

Current Topics in Perception: Multisensory Integration

I) Course information

Course number: PSYD51H3

Thursdays, 1-3pm
Place: IC204

Prerequisites: PSYB51

II) Instructor:

Dr. Matthias Niemeier
1265 Military Trail S572
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Office Hours: Fri, 2-3 pm and by appointment. Also, I will have special office hours for everyone to help with preparations for their presentation in class. I request to please approach me about this at least one week before your presentation.

III) Course coverage and goals

The world around us is multimodal. How do we join our senses (vision, audition, touch, olfaction, balance etc.) together to obtain a coherent percept of the world? In the past few years, multisensory integration has become a topic of major research interest. The course provides a survey of the recent developments. Selected readings will cover neurophysiological results, psychological and neuropsychological findings, synaesthesia, and an introduction to the Bayesian mechanisms of multisensory integration.

On a more general level PSYD51 is modeled after seminar courses in grad school as well as lab meetings in research labs. As such PSYD51 provides training in reading and understanding scientific articles, oral and written scientific communication, critical thinking, and grant writing.

IV) Web pages

Course Web Site: BlackBoard

Here you will find the syllabus, instructions for the papers, the most up-to-date version of the lecture schedule, and announcements.

Please check on a regular basis for announcements.

V) Evaluation

One aim of this course is to be closer to the real world of science than that is possible in a lecture. That is, **there won't be exams nor a textbook**. There won't even be a regular lecture. Instead, your presence in class and **active** participation in the course is expected and will be a significant part of the grade. We will have a reading list of original research papers (2 per week), and every week there will be presentations and discussions on them. Also, we will have assignments; every week a short thought paper on one of the research papers from the reading list, and at the end of the course there will be a research proposal on a topic of multisensory integration.

30% Presentation. On one day you are asked to present one of the research papers for the respective day. The quality of your presentation will be crucial for your own and for everyone else's learning experience. You can earn these 30% within 20-25 min, which is the length of your presentation. To be successful it needs to be a free presentation. You can use notes, but reading from a manuscript just doesn't work for your audience. The exact structure of the presentations will vary from article to article. But it should have the following parts:

- (a) a brief introduction to the topic (up to 5 min)
- (b) a summary of the methods, results and conclusions of the paper. (~15 min)
- (c) a summary of the discussion of the article (up to 5 min)

A group discussion will follow your presentation (not part of your grade).

To choose a topic, please refer to the Schedule and the reading list. Topics will be assigned on a first-come-first-serve basis. Please email me your first 3 choices. Please contact me to set up a 1-hr appointment with me to prepare for your presentation.

30% Active participation in the group discussions. Every week you are expected to read the respective literature (2 papers) so that you are properly prepared to engage in discussions on them. The 30% emphasize that I value participation very much. Science lives from discussions. For this seminar it means that you need to say something in class that pertains to the respective topic. No worries, you don't need to make genius comments in class (but it doesn't hurt, of course). It is perfectly fine to convey any kind of thought of your own. For example: Do you agree with the authors? Do you have concerns about confounds or gaps in the study? Or maybe, were you impressed with something about the study? Do you have ideas about how to extend the research? Anything from your thought paper (see below) that you might want to share? Even if there was something in the paper that you didn't understand that could be worth talking about. There is a good chance that others had the same problem (but you get the credit for bringing it up). – Our discussions can be about many different things, and you will get a point for every session during which you contribute to those discussions. Speaking of "every session". Part of participating implies that you are present. Every week. That's the hitch of having no exams and no textbook. For more than one missed session I will need to factor this in, unless I receive medical certificates from you.

20% Five thought papers (4% each). Having read the weekly literature (2 papers) you also need to write thought papers. That means **2 pages of your own thoughts**. The purpose is (a) to make you read the literature and prepare for the course, (b) to practice scientific writing, (c) to encourage you to develop your own thoughts on the particular topic. Please note that I have certain expectations as to how to structure a thought paper, see instructions on BlackBoard ("**How to write a thought paper**"). Thought papers are due about every 2 weeks, and each of them needs to be submitted on the day of the session for which it is scheduled at 1pm (-10% per every 24h of late submission). Here are the "milestones" of t-paper submission:

By week 4: at least 1 t-paper

By week 6: at least 2 t-papers

By week 8: at least 3 t-papers

By week 10: at least 4 t-papers

By week 12: at least 5 t-papers

If you want you can submit up to 7 t-papers. In that case I will count the 5 best papers. Please email me your t-papers.

20% Research proposal. The proposal is due on the last day of classes. Please go to BlackBoard for tips and instructions on "**How to write a research proposal**".

VI) Schedule

The schedule is subject to changes as we go along. The most up-to-date version will be on the Intranet.

