Current Topics in Perception: Multisensory Integration

I) Course information

Course number: PSYD51H3

Wednesdays, 10 am – 12 pm
Section: L01 2006 S
Place: MW 223

Prerequisites: PSYB51 & PSYC08

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: Wed, 12:30 pm – 1:30 pm and by appointment. Contact me by e-mail to set up a time.

I received my MA at the University of Hamburg (Germany) and my PhD at the University of Tübingen (Germany). From October 2000 – June 2003 I've been working as a postdoctoral fellow at UofT's Department of Physiology. Since July 2003 I'm an assistant 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 will be presenting 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. For your own sake, make it a free presentation. You can use notes but reading just doesn't work, not for you nor 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 your contribution to be extra smart (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.

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 make you 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. 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
11 Jan	Introduction	--
18 Jan	Neural mechanisms of multisensory integration	Fu et al. (2003), Macaluso et al. (2000)
25 Jan	Neural mechanisms II: supramodal areas in the brain	Bell et al. (2005), Bremmer et al. (2001)
1 Feb	Multisensory object perception	Newell et al. (2001), Amedi et al. (2001)
8 Feb	Optimal multisensory integration	Ernst et al. (2001), Hillis et al. (2001)

15 Feb	Optimal sensorimotor combination	Niemeier et al. (2003), Trommershauser et al. (2003)
1 Mar	Vision and sound in space	Alais & Burr (2004), Ghazanfar et al. (2005)
8 Mar	Vision and touch in space	Avillac et al. (20005), Macaluso et al. (2002)
15 Mar	Learning & plasticity	Wallace et al. (2004), Zwiers et al. (2003)
22 Mar	Timing	Fujisaki et al. (2004) Morein-Zamir et al. (2003)
29 Mar	Neuropsychological deficits	Farne et al. (2005), Valenza et al. (2004)
5 Apr	Synaesthesia	Hubbard et al. (2005), Laeng et al. (2005)

VII) References

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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.

Bell AH, Meredith MA, Van Opstal AJ, Munoz DP (2005). Crossmodal integration in the primate superior colliculus underlying the preparation and initiation of saccadic eye movements. J Neurophysiol 93:3659-3673.

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.

Ernst MO, Banks MS (2002). Humans integrate visual and haptic information in a statistically optimal fashion. Nature 415:429-433.

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Fu KM, Johnston TA, Shah AS, Arnold L, Smiley J, Hackett TA, Garraghty PE, Schroeder CE (2003). Auditory cortical neurons respond to somatosensory stimulation. J Neurosci 23:7510-7515.

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Ghazanfar AA, Maier JX, Hoffman KL, Logothetis NK (2005). Multisensory integration of dynamic faces and voices in rhesus monkey auditory cortex. J Neurosci 25:5004-5012.

Hillis JM, Ernst MO, Banks MS, Landy MS (2002). Combining sensory information: mandatory fusion within, but not between, senses. Science 298:1627-1630.

Hubbard EM, Ramachandran VS (2005). Neurocognitive mechanisms of synesthesia. Neuron 48:509-520.

Laeng B, Svartdal F, Oelmann H (2004). Does color synesthesia pose a paradox for early-selection theories of attention? Psychol Sci 15:277-281.

Macaluso E, Frith CD, Driver J (2000). Modulation of human visual cortex by crossmodal spatial attention. Science 289:1206-1208.

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.

Morein-Zamir S, Soto-Faraco S, Kingstone A (2003). Auditory capture of vision: examining temporal ventriloquism. Brain Res Cogn Brain Res 17:154-163.

Newell FN, Ernst MO, Tjan BS, Bulthoff HH (2001). Viewpoint dependence in visual and haptic object recognition. Psychol Sci 12:37-42.

Niemeier M, Crawford JD, Tweed DB (2003). Optimal transsaccadic integration explains distorted spatial perception. Nature 422:76-80.
Trommershauser J, Maloney LT, Landy MS (2003). Statistical decision theory and the selection of rapid, goal-directed movements. J Opt Soc Am A Opt Image Sci Vis 20:1419-1433.
Valenza N, Murray MM, Ptak R, Vuilleumier P (2004). The space of senses: impaired crossmodal interactions in a patient with Balint syndrome after bilateral parietal damage. Neuropsychologia 42:1737-1748.
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.
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.