Department of Psychology – Columbia University

Consciousness and Attention Seminar

GU4225 – Spring 2021

4 points

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Course Bulletin Description

Modern theories attempt to characterize the human mind in terms of information processing. But machines that process information do not seem to *feel* anything; a computer may for instance receive inputs from a video camera, yet it would be hard to imagine that it *sees* or experiences the vividness of colors like we do. Nobody has yet provided a convincing theory as to how to explain the subjective nature of our mental lives in objective physical terms. This is called the problem of consciousness, and is generally considered to be one of the last unsolved puzzles in science. Philosophers even debate whether there could be a solution to this problem at all.

In this class we review the latest developments in the fields of cognitive neuroscience and psychophysics that are related to these important questions (though often the current research does not directly address them). We focus on the latest articles on attention, vision psychophysics, subjective perception and confidence ratings, etc.

Discussion will be related of current issues in the scientific studies of consciousness, including the search for the neural correlates of visual awareness, volition, and the various kinds of impairments of consciousness and attention as described in clinical cases. Specific topics may vary from year to year; may be repeated for credit.

A crucial aspect of this seminar is to help students develop their ability to critically read and evaluate the latest published research in this field.

Prerequisites

Open to Ph.D. students in the Psychology department and graduate students in other related departments, with instructor's permission. Open to advanced undergraduate students who have taken

an introductory course in neuroscience or cognitive psychology (e.g., UN2430), with instructor's permission.

Full Description:

What is consciousness, and what does it mean to be conscious of something; what are non-conscious processes. Can we perceive without paying attention about what we perceive? What happens if the connection between the brain and the sensory systems is disrupted or damaged? After briefly reviewing the historical philosophical debate that dominated the study of consciousness (weeks 1 and 2), this seminar will then focus on contemporary investigations of consciousness, including major challenges and pitfalls. By the end of the seminar, students should have learned about major theories of consciousness and contemporary neuroscientific methodologies that allows to study this cognitive function.

Specifically:

- The course will introduce theories, research, and experiments that provided the basis for most debates on consciousness and mind;
- Overview of structure and function of sense organs and discussion on the role of psychophysical and neurophysiological experiments in providing insights in our understanding of consciousness/
- Further, the seminar will stream through a variety of cognitive functions who are important to achieve and maintain over time a "conscious state", from emotion, to the relationship between attention-sleep-mind wandering, to altered state of consciousness associated with brain lesions or psychopharmacological interventions (including substance abuse and induced states of unconsciousness during medical treatments);
- The data from both the behavioral and neurobiological sources are melded together for each topic to show our current thinking on how consciousness is instantiated in the brain, and how it is mapped onto specific brain networks and the nature of the calculations performed in the different nodes within these networks.
- Students will also participate in discussions of neuropsychological patient case studies with the goal of demonstrating how data from patients with specific types of brain damage provide important insights into the neural bases of normal cognitive functioning.

Learning Objectives:

By the end of the course, students are expected to demonstrate their knowledge of:

- The history and methods used in the science of consciousness.
- The structure of the major sensory systems.
- The transduction and transmission processes for the major sensory systems.
- Behaviorally-based models and theories of consciousness.
- The neurobiological bases of normal and abnormal conscious states.

Role in the Psychology curriculum

PSYC G4225 is an advanced seminar, designed particularly for undergraduates who are majoring in Psychology or in Neuroscience and Behavior, for students participating in the Post-bac Psychology Program, and for Psychology Graduate Students. Students with a background in the computational sciences and philosophy are also welcome to apply. In covering the cognitive and neural bases of consciousness and attention, the course provides an integrated perspective on topics of current interest in the fields of psychology and cognitive neuroscience.

The course is intended to explore the ideas of interest in the broader context of liberal arts education, such as how contemporary philosophical ideas affect our understanding of ourselves as well as the development of science.

