

Current Topics in Perception: Multisensory Integration

I) Course information

Course number: PSYD51H3

Thursdays, 4-6 pm

Room: HL 006

Prerequisites: PSYB51, [0.5 credit from the PSYC50-series of courses] or NROC64H3

II) Instructor:

Dr. Matthias Niemeier

1265 Military Trail

SW550

phone: 416-287-7466

e-mail: niemeier@utsc.utoronto.ca

Office Hours: Wednesdays 2PM

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.

By the end of this course, you will have ...

- developed an in-depth understanding of the contemporary scientific body of knowledge about multisensory perception
- further strengthened your ability to consume scientific literature (especially original articles)
- become quite independent to acquire scientific knowledge
- increased your ability to understand, critique and extend original research in psychology and neuroscience

- further trained your ability to effectively communicate scientific knowledge to others

IV) Course Web Site: Quercus

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 5min)

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 you submit a Request for Missed Term Work Accommodations form.

20% Five thought papers (4% each). Having read the weekly literature (2 papers) you also need to write thought papers about some of these articles. That means 2 double-spaced pages of your own thoughts. The purpose is (a) to encourage you to read the literature carefully and to prepare for the respective session of course (e.g., you may write a paper about a great idea and bring that same idea up during class), (b) to practice scientific writing, (c) to encourage you to develop your own thoughts on the particular topic. Thought papers need to be submitted for the respective session during which the respective article is being discussed (email submission before the start of the class; a deduction of 10% per every 24h of late submission). Please note that thought papers need to be structured in a specific way, see instructions on **Quercus** (“**How to write a thought paper**”).

Also, we cannot have all thought papers submitted towards the end of the course because I could not offer you timely feedback; what is worse, quite a few people would be unable to complete their work. Therefore, please submit thought papers according to the following schedule:

- Thought paper 1: session 2, 3, or 4
- Thought paper 2: session 5 or 6
- Thought paper 3: session 7 or 8
- Thought paper 4: session 9 or 10
- Thought paper 5: session 11 or 12

You can make up for grades for up to 2 thought papers, on the condition that the make-up paper is submitted during the same time period. That is, if you submit a paper for session 7 and another paper for session 8, then I will take the better of the two grades to count as your “thought paper 3 grade.” However, a grade for a paper submitted for session 9 can only count as paper 4 grade, it cannot count as paper 3 grade.

Because there are multiple opportunities to make up for missed thought paper submissions I will not accept accommodation requests.

20% Research proposal. The proposal is due on the last day of classes. Please go to Quercus 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) Mengotti et al. (2018)
4	Multisensory object perception I	Ocelli et al. (2016) , Amedi et al. (2001)
5	Multisensory object perception II	Amedi et al. (2007) , Sathian et al. (2011)
6	Optimal multisensory integration: psychophysics and models	--- <i>Introduction to Maximum Likelihood Estimation</i> --- Ernst & Banks (2002) Deneve et al. (2001)
7	Vision and sound in space	Alais & Burr (2004) , Fujiisaki et al. (2004)
8	Vision and somatosensation in space	Zwiers et al. (2003) , Blanke et al. (2005)
9	Plasticity	Wallace et al. (2004) , Putzar et al. (2007)
10	Development & learning	Gori et al. (2008) , Lewkowicz & Hansen-Tift (2012)
11	Multisensory integration and action	Juravle et al. (2010) , Cappagli et al. (2019)
12	Plus and minus syndromes of multisensory perception: A crossmodal illusion vs. autism	Dieter et al. (2014) , Foxe et al. (2015)

