

## Current Topics in Perception: Multisensory Integration

### I) Course information

Course number: PSYD51H3

Thursdays, 9 am – 11 am  
Place: MW 264

Prerequisites: PSYB51

### II) Instructor:

Dr. Matthias Niemeier  
1265 Military Trail S572  
phone: 416-287-7466  
e-mail: niemeier@utsc.utoronto.ca I will respond within two working days.  
Office Hours: Thur, 11 am – 12 pm and by appointment. If that doesn't work for you please contact me by e-mail or during the our seminar to set up a time. Also, I will have special office hours for students having their presentation in class. For that we can on Thursdays at 12pm or on some other day. Please approach me about this at least one week before your presentation.

I received my MA in psychology at the University of Hamburg (Germany) and my PhD in Neuropsychology at the University of Tübingen (Germany). From October 2000 – June 2003 I was a postdoctoral fellow at UofT's Department of Physiology and the Centre for Vision Research at York University. Since July 2003 I'm a professor at UTSC.

### 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.

### IV) Web pages

#### Course Web Site: intranet page

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 your normal course. That is, there won't be exams nor a textbook (there are none on multisensory integration anyway). There won't even be a regular lecture. Instead, your active participation in the course is requested. We will have a reading list of original research papers, 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.

**20% Presentation.** On one day you are asked to present one of the research papers for the respective day and then lead a group discussion on that paper. The presentation (including discussion) will be 45 min. I strongly recommend make it a free presentation. You can use notes but reading from a manuscript just doesn't work, not for you and not for others. The exact structure of the presentations will vary from paper to paper. But it should have the following three parts:

- (a) a brief introduction to the topic (~5 min)
- (b) a summary of the methods, results and conclusions of the paper. I will make figures available on the intranet (~25 min)
- (c) a group discussion led by you (~15 min)

To choose a topic, please refer to the Schedule and the reading list. Topics will be assigned on a first-come-first-serve basis. So, please email me your first choice – and perhaps a second and third choice as well.

**15% Participation in group discussions on research papers.** Science lives from discussions. Here is your chance to contribute your own thoughts. 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? – Note that discussions can be many things. I don't expect each contribution to be the thought of a genius (though that wouldn't hurt either). 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. Last thing: in order to score on the participation scale it will be necessary to actually to be there ...

**45% Thought papers.** Every week you are expected to read the respective literature (2 papers) and to write about one of them 1-2 pages of your own thoughts. These thought papers serve three main purposes. (a) They should make you read the literature in the first place and help you prepare for the course. (b) They should train you to write scientifically. (c) They should encourage you to develop your own thoughts on the particular topic. Please note that I have relatively detailed expectations as to how a thought paper should look like in terms of structure. Therefore, please make sure that you check out the instructions provided on the Intranet (“**How to write a thought paper**”). This information sheet also contains the grading system that I will be using. Each thought paper is due for the respective seminar, 10 am. The 45% will be calculated as follows: I will score each of your papers with a point system. Maximum score will be 10 points. Then I will select your 9 best thought papers, and each of them will be worth 5% of the total grade. Since the purpose of the paper is to be prepared for class I have to deduct 1 scoring point (out of 10) per day.

**20% Research proposal.** The proposal is due on March 31, 2006. Please go to the Intranet 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.

Day	Topic	Literature
13 Jan	Introduction	--
20 Jan	Neural mechanisms of multisensory integration	Lakatos et al. (2007), Bremmer et al. (2001)
27 Jan	Crossmodal cueing of attention	Spence & Driver (1997) Ward et al. (2000)

3 Feb	Multisensory object perception	Lacey et al. (2007), Amedi et al. (2001)
10 Feb	Optimal multisensory integration	--- <i>Introduction to Maximum Likelihood Estimation</i> --- Ernst et al. (2002) Deneve et al. (2001)
17 Feb	Optimization and eye movements	Niemeier et al. (2003), Haarmeier et al. (2001)
3 Mar	Vision and sound in space	Alais & Burr (2004), Fujisaki et al. (2004)
10 Mar	Vision and touch in space	Avillac et al. (20005), Macaluso et al. (2002)
17 Mar	Body schema	Pavani et al. (2000), Ehrsson et al. (2004)
24 Mar	Learning & plasticity	Wallace et al. (2004), Zwiers et al. (2003)
31 Mar	Neuropsychology & development	Spence et al. (2001), Gori et al. (2008)
7 Apr	Synaesthesia	Mattingley et al. (2001), Hubbard et al. (2005)

## 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.
- 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.
- 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* 4:826-831.
- Ehrsson HH, Spence C, Passingham RE (2004). That's my hand! Activity in premotor cortex reflects feeling of ownership of a limb. *Science* 305:875-877.
- 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.
- Haarmeier T, Bunjes F, Lindner A, Berret E, Thier P (2001). Optimizing Visual Motion Perception during Eye Movements.
- Hubbard EM, Ramachandran VS (2005). Neurocognitive mechanisms of synesthesia. *Neuron* 48:509-520.
- Lacey S, Peters A, Sathian K (2007). Cross-modal object recognition is viewpoint-independent. *PLoS One* 2(9):e890
- Lakatos P, Chen, CM, O'Connell MN, Mills A, Schroeder CE (2007). Neuronal oscillations and multisensory interaction in primary auditory cortex. *Neuron* 53:279-292.
- 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.
- Niemeier M, Crawford JD, Tweed DB (2003). Optimal transsaccadic integration explains distorted spatial perception. *Nature* 422:76-80.
- Pavani F, Spence C, Driver J (2000). Visual capture of touch: out-of-the-body experiences with rubber gloves. *Psychol Sci* 11:353-359.
- 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.
- 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.