



Computational Psychiatry Seminar

Autumn Semester 2014: Autism Spectrum Disorder (ASD)

Helene Haker, Maya Schneebeli, Klaas Enno Stephan

When: Friday 14:00 to 16:00, 19.09.2014 to 19.12.2014

Where: ETH Zürich, ETZ building (Gloriastrasse 35), room F 91 (F floor)

Credits: To receive credit points you can

- give one of the scheduled (N.N.) presentations, covering the topics and the literature suggested
- or perform a computational modeling project and present it in the last session of the seminar (19.12.2014).

Program Overview

Introduction

Clinical impression incl. case presentations

1. Session, 19.09.14 **Clinical introduction I – Asperger’s Syndrome** (S. u. M. Schneebeli)
2. Session, 26.09.14 **Clinical introduction II – Early childhood autism** (R. Gundelfinger)

Previous findings: Cognition

3. Session, 03.10.14 **Visual system** (Eduardo Aponte)
4. Session, 10.10.14 **Motor system** (Viivi Inkeri Jokinen)
5. Session, 17.10.14 **Higher order cognition** (Alpha Renner)
6. Session, 24.10.14 **Social cognition** (Evelyn Chen)

Previous findings: Biology

8. Session, 07.11.14 **Biology** (Isabel Berwian) – *mind the date!*

Computational modeling

Modeling cognition

7. Session, 31.10.14 **Bayesian modeling of cognition** (Lilian Weber) – *mind the date!*
9. Session, 14.11.14 **Bayesian modeling of social cognition** (Jean Daunizeau)
10. Session, 21.11.14 **Bayesian accounts of ASD** (Andreea Diaconescu)

Modeling biology

11. Session, 28.11.14 **Neuronal connectivity** (Po-Jui Lu)
12. Session, 05.12.14 **Modeling connectivity** (Sudhir Shankar Raman/Jakob Heinzle)

Outlook

13. Session, 12.12.14 **Experimental paradigms** (Maya Schneebeli)
14. Session, 19.12.14 **Project presentations** (Students, Klaas Enno Stephan)

Sessions

1. Session, 19.09.14 Clinical introduction I – Asperger's Syndrome

Presenter: Sandra Schneebeli and Maya Schneebeli

Description: "My sister and me" – The story of two sisters. One affected by Asperger's Syndrome, one being "neurotypical".

Literature

- Asperger, H. (1943). Die „Autistischen Psychopathen“ im Kindesalter. Medizinische Fakultät der Wiener Universität.
- Atwood, T. (2006). The complete guide to Asperger's syndrome (London and Philadelphia: Jessica Kingsley Publishers).
- Atwood, T. (2006). Asperger's and Girls (Future Horizons).
- Schneebeli, S. (2009). Verstehen und Verstanden Werden – mein Leben mit dem Asperger Syndrom. Autismus Deutsche Schweiz.
- Wing, L. (1981). Asperger's syndrome: a clinical account. Psychol Med 11: 115–129.

2. Session, 26.09.14 Clinical introduction II – Early childhood autism

Presenter: Ronnie Gundelfinger (Department of child and adolescent psychiatry, UZH)

Description: Clinical description of early childhood autism, incl. case reports.

Literature

- Kanner, L. (1943). Autistic disturbances of affective contact. Nervous Child 2: 217–250.
- Fuentes, J., Bakare, M., Munir, K., Aguayo, P., Gaddour, N., Öner, Ö., et al. (2012). Autism spectrum disorders. In IACAPAP Textbook of Child and Adolescent Mental Health.

3. Session, 03.10.14 Visual system

Presenter: Eduardo Aponte

Description: Peculiarities of the visual system in ASD.

Literature

Two major reviews

- Simmons, D.R., Robertson, A.E., McKay, L.S., Toal, E., McAleer, P., and Pollick, F.E. (2009). Vision in autism spectrum disorders. Vision Research 49: 2705–2739.
- Dakin, S., and Frith, U. (2005). Vagaries of visual perception in autism. Neuron 48: 497–507.

And some original work of your choice, described in these reviews.

4. Session, 10.10.14 Motor system

Presenter: Viivi Inkeri Jokinen

Description: A computational view on the motor system and its peculiarities in autism.

Literature

Introductory reviews

- Gowen, E., and Hamilton, A. (2012). Motor Abilities in Autism: A Review Using a Computational Context. *J Autism Dev Disord* 43: 323–344.

And some original work cited in the review

- Glazebrook, C., Gonzalez, D., Hansen, S., and Elliott, D. (2009). The role of vision for online control of manual aiming movements in persons with autism spectrum disorders. *Autism* 13: 411–433.
- Cascio, C.J., Foss-Feig, J.H., Burnette, C.P., Heacock, J.L., and Cosby, A.A. (2012). The rubber hand illusion in children with autism spectrum disorders: delayed influence of combined tactile and visual input on proprioception. *Autism* 16: 406–419.
- Fabbri-Destro, M., Cattaneo, L., Boria, S., and Rizzolatti, G. (2008). Planning actions in autism. *Exp Brain Res* 192: 521–525.
- Schmitz, C., Martineau, J., Barthélémy, C., and Assaiante, C. (2003). Motor control and children with autism: deficit of anticipatory function? *Neuroscience Letters* 348: 17–20.