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, Bermpohl 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.
- 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.
- Cappagli G, Finocchietti S, Cocchi E, Giammari G, Zumiani R, Cuppone AV, Baud-Bovy G, Gori M (2019). Audio motor training improves mobility and spatial cognition in visually impaired children. *Sci Rep*;9(1):3303.
- Deneve S, Latham PE, Pouget A (2001). Efficient computation and cue integration with noisy population codes. *Nat Neurosci*. 2001 Aug;4(8):826-31.
- Dieter KC, Hu B, Knill DC, Blake R, Tadin D (2014). Kinesthesia can make an invisible hand visible. *Psychol Sci* 25(1):66-75.
- Ernst MO, Banks MS (2002). Humans integrate visual and haptic information in a statistically optimal fashion. *Nature* 415:429-433.
- Foxe et al. (2015). Severe Multisensory Speech Integration Deficits in High-Functioning School-Aged Children with Autism Spectrum Disorder (ASD) and Their Resolution During Early Adolescence. *Cerebral Cortex*, 25:288-312.
- 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.
- Juravle G, Deubel H, Tan HZ, Spence C (2010). Changes in tactile sensitivity over the time-course of a goal-directed movement. *Behavioural Brain Research*, 208(2), 391- 401.
- Lewkowicz DJ, Hansen-Tift AM (2012). Infants deploy selective attention to the mouth of a talking face when learning speech. *Proc Natl Acad Sci U S A*, 109(5):1431-6.
- Mengotti P, Boers F, Dombert PL, Fink GR, Vossel S (2018). Integrating modality-specific expectancies for the deployment of spatial attention. *Sci Rep*;8(1):1210.
- Occelli V, Lacey S, Stephens C, John T, Sathian K (2016). Haptic object recognition is view-independent in early blind but not sighted people. *Perception*. 2016 Mar;45(3):337-45.

- Putzar L, Goerendt I, Lange K, Rösler F, Röder B (2007). Early visual deprivation impairs multisensory interactions in humans. *Nat Neurosci*;10(10):1243-5.
- Sathian K, Lacey S, Stilla R, Gibson GO, Deshpande G, Hu X, Laconte S, Glielmi C (2011). Dual pathways for haptic and visual perception of spatial and texture information. *Neuroimage*, 57(2):462-75.
- Spence C, Driver J (1997). On measuring selective attention to an expected sensory modality. *Percept Psychophys* 59(3):389-403.
- 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) Additional information

Missed Term Work due to Medical Illness or Other Emergency:

All students citing a documented reason for missed term work must submit their request for accommodations **within three (3) business days** of the deadline for the missed work.

Students must submit **BOTH** of the following:

- (1.) A completed **Request for Missed Term Work Accommodations form** (<http://uoft.me/PSY-MTW>), and
- (2.) **Appropriate documentation** to verify your illness or emergency, as described below.

Appropriate documentation:

For missed **TERM TESTS** due to **ILLNESS**:

- Submit the Request for Missed Term Work Accommodations form (<http://uoft.me/PSY-MTW>), along with an **original** copy of the official UTSC Verification of Illness Form (uoft.me/UTSC-Verification-Of-Illness-Form) or an **original** copy of the record of visitation to a hospital emergency room. Forms are to be completed in full, clearly indicating the start date, anticipated end date, and severity of illness. The physician's registration number and business stamp are required.
- Note: If an end date of "ongoing" is specified, the medical note will be assumed to cover a period of two weeks. If no end date / an "unknown" end date is specified, the note will be assumed to cover a period of three business days (starting from illness start date.)

For missed **TERM TESTS** due to **ACCESSABILITY REASONS**:

- Meet with your **AccessAbility consultant** and have them email Keely (keely.hicks@utoronto.ca) detailing the accommodations required.

For missed **ASSIGNMENTS** due to **ILLNESS**:

- Submit the Request for Missed Term Work Accommodations form (<http://uoft.me/PSY-MTW>), along with a **hardcopy** of the Self-Declaration of Student Illness Form (uoft.me/PSY-self-declare-form).