The seminar fulfills the following degree requirements

- For Psychology Graduate Students, PSYC G4225 will apply toward the "two seriously graded seminars" requirement of the Master's degree.
- For the Psychology major or concentration in the College and in G. S., for the Psychology minor in Engineering, and for the Psychology Post-bac certificate, PSYC G4225 will meet the Group I (Perception and Cognition) distribution requirement.
- For the Neuroscience and Behavior joint major, G4225 will fulfill the 5th Psychology requirement: "one advanced psychology seminar from a list approved by the Psychology Department advisor to the program."
- For the Psychology post-bac certificate, PSYC G4225 will fulfill the 7th (advanced seminar) requirement
- For the science requirements of the College and GS, G4225 is numbered among the group of courses (3200s, 4200s, 3400s, 4400s) that are not designed for non-science majors but that do fulfill one term of the requirement. Graduate students, and students who are majoring in Psychology or in Neuroscience and Behavior, will have priority over students who wish to take the course for the science requirement, and we anticipate that it will rarely be used for that purpose.
- For the Barnard Psychology major, PSYC G4225 will fulfill the senior seminar requirement.

Readings: There is no textbook required for this course: Readings will comprise scientific articles from peer - reviewed journals, literature reviews, and commentaries in the fields of attention and perception. The readings listed in the Schedule below are divided into five categories: **History, Review, Original Research, Method, Supplementary**, labels that briefly describe each article. All readings will be posted in PDF form on CourseWorks, and each week you will be asked to read at least one article from each category. So, in total, you will be asked to read a maximum of five articles per week. Although this may sound like a lot, it is the **best and easiest** way to learn about science, while at the same time improving

your writing skills by delving into other authors' writing and to expand your background knowledge. Trust me, it works!

Schedule

The calendar below details topics, readings, and assignments for each class period. It may be subject to changes to reflect interests of students. Students are responsible to be prepared to discuss the assigned readings for each class period. Typically, each class period will begin with a short lecture providing the background in neuroscience necessary to better explore the issue of the day, conducted by the Instructor. The majority of class time will be devoted to student presentations and student-led discussions (detailed in Course Requirements). As an example, for the class on Attention and Consciousness (week 10), the Instructor will give a brief lecture on the neural correlates of attention and of consciousness, providing an overview of the field and highlighting recent findings from empirical research. Then students will present the findings and implications of the Posner 2012 article, another might present the findings and implications of the Tallon-Baudry 2012 article, and another one the Sergent et al., 2013 article, and so on. Then, the remainder of class time will be devoted to a discussion addressing questions related to the weeks' topic. Optional, supplementary readings are also included for those who might be interested in exploring the topic of a specific class more in depth, and students are encouraged to do so, especially by contributing to the discussion with more recent knowledge.

Date	Topics and Assignments	Readings
Week 1 Tue Jan 12	**Introduction to the Seminar:** review of Syllabus and overview of the topic	Watch this video: Antonio Damasio: The quest to understand consciousness
Week 2 Tue Jan 19	**Theoretical approaches to the study of consciousness Part I** *Reading response due*	**Category: History** 1. Dehaene S, Changeux JP, Naccache L, Sackur J, Sergent C (2006) Conscious, preconscious, and subliminal processing: a testable taxonomy. Trends Cognit Sci 10(5):204–211 2. Dehaene S, Changeux JP (2011) Experimental and theoretical approaches to conscious processing. Neuron 70(2):200–227. doi:10.1016/j.neuron.2011.03.018 **Category: Review** 3. Cavanna, A. E., Bartolomei, F., & Naccache, L. (2011). The global workspace (GW) theory of consciousness and epilepsy. Behavioural Neurology, 24(1).

		4. Naccache, L. (2018). Why and how access consciousness can account for phenomenal consciousness. Phil. Trans. R. Soc. B, 373(1755), 20170357. **Category: Method** 5. Bandettini, P. A. (2012). Twenty years of functional MRI: the science and the stories. *Neuroimage*, *62*(2), 575-588 **Category: Opinion** 6. Buzsáki, G. (2020). The Brain–Cognitive Behavior Problem: A Retrospective. *eNeuro*, *7*(4). **Category: Supplementary** 7. Naccache L. 2017 Minimally conscious state or cortically mediated state? