Human Development 474:
Autism and the Development of Social Cognition

Cornell University
fall 2006
3 credits

PREREQUISITES: One course in statistics, and either BIONB 222 or one course in neuroscience beyond the 200 level.

MEETING TIME AND PLACE: Tuesdays and Thursdays, 11.40-12.55, MVR 155

OFFICE HOURS: MVR G62A (607.255.6385), Thursdays 10.35-11.35 and by appointment. To make an appointment or to discuss anything about the course, please speak with me in person or by telephone. Do not send email.

URL: http://www.mattababy.org/~belmonte/Teaching/HD474/

MAILING LIST: hd474@mit.edu

DESCRIPTION: What drives the development of social cognitive skills such as language, theory of mind, and empathy? To what extent do these capacities constitute isolable "modules," or how might they emerge from more elementary neural properties? How can understanding what goes wrong during autistic development teach us about what goes right during normal development, and about how neural and cognitive development intertwine? This seminar covers current psychological and neurobiological theories of autism, emphasising written analysis and critical review of the primary research literature. Specific topics will be selected to match students' interests, and each student will develop and orally defend a research proposal on an open question in the neuroscience of autism or related developmental disorders.

ASSIGNMENTS:

1. For each day's readings with specific titles listed below, you are to submit a short, written response of no more than a few hundred words (one page) per reading. (So, for example, if there were two readings you could write up to two pages – but you might decide that that day's topics could be covered more briefly than that.) This response may discuss the day's readings separately or *en bloc,* and should consider how the papers relate to your own knowledge from other readings and discussion in this course or from other sources. This response must be submitted by the beginning time of the class in which the paper in question is to be discussed. No credit will be given for responses submitted late – even if these are submitted after class on the same day that they were due. Assignments are to be submitted by saving them as a file whose name consists of your surname, the date of the relevant class meeting in YYMMDD format, and the appropriate extension (for example "`smith060824.pdf`") and uploading them to `http://www.mattababy.org/upload.html` (double-click on the "`incoming`" folder), and also handing me or placing on my door a hardcopy whose content is identical to the uploaded copy. In the event that the upload system is not functioning, assignments can be emailed to me. No credit will be given for assignments submitted via any other means. These assignments will not be marked individually, but will receive a mark in aggregate once the last of them has been submitted. Up to three of these responses can be omitted without penalty, though all responses submitted will figure in the calculation of your aggregate mark.

2. After the term is well under way and we've had a chance to cover some essential background, each of you will select a paper from the primary research literature and lead a discussion on that paper. This

discussion will occupy half of one 75-minute class period, and you may, if you wish, coordinate with a partner whose topic complements yours and who is willing to present on the same day. Though you should encourage your classmates to do a lot of the talking, you yourself should come prepared to present critically the paper's experimental methods and results, and how its stated conclusions do or do not follow from these results. You are responsible for telling your classmates how to access the paper that you select, at least one week before it's scheduled to be discussed.

3. You are to submit, by the beginning of class on Tuesday 21 November, a written term paper consisting of a proposal for research on an open question in the neuroscience of autism or related developmental disorders. Formats for this project will be covered during a class discussion on scientific communication. Although there is no minimum or maximum length, you probably will not be able to do a thorough job in fewer than 2500 words, and if you exceed 5000 words you may be overdoing it. (These word counts exclude titles, notes, and bibliography.) The writing walk-in service (http://www.arts.cornell.edu/knight_institute/walkin/walkin.htm) offers help and advice on academic writing, and you are encouraged to make use of this resource should you need assistance. No credit will be given for term papers submitted late. You may, however, submit one revised term paper after having submitted an earlier version on time. This revised version can be submitted anytime up to the end of the exams period, must clearly identify all changes in relation to the on-time version, and can increase or decrease your mark by no more than one letter. Papers are to be submitted by upload and in hardcopy, and should be named with your surname, an underscore, and the term "paper" or "revision" – for example `smith_paper.pdf` or `smith_revised.pdf`.

4. You are to prepare a seven-minute oral presentation on your term paper, for delivery during one of the last three class meetings. This presentation should summarise the background on which your proposal builds, the proposal's specific aims, the experimental methods by which results will be obtained, and the interpretations of the various possible results.

MARKS: One quarter of your mark will be based on the quality of your brief written responses and accompanying oral discussion during class, one quarter will be based on your paper presentation, and one half will be based on your written term project and its oral presentation. As there are no final exams in real scientific research, there is no final exam in this course.
Marking of written assignments often seems unavoidably subjective and difficult to quantify. In an effort to make evaluation more transparent, the following general criteria will be applied:

A: A clearly written, strongly themed, critical treatment that highlights the successes and shortcomings of previous work and places it in context, identifying points of confluence with, and differences from, other theoretical viewpoints. Aims and hypotheses are specific and well defined. Experimental and statistical methods are original, precise, complete, understood by the author, and relevant to the hypotheses. Oral presentation is clear and engaging, and responses to the audience's questions are thoughtful and informative.

B: The ideas are there, but held back by some flaws in written or oral presentation. Questions and methods are interesting but perhaps not optimal or not completely understood in the details. Oral presentation contains some minor flaws of organisation or presentation.

C: A summary of relevant background, but without synthesis. Aims and hypotheses are not clearly enunciated or are not completely addressed by the methods. Experimental methods may have been adapted without being completely understood. Oral presentation contains most of the information but lacks engagement.

D: Background information is significantly incomplete. Aims and hypotheses are not enunciated. Methods are unsound.

F: Little or no understanding of the scientific background or of experimental design.

SCHEDULE: The following schedule is approximate and may be adjusted as the term progresses. Readings are listed for each day, with asterisks marking those that are especially long or detailed and whose understanding may take more than the usual amount of time.

Đ 24 Aug introduction and overview
T 29 Aug theories of autism: theory-of-mind (Baron-Cohen 1995**, Baron-Cohen 2002, Johnson)

Đ 31 Aug	developmental pitfalls: the case of face processing (Schultz, Klin, Hadjikhani)
T 5 Sep	theories of autism: weak central coherence (Frith & Happé*, Happé & Frith*, Castelli)
Đ 7 Sep	theories of autism: executive dysfunction (Hill, Ozonoff, Russell)
T 12 Sep	theories of autism: attention (Townsend, Burack, Charman)
Đ 14 Sep	theories of autism: complex information processing (Minshew, Just)
T 19 Sep	theories of autism: enhanced perceptual function (Plaisted, Bertone, Mottron*)
Đ 21 Sep	motor issues in autism (Teitelbaum, Müller, Allen, Greenspan**)
T 26 Sep	self-reports of autism (Grandin, Barron, Mukhopadhyay)
Đ 28 Sep	neuroanatomy of autism (Courchesne, Herbert)
T 3 Oct	neuropathology and neural models of autism (Casanova, Rubenstein)
Đ 5 Oct	Asperger syndrome (Miller, Rinehart, Lotspeich)
Đ 12 Oct	the Broader Autism Phenotype (Piven, Happé 2001, Dawson**)
T 17 Oct	genetics of autism (Veenstra-Vanderweele*, D'Amelio, Persico)
Đ 19 Oct	student paper presentations – topics TBA; and discussion of scientific communication
T 24 Oct	student paper presentations – topics TBA
Đ 26 Oct	student paper presentations – topics TBA
T 31 Oct	student paper presentations – topics TBA
Đ 2 Nov	student paper presentations – topics TBA
T 7 Nov	student paper presentations – topics TBA
Đ 9 Nov	student paper presentations – topics TBA
T 14 Nov	student paper presentations – topics TBA
Đ 16 Nov	student paper presentations – topics TBA
T 21 Nov	student paper presentations – topics TBA
T 28 Nov	student project presentations
Đ 30 Nov	student project presentations

COLLABORATION AND ACADEMIC HONESTY: Each student in this course is expected to abide by the Cornell University Code of Academic Integrity. Any work submitted by a student in this course for academic credit will be the student's own work. Under no circumstances is it appropriate to copy or even to paraphrase someone else's words or ideas without citing them. This goes for the works of published authors as well as for those of your fellow students. The penalty for even one instance of plagiarism is a failing mark for the entire course. As the distinction between copying and collaboration can sometimes be murky, you should consult me if you feel at all uncertain about which side of the boundary you stand on. (In particular, if experimental stimuli are adapted from others' work, you must cite that source in the context of those stimuli; it is not appropriate just to cite the source elsewhere in your paper.)

You are permitted, and in fact encouraged, to discuss the readings with each other in advance of submitting your written responses. However, the writing should be your own.

You are also permitted to collaborate on term projects. However, this collaboration should not decrease the amount of effort contributed by any one student. That is, a team of three people ought to produce a project whose size and complexity are approximately three times that of a term project written by one person. One way to divide responsibilities would be to have each person handle a separate set of experimental methods – for example, a genetic study, a behavioural study, and an experimental study all addressing the same problem. Students intending to collaborate on their term projects must consult me well in advance with their proposed topics and division of labour.

READINGS:

Publishers' restrictions make some of these readings unavailable from outside Cornell's campus network:

Allen G, Müller RA, Courchesne E. Cerebellar function in autism: functional magnetic resonance image activation during a simple motor task. *Biological Psychiatry* **56**(4):269-78 (2004).

http://dx.doi.org/10.1016/j.biopsych.2004.06.005

Baron-Cohen S. *Mindblindness: an essay on autism and theory of mind.* Cambridge, Massachusetts: The MIT Press, 1995.
http://cognet.mit.edu/library/books/view?isbn=026252225X
Read chapters 4 through 7. The other chapters also are of interest, and I encourage you to read them if time allows.

Baron-Cohen S. The extreme male brain theory of autism. *Trends in Cognitive Sciences* **6**(6):248-254 (2002).
http://dx.doi.org/10.1016/S1364-6613(02)01904-6

Barron J, Barron S. *There's a Boy in Here.* New York: Simon & Schuster, 1992. pp 12-21 and pp 101-126.
http://campusgw.library.cornell.edu/services/reserves.html

Bertone A, Mottron L, Jelenic P, Faubert J. Enhanced and diminished visuo-spatial information processing in autism depends on stimulus complexity. Brain **128**(10):2430-2441 (2005).
http://dx.doi.org/10.1093/brain/awh561

Burack JA. Selective attention deficits in persons with autism: preliminary evidence of an inefficient attentional lens. *Journal of Abnormal Psychology* **103**(3):535-543 (1994).
http://content.apa.org/journals/abn/103/3/535

Casanova MF, Buxhoeveden DP, Switala AE, Roy E. Minicolumnar pathology in autism. *Neurology* **58**(3):428-432 (2002).
http://www.neurology.org/cgi/content/full/58/3/428

Castelli F, Frith C, Happé F, Frith U. Autism, Asperger syndrome and brain mechanisms for the attribution of mental states to animated shapes. *Brain* **125**(8):1839-1849 (2002).
http://brain.oxfordjournals.org/cgi/content/full/125/8/1839

Charman T. Why is joint attention a pivotal skill in autism? *Philosophical Transactions of the Royal Society of London B* **358**(1430):315-324 (2003).
http://dx.doi.org/10.1098/rstb.2002.1199

Courchesne E, Karns CM, Davis HR, Ziccardi R, Carper RA, Tigue ZD, Chisum HJ, Moses P, Pierce K, Lord C, Lincoln AJ, Pizzo S, Schreibman L, Haas RH, Akshoomoff NA, Courchesne RY. Unusual brain growth patterns in early life in patients with autistic disorder: an MRI study. *Neurology* **57**(2):245-254 (2001).
http://www.neurology.org/cgi/content/full/57/2/245

D'Amelio M, Ricci I, Sacco R, Liu X, D'Agruma L, Muscarella LA, Guarnieri V, Militerni R, Bravaccio C, Elia M, Schneider C, Melmed R, Trillo S, Pascucci T, Puglisi-Allegra S, Reichelt KL, Macciardi F, Holden JJ, Persico AM. Paraoxonase gene variants are associated with autism in North America, but not in Italy: possible regional specificity in gene-environment interactions. *Molecular Psychiatry* **10**(11):1006-1016 (2005).
10.1038/sj.mp.4001714

Dawson G, Webb S, Schellenberg GD, Dager S, Friedman S, Aylward E, Richards T. Defining the broader phenotype of autism: genetic, brain, and behavioral perspectives. *Development and Psychopathology* **14**(3):581-611 (2002).
http://dx.doi.org/10.1017/S0954579402003103

Frith U, Happé F. Autism: beyond "theory of mind". *Cognition* **50**(1-3):115-132 (1994).
http://dx.doi.org/10.1016/0010-0277(94)90024-8

Grandin T. *Thinking in Pictures: and Other Reports from My Life with Autism.* New York: Doubleday, 1995.

Chapter 1 (pp 19-42) and chapter 3 (pp 62-81).
http://campusgw.library.cornell.edu/services/reserves.html

Greenspan SI. The affect diathesis hypothesis: the role of emotions in the core deficit in autism and the development of intelligence and social skills. *Journal of Developmental and Learning Disorders* **5**:1-45 (2001).
http://www.icdl.com/icdld/2001_v5_1_.pdf

Hadjikhani N, Joseph RM, Snyder J, Chabris CF, Clark J, Steele S, McGrath L, Vangel M, Aharon I, Feczko E, Harris GJ, Tager-Flusberg H. Activation of the fusiform gyrus when individuals with autism spectrum disorder view faces. *NeuroImage* **22**(3):1141-1150 (2004).
http://dx.doi.org/10.1016/j.neuroimage.2004.03.025

Happé F, Briskman J, Frith U. Exploring the cognitive phenotype of autism: weak "central coherence" in parents and siblings of children with autism: I. Experimental tests. *Journal of Child Psychology and Psychiatry* **42**(3):299-307 (2001).
http://dx.doi.org/10.1111/1469-7610.00723

Happé F, Frith U. The weak coherence account: detail-focused cognitive style in autism spectrum disorders. *Journal of Autism and Developmental Disorders* **36**(1):5-25 (2006).
http://dx.doi.org/10.1007/s10803-005-0039-0

Herbert MR, Ziegler DA, Makris N, Filipek PA, Kemper TL, Normandin JJ, Sanders HA, Kennedy DN, Caviness VS Jr. Localization of white matter volume increase in autism and developmental language disorder. *Annals of Neurology* **55**(4):530-540 (2004).
http://dx.doi.org/10.1002/ana.20032

Hill EL. Executive dysfunction in autism. *Trends in Cognitive Sciences* **8**(1):26-32 (2004).
http://dx.doi.org/10.1016/j.tics.2003.11.003

Johnson MH, Halit H, Grice SJ, Karmiloff-Smith A. Neuroimaging of typical and atypical development: a perspective from multiple levels of analysis. *Development and Psychopathology* **14**(3):521-536 (2002).
http://dx.doi.org/10.1017/S0954579402003073

Just MA, Cherkassky VL, Keller TA, Minshew NJ. Cortical activation and synchronization during sentence comprehension in high-functioning autism: evidence of underconnectivity. *Brain* **127**(8):1811-1821 (2004).
http://dx.doi.org/10.1093/brain/awh199

Klin A, Jones W, Schultz R, Volkmar F, Cohen D. Visual fixation patterns during viewing of naturalistic social situations as predictors of social competence in individuals with autism. *Archives of General Psychiatry* **59**(9):809-816 (2002).
http://archpsyc.ama-assn.org/cgi/content/full/59/9/809

Lotspeich LJ, Kwon H, Schumann CM, Fryer SL, Goodlin-Jones BL, Buonocore MH, Lammers CR, Amaral DG, Reiss AL. Investigation of neuroanatomical differences between autism and Asperger syndrome. *Archives of General Psychiatry* **61**(3):291-298 (2004).
http://archpsyc.ama-assn.org/cgi/content/full/61/3/291

Miller JN, Ozonoff S. The external validity of Asperger disorder: lack of evidence from the domain of neuropsychology. *Journal of Abnormal Psychology* **109**(2):227-238 (2000).
http://content.apa.org/journals/abn/109/2/227

Minshew NJ, Goldstein G, Siegel DJ. Neuropsychologic functioning in autism: profile of a complex information processing disorder. *Journal of the International Neuropsychological Society* **3**(4):303-316 (1997).
http://journals.cambridge.org/action/displayFulltext?type=1&fid=49154&jid=INS&volumeId=3&issueId=04&ai

d=49153

Mottron L, Dawson M, Soulières I, Hubert B, Burack JA. Enhanced perceptual functioning in autism: an update, and eight principles of autistic perception. *Journal of Autism and Developmental Disorders* **36**(1):27-43 (2006). http://dx.doi.org/10.1007/s10803-005-0040-7

