (2002). The neural system that bridges reward and cognition in humans: an fMRI study. *PNAS, 99*, 5669-5674.

Kouneiher, F., Charron, S., & Koechlin, E. (2009). Motivation and cognitive control in the human prefrontal cortex. *Nature Neuroscience, 12*, 939-945.

Etzel, J. A., Cole, M. W., Zacks, J. M., Kay, K. N., & Braver, T. S. (2015). Reward motivation enhances task coding in frontoparietal cortex. *Cerebral Cortex,*

May 1st: Interesting/important articles that don't fit anywhere else.

Assignment

Weekly discussion question/comment #9

Assigned Readings

Norman, D. A., & Shallice, T. (1986). Attention to action: Willed and automatic control of behavior. In R. J. Davidson, G. E. Schwartz, & D. Shapiro (Eds.), *Consciousness and self-regulation: Advances in research and theory* (Vol. 4, pp 1-18). New York: Plenum Press.

Logan, G. D. (2003). Executive control of thought and action: In search of the wild homunculus. *Current Directions in Psychological Science, 12*, 45-48.

Botvinick, M. M., & Bylsman, L. M. (2005). Distraction and action slips in an everyday task: Evidence for a dynamic representation of task context. *Psychonomic Bulletin & Review, 12*, 1011-1017.

May 8th: NO CLASS (BOARD WEEK)

May 15th: In-class presentations

Botvinick, M. M., & Cohen, J. D. (2014). The computational and neural basis of cognitive control: chartered territories and new frontiers. *Cognitive Science, 1-37.*

May 20th: Final Papers Due