5. Session, 17.10.14 Higher order cognition

Presenter: Alpha Renner

Description: Peculiarities of higher cognitive functions in ASD such as attention, working memory, planning, etc.

Literature

Weak central coherence and executive functions

- Rajendran, G., and Mitchell, P. (2007). Cognitive theories of autism. *Developmental Review* 27: 224–260. (you can skip the ToM part here, see session 6)
- Happé, F. and Frith, U. (2006). The Weak Coherence Account: Detail-focused Cognitive Style in Autism Spectrum Disorders. *J Autism Dev Disord* 36: 5–25.

Cognitive flexibility

- Geurts, H. M., Corbett, B., & Solomon, M. (2009). The paradox of cognitive flexibility in autism. *Trends in Cognitive Sciences*, 13(2), 74–82. doi:10.1016/j.tics.2008.11.006

Implicit learning

- Brown, J., Aczel, B., Jiménez, L., Kaufman, S.B., and Grant, K.P. (2010). Intact implicit learning in autism spectrum conditions. *Q J Exp Psychol (Hove)* 63: 1789–1812.

6. Session, 24.10.14 Social cognition

Presenter: Evelyn Chen

Description: A view on processes related to theory of mind, empathy, social salience, and social motivation in ASD.

Literature

Theory of mind

- Frith, U. (2001). Mind blindness and the brain in autism. *Neuron* 32: 969–979.

Mirror neurons

- Hamilton, A.F. de C. (2013). Reflecting on the mirror neuron system in autism: A systematic review of current theories. *Developmental Cognitive Neuroscience* 3: 91–105.

Social salience

- Jones, W., and Klin, A. (2013). Attention to eyes is present but in decline in 2–6-month-old infants later diagnosed with autism. *Nature* 504: 427–431.

Social motivation

- Chevallier, C., Kohls, G., Troiani, V., Brodtkin, E.S., and Schultz, R.T. (2012). The social motivation theory of autism. *Trends Cogn Sci* 16: 231–239.

8. Session, 7.11.14 (sic) Biology

Presenter: Isabel Berwian

Description: A view on biological facts: neurochemistry, genetics and animal models.

Literature

Neurochemistry

- Lam, K.S.L., Aman, M.G., and Arnold, L.E. (2006). Neurochemical correlates of autistic disorder: a review of the literature. *Res Dev Disabil* 27: 254–289.

further neurochemistry reading (must not be covered in the presentation)

- Bakermans-Kranenburg, M.J., and van Ijzendoorn, M.H. (2013). Sniffing around oxytocin: review and meta-analyses of trials in healthy and clinical groups with implications for pharmacotherapy. *Translational Psychiatry* 3: e258.
- Auyeung, B., Baron-Cohen, S., Ashwin, E., Knickmeyer, R., Taylor, K., and Hackett, G. (2010). Fetal testosterone and autistic traits. *Br J Psychol* 100: 1–22.

Genetics

- Klei, L., Sanders, S.J., Murtha, M.T., Hus, V., Lowe, J.K., Willsey, A.J., et al. (2012). Common genetic variants, acting additively, are a major source of risk for autism. *Mol Autism* 3: 9.

Animal models

- Schneider, T. (2010). Autism: Animal Models. (*Encyclopedia of Psychopharmacology*)

7. Session, 31.10.14 (sic) Bayesian modeling

Presenter: Lilian Weber

Description: Introduction into hierarchical Bayesian modeling of belief updating.

Literature

- Stephan, K.E. (2014). Bayesian inference, model selection and generative models. Translational Neuromodeling Lecture FS2014, ETH Zurich.
- Mathys, C., Daunizeau, J., Friston, K.J., and Stephan, K.E. (2011). A bayesian foundation for individual learning under uncertainty. *Front. Hum. Neurosci.* 5: 39.
- Diaconescu, A.O., Mathys, C., Weber, L.A.E., Daunizeau, J., Kasper, L., Lomakina, E.I., Fehr, E., and Stephan, K.E. (2014). Inferring on the Intentions of Others by Hierarchical Bayesian Learning. *PLoS Comput Biol* 10: e1003810.

Dataset and Code

- Bayes demo from Klaas Enno Stephan
- An example (dataset and code) provided by Andreea Diaconescu

9. Session, 14.11.14 Modeling social cognition

Presenter: Jean Daunizeau

Description: Modeling Theory of mind sophistication phenotypes.

Literature

- Devaine, M., Hollard, G., and Daunizeau, J. (2014). Theory of mind: did evolution fool us? *PLoS One* 9: e87619.

Further reading

- Yoshida, W., Dziobek, I., Kliemann, D., Heekeren, H.R., Friston, K.J., and Dolan, R.J. (2010). Cooperation and Heterogeneity of the Autistic Mind. *J Neurosci* 30: 8815–8818.
- Kishida, K.T., King-Casas, B., and Montague, P.R. (2010). Neuroeconomic Approaches to Mental Disorders. *Neuron* 67: 543–554.

Code

- Code provided by Jean Daunizeau

10. Session, 21.11.14 Bayesian accounts of ASD

Presenter: Andreea Diaconescu

Description: A new perspective on ASD: a unifying theory?

Literature

- Pellicano, E., and Burr, D. (2012). When the world becomes ‘too real’: a Bayesian explanation of autistic perception. *Trends Cogn Sci* 16: 503–509.

- Brock, J. (2012). Alternative Bayesian accounts of autistic perception: comment on Pellicano and Burr. *Trends Cogn Sci* 16: 573–574.x
- Pellicano, E. and Burr, D. (2012). Response to Brock: noise and autism. *Trends Cogn Sci* 16: 574–575.
- Friston, K.J., Lawson, R., and Frith, C.D. (2013). On hyperpriors and hypopriors: comment on Pellicano and Burr. *Trends Cogn Sci* 17: 1.
- Lawson, R.P., Rees, G., and Friston, K.J. (2014). An aberrant precision account of autism. *Front. Hum Neurosci* 8: 1-10.

11. Session, 28.11.14 Neuronal connectivity

Presenter: Po-Jui Lu

Description: Neuronal connectivity in ASD: an anatomical developmental view, fMRI findings and an animal model.

Literature

Neuronal connectivity in ASD

- Courchesne, E., Campbell, K., and Solso, S. (2011). Brain growth across the life span in autism: age-specific changes in anatomical pathology. *Brain Res* 1380: 138–145.
- Müller, R.-A., Shih, P., Keehn, B., Deyoe, J. R., Leyden, K. M., & Shukla, D. K. (2011). Underconnected, but How? A Survey of Functional Connectivity MRI Studies in Autism Spectrum Disorders. *Cerebral Cortex*, 21(10), 2233–2243. doi:10.1093/cercor/bhq296
- Alaerts, K., Woolley, D.G., Steyaert, J., Di Martino, A., Swinnen, S.P., and Wenderoth, N. (2013). Underconnectivity of the superior temporal sulcus predicts emotion recognition deficits in autism. *Social Cognitive and Affective Neuroscience*.

A connectivity based animal model of ASD

- Testa-Silva, G., Loebel, A., Giugliano, M., de Kock, C.P.J., Mansvelder, H.D., and Meredith, R.M. (2012). Hyperconnectivity and slow synapses during early development of medial prefrontal cortex in a mouse model for mental retardation and autism. *Cerebral Cortex* 22: 1333–1342.

12. Session, 05.12.14 Modeling connectivity

Presenter: Sudhir Shankar Raman and Jakob Heinzle

Description: Introduction into dynamic causal modeling (DCM) for fMRI resting state, taking as example an open dataset of ASD resting state MRI data.

Literature

- Friston, K.J., Kahan, J., Biswal, B., and Razi, A. (2014). A DCM for resting state fMRI. *Neuroimage* 94: 396–407.
- Li, B., Daunizeau, J., Stephan, K.E., Penny, W., Hu, D., and Friston, K. (2011). Generalised filtering and stochastic DCM for fMRI. *Neuroimage* 58: 442–457.

Dataset

- http://fcon_1000.projects.nitrc.org/indi/abide/

Code

- SPM: <http://www.fil.ion.ucl.ac.uk/spm/>

13. Session, 12.12.14 Experimental paradigms

Presenter: Maya Schneebeli

Description: What kind of experimental paradigms have been used to study autism so far? What are their drawbacks? What has to be taken into account while designing future paradigms? How could they look like?

Literature

- Kenworthy, L., Yerys, B. E., Anthony, L. G., & Wallace, G. L. (2008). Understanding executive control in autism spectrum disorders in the lab and in the real world. *Neuropsychology review*, 18(4), 320–338. doi:10.1007/s11065-008-9077-7
- Baron-Cohen, S., Jolliffe, T., Mortimore, C., et al. (1997). Another advanced test of theory of mind: Evidence from very high functioning adults with autism or Asperger syndrome. *J Child Psychol & Psychiat* 38: 813–822.
- Klin, A. (2000). Attributing social meaning to ambiguous visual stimuli in higher-functioning autism and Asperger syndrome: The Social Attribution Task. *J Child Psychol Psychiatry* 41: 831–846.
- Maekawa, T., Tobimatsu, S., Inada, N., Oribe, N., Onitsuka, T., Kanba, S., et al. (2011). Top-down and bottom-up visual information processing of non-social stimuli in high-functioning autism spectrum disorder. *Research in Autism Spectrum Disorders* 5: 201–209.
- Iglesias, S., Mathys, C., Brodersen, K. H., Kasper, L., Piccirelli, M., den Ouden, H. E. M., & Stephan, K. E. (2013). Hierarchical Prediction Errors in Midbrain and Basal Forebrain during Sensory Learning. *Neuron*, 80(2), 519–530. doi:10.1016/j.neuron.2013.09.009

14. Session, 19.12.14 Project presentations

Moderator: Klaas Enno Stephan

Description: Participants present their modeling projects