Mukhopadhyay TR. *The Mind Tree.* New York: Arcade Publishing, 2003. pp ix-xii, 1-5, 80-85, 201-212. http://campusgw.library.cornell.edu/services/reserves.html

Müller RA, Pierce K, Ambrose JB, Allen G, Courchesne E. Atypical patterns of cerebral motor activation in autism: a functional magnetic resonance study. *Biological Psychiatry* **49**(8):665-676 (2001). http://dx.doi.org/10.1016/S0006-3223(00)01004-0

Ozonoff S, Cook I, Coon H, Dawson G, Joseph RM, Klin A, McMahon WM, Minshew N, Munson JA, Pennington BF, Rogers SJ, Spence MA, Tager-Flusberg H, Volkmar FR, Wrathall D. Performance on Cambridge Neuropsychological Test Automated Battery subtests sensitive to frontal lobe function in people with autistic disorder: evidence from the Collaborative Programs of Excellence in Autism network. *Journal of Autism and Developmental Disorders* **34**(2):139-150 (2004). http://dx.doi.org/10.1023/B:JADD.0000022605.81989.cc

Persico AM, Bourgeron T. Searching for ways out of the autism maze: genetic, epigenetic and environmental clues. *Trends in Neurosciences* **29**(7):349-358 (2006). http://dx.doi.org/10.1016/j.tins.2006.05.010

Piven J, Palmer P, Jacobi D, Childress D, Arndt S. Broader autism phenotype: evidence from a family history study of multiple-incidence autism families. *American Journal of Psychiatry* **154**(2):185-190 (1997). http://ajp.psychiatryonline.org/cgi/reprint/154/2/185

Plaisted K, Swettenham J, Rees L. Children with autism show local precedence in a divided attention task and global precedence in a selective attention task. *Journal of Child Psychology and Psychiatry* **40**(5):733-742 (1999). http://dx.doi.org/10.1111/1469-7610.00489

Rinehart NJ, Bradshaw JL, Brereton AV, Tonge BJ. Movement preparation in high-functioning autism and Asperger disorder: a serial choice reaction time task involving motor reprogramming. Journal of Autism and Developmental Disorders 31(1):79-88 (2001). http://dx.doi.org/10.1023/A:1005617831035

Rubenstein JLR, Merzenich MM. Model of autism: increased ratio of excitation/inhibition in key neural systems. *Genes, Brain and Behavior* **2**(5):255-267 (2003). http://dx.doi.org/10.1034/j.1601-183X.2003.00037.x

Russell J, Saltmarsh R, Hill E. What do executive factors contribute to the failure on false belief tasks by children with autism? *Journal of Child Psychology and Psychiatry* **40**(6):859-868 (1999). http://dx.doi.org/10.1111/1469-7610.00504

Schultz RT, Gauthier I, Klin A, Fulbright RK, Anderson AW, Volkmar F, Skudlarski P, Lacadie C, Cohen DJ, Gore JC. Abnormal ventral temporal cortical activity during face discrimination among individuals with autism and Asperger syndrome. *Archives of General Psychiatry* **57**(4):331-340 (2000). http://archpsyc.ama-assn.org/cgi/content/full/57/4/331

Teitelbaum P, Teitelbaum O, Nye J, Fryman J, Maurer RG. Movement analysis in infancy may be useful for early diagnosis of autism. *Proceedings of the National Academy of Sciences of the United States of America.* **95**(23):13982-13987 (1998).

http://www.pnas.org/cgi/content/full/95/23/13982

Townsend J, Courchesne E, Covington J, Westerfield M, Harris NS, Lyden P, Lowry TP, Press GA. Spatial attention deficits in patients with acquired or developmental cerebellar abnormality. *Journal of Neuroscience* **19**(13):5632-5643 (1999).
http://www.jneurosci.org/cgi/content/full/19/13/5632

Veenstra-Vanderweele J, Christian SL, Cook EH Jr. Autism as a paradigmatic complex genetic disorder. *Annual Review of Genomics and Human Genetics* **5**:379-405 (2004).
http://dx.doi.org/10.1146/annurev.genom.5.061903.180050

In addition to the listed readings, you are free to read as background material my collection of my own papers at `http://www.mattababy.org/~belmonte/Publications/` using the username and password given in class.