For missed **ASSIGNMENTS** due to **ACCESSABILITY REASONS**:

- If your desired accommodation is **within the scope** of your Accommodation Letter (ex. your letter includes “extensions of up to 7 days” and you need 3 days), submit the Request for Missed Term Work Accommodations form (<http://uoft.me/PSY-MTW>) and attach a copy of your letter. **Specify how many days extension you are requesting** on the request form.
- If your desired accommodation is **outside the scope** of your Accommodation Letter (ex. your letter includes “extensions of up to 7 days” but you need more time than that) you will need to meet with your **AccessAbility consultant** and have them email Keely (keely.hicks@utoronto.ca) detailing the accommodations required.

For missed term tests or assignments in **OTHER CIRCUMSTANCES**:

Submit the Request for Missed Term Work Accommodations form (<http://uoft.me/PSY-MTW>), along with:

- In the case of a **death of a family member or friend**, please provide a copy of a death certificate.
- For U of T varsity-level or professional **athletic commitments**, an email from your coach or varsity administrator should be sent directly to Keely Hicks (keely.hicks@utoronto.ca) **well in advance** of the missed work, detailing the dates and nature of the commitment.
- For **religious accommodations**, please email (keely.hicks@utoronto.ca) **well in advance** of the missed work.
- For circumstances **outside of these guidelines**, please email Keely (keely.hicks@utoronto.ca) on or before the date of the test / assignment deadline to describe your circumstances and ask what documentation would be appropriate

Documents covering the following situations are NOT acceptable: medical prescriptions, personal travel, weddings/personal/work commitments.

Procedure:

Submit your (1.) [request form](#) and (2.) [medical/self-declaration](#)/other documents in person **WITHIN 3 BUSINESS DAYS** of the missed term test or assignment.

Submit to: Keely Hicks, Room SW420B, Monday – Friday, 9 AM – 4 PM. (Slide forms under door if out of office.)

After submitting your documentation, within approximately one to five business days, you will receive a response from your instructor detailing the accommodations to be made (if any).

You are responsible for checking your official U of T email and Quercus course announcements daily, as accommodations may be time-critical.

You should continue to work on your assignments to the best of your ability, as extension accommodations may be as short as one business day, depending on the nature of the illness/emergency.

If an accommodation has been granted but you are unable to meet the conditions of the accommodation (ex. you need a longer extension, or you missed a make-up test), you will need to repeat the missed term work procedure and submit additional forms to

request further accommodation. Note that in the case of a missed make-up test, an opportunity to write a second make-up test may not be provided.

Completion of this form does NOT guarantee that accommodations will be made. The course instructor reserves the right to decide what accommodations (if any) will be made. Failure to adhere to any aspect of this policy may result in a denial of your request for accommodation.

Missed Accommodations

If an accommodation is granted but a continued illness/emergency prevents you from meeting the requirements of your accommodation, you must repeat the missed term work procedure to request additional accommodations.

(E.g.) If you miss a make-up midterm, you would need to submit another Request for Missed Term Work Accommodations form. If your original medical note / documentation included the date of the make-up midterm, then only the Request form is required. If the date of the make-up midterm fell outside of the dates indicated on your original medical note/other documentation, then a new medical note/other appropriate documentation must also be submitted.

Importance of Three Business Day window:

If you are unable to submit your documents in-person within the three business day window, **you must email Keely** (keely.hicks@utoronto.ca) **within the three business day window** to explain when you will be able to bring your documents in person. Exceptions to the documentation deadline will only be made under **exceptional circumstances**. Attach scans of your documentation, and be prepared to bring your documents to Keely in-person as soon as you are well. Late documents may not be accepted.

NOTE: Assignments due at end of term

Instructors cannot accept term work any later than five business days after the last day of class. Beyond this date, you would need to file a petition with the Registrar's Office (<https://www.utsc.utoronto.ca/registrar/term-work>).

NOTE: Final Exams

This policy applies only to missed assignments and term tests. Missed final exams are handled by the Registrar's Office (<http://www.utsc.utoronto.ca/registrar/missing-examination>).

Help With Writing

If you would like help with academic writing, the following resources are available to you:

- The Centre for Teaching and Learning (AC312) Writing Centre offers students

one-to-one appointments and supplementary materials to help improve upon their writing skills. <http://ctl.utsc.utoronto.ca/home/> <http://ctl.utsc.utoronto.ca/twc/>

- The English Language Development Centre offers support and specialized writing programs for students who do not speak English as their primary language. <http://ctl.utsc.utoronto.ca/eld/>

- Advice on academic writing

<http://www.writing.utoronto.ca/advice>

Academic Integrity

Academic integrity is essential to the pursuit of learning and scholarship in a university, and to ensuring that a degree from the University of Toronto is a strong signal of each student's individual academic achievement. As a result, the University treats cases of cheating and plagiarism very seriously. The University of Toronto's Code of Behaviour on Academic Matters (<http://www.governingcouncil.utoronto.ca/Assets/Governing+Council+Digital+Assets/Policies/PDF/ppjun011995.pdf>) outlines the behaviours that constitute academic dishonesty and the processes for addressing academic offences. Potential offences include, but are not limited to:

In papers and assignments:

Using someone else's ideas or words without appropriate acknowledgement;
Submitting your own work in more than one course without the permission of the instructor;

- Making up sources or facts;
- Obtaining or providing unauthorized assistance on any assignment.

On tests and exams:

- Using or possessing unauthorized aids;
- Looking at someone else's answers during an exam or test;
- Misrepresenting your identity; and
- When you knew or ought to have known you were doing it.

In academic work:

- Falsifying institutional documents or grades;
- Falsifying or altering any documentation required by the University, including (but not limited to) doctor's notes; and
- When you knew or ought to have known you were doing so. All suspected cases of academic dishonesty will be investigated following procedures outlined in the Code of Behaviour on Academic Matters. If students have questions or concerns about what constitutes appropriate academic behaviour or appropriate

research and citation methods, they are expected to seek out additional information on academic integrity from their instructors or from other institutional resources. Note: You may see advertisements for services offering grammar help, essay editing and proof-reading. Be very careful. If these services take a draft of your work and significantly change the content and/or language, you may be committing an academic offence (unauthorized assistance) under the *Code of Behaviour on Academic Matters*. It is much better and safer to take your draft to the Writing Centre as early as you can. They will give you guidance you can trust. Students for whom English is not their first language should go to the English Language Development Centre. If you decide to use these services in spite of this caution, you must keep a draft of your work and any notes you made before you got help and be prepared to give it to your instructor on request.

AccessAbility Services

Students with diverse learning styles and needs are welcome in this course. In particular, if you have a disability/health consideration that may require accommodations, please feel free to approach me and/or the AccessAbility Services as soon as possible. AccessAbility Services staff (located in Rm SW302, Science Wing) are available by appointment to assess specific needs, provide referrals and arrange appropriate accommodations [416-287-7560](tel:416-287-7560) or email ability@utsc.utoronto.ca. The sooner you let us know your needs the quicker we can assist you in achieving your learning goals in this course.

Literature Searches

Students can use the following resources when conducting literature searches to find relevant articles for their presentation and final essay:

The UTSC Library (AC235)

<http://www.library.utoronto.ca/utsc/>

PubMed

<http://www.ncbi.nlm.nih.gov/pubmed>

PsychINFO

<http://www.apa.org/pubs/databases/psycinfo/index.aspx>

Google Scholar

<http://scholar.google.ca/>

For Your Health

The Health and Wellness Centre (SL270, 416-287-7065) provides diagnostic, treatment and referral services for all illnesses ranging from the medical to psychological to health promotion. The professional staff of physicians, nurses

and counselors provides personal advice and assistance with family issues, eating disorders, depression, stress, drug and alcohol abuse, relationship issues, a positive space for gender/sexuality issues, and more.

<http://www.utsc.utoronto.ca/wellness>