Week	Topic	Literature
1	Introduction	--
2	Neural mechanisms of multisensory integration	Hummel & Gerloff (2005), Bremmer et al. (2001)
3	Crossmodal cueing of attention	Spence & Driver (1997) Ward et al. (2000)
4	Multisensory object perception: behaviour	Newell et al. (2001), Lacey et al. (2007)
5	Multisensory object perception: fMRI	Amedi et al. (2001) Amedi et al. (2007)
6	Optimal multisensory integration: psychophysics and models	--- <i>Introduction to Maximum Likelihood Estimation</i> --- Ernst et al. (2002) Deneve et al. (2001)
7	Multisensory integration in parietal cortex: space and numbers	Avillac et al. (2005), Rusconi et al. (2005)
8	Vision and sound in space	Alais & Burr (2004), Fujisaki et al. (2004)
9	Vision and sound / touch in space	Zwiers et al. (2003), Macaluso et al. (2002)
10	Body schema	Blanke et al. (2005) Rousseaux et al. (2013)
11	Plasticity & development	Wallace et al. (2004), Gori et al. (2008)
12	Plus and minus syndromes of multisensory perception: Synaesthesia vs. autism	Mattingley et al. (2001), Stevenson et al. (2014)

VII) References

- Alais D, Burr D (2004). The ventriloquist effect results from near-optimal bimodal integration. *Curr Biol* 14:257-262.
- Amedi A, Malach R, Hendler T, Peled S, Zohary E (2001). Visuo-haptic object-related activation in the ventral visual pathway. *Nat Neurosci* 4:324-330.
- Amedi A, Stern WM, Camprodon JA, Berman F, Merabet L, Rotman S, Hemond C, Meijer P, Pascual-Leone A (2007). Shape conveyed by visual-to-auditory sensory substitution activates the lateral occipital complex. *Nat Neurosci* 10:687-689.
- Avillac M, Deneve S, Olivier E, Pouget A, Duhamel JR (2005). Reference frames for representing visual and tactile locations in parietal cortex. *Nat Neurosci* 8:941-949.
- Blanke O, Mohr C, Michel CM, Pascual-Leone A, Brugger P, Seeck M, Landis T, Thut G (2005). Linking out-of-body experience and self processing to mental own-body imagery at the temporoparietal junction. *J Neurosci* 25:550-557.
- Bremmer F, Schlack A, Shah NJ, Zafiris O, Kubischik M, Hoffmann K, Zilles K, Fink GR (2001). Polymodal motion processing in posterior parietal and premotor cortex: a human fMRI study strongly implies equivalencies between humans and monkeys. *Neuron* 29:287-296.
- Deneve S, Latham PE, Pouget A (2001). Efficient computation and cue integration with noisy population codes. *Nat Neurosci*. 2001 Aug;4(8):826-31.
- Ernst MO, Banks MS (2002). Humans integrate visual and haptic information in a statistically optimal fashion. *Nature* 415:429-433.
- Fujisaki W, Shimojo S, Kashino M, Nishida S (2004). Recalibration of audiovisual simultaneity. *Nat Neurosci* 7:773-778.

- Gori M, Del Viva M, Sandini G, Burr DC (2008). Young children do not integrate visual and haptic form information. *Curr Biol* 18:694-698.
- Hummel F, Gerloff C (2005). Larger interregional synchrony is associated with greater behavioral success in a complex sensory integration task in humans. *Cereb Cortex* 15(5):670-8.
- Lacey S, Peters A, Sathian K (2007). Cross-modal object recognition is viewpoint-independent. *PLoS One* 2(9):e890
- Macaluso E, Frith CD, Driver J (2002). Crossmodal spatial influences of touch on extrastriate visual areas take current gaze direction into account. *Neuron* 34:647-658.
- Mattingley JB, Rich AN, Yelland G, Bradshaw JL (2001). Unconscious priming eliminates automatic binding of colour and alphanumeric form in synaesthesia. *Nature* 410:580-582.
- Newell FN, Ernst MO, Tjan BS, Bulthoff HH (2001). Viewpoint dependence in visual and haptic object recognition. *Psychol Sci* 12:37-42.
- Rousseaux M, Sauer A, Saj A, Bernati T, Honoré J (2013). Mislocalization of tactile stimuli applied to the trunk in spatial neglect. *Cortex* 49(10):2607-15.
- Rusconi E, Walsh V, Butterworth B (2005). Dexterity with numbers: rTMS over left angular gyrus disrupts finger gnosis and number processing. *Neuropsychologia* 43(11):1609-24.
- Spence C, Driver J (1997). Audiovisual links in exogenous covert spatial orienting. *Percept Psychophys* 59:1-22. (no pdf)
- Spence C, Kingstone A, Shore DI, Gazzaniga MS (2001). Representation of visuotactile space in the split brain. *Psychol Sci* 12:90-93.
- Stevenson RA, Siemann JK, Woynaroski TG, Schneider BC, Eberly HE, Camarata SM, Wallace MT (2014). Evidence for diminished multisensory integration in autism spectrum disorders. *J Autism Dev Disord*. 2014 Jul 15. [Epub ahead of print]
- Wallace MT, Perrault TJ Jr, Hairston WD, Stein BE (2004). Visual experience is necessary for the development of multisensory integration. *J Neurosci* 24:9580-9584.
- Ward LM, McDonald JA, Lin D (2000). On asymmetries in cross-modal spatial attention orienting. *Perception & Psychophysics* 62:1258-1264. (no pdf)
- Zwiers MP, Van Opstal AJ, Paige GD (2003). Plasticity in human sound localization induced by compressed spatial vision. *Nat Neurosci* 6:175-181.

VIII) Course Policies

For academic regulations (such as UTSC's official grading practices policy, petitions, code of behaviour on academic matters etc.) please refer to the UTSC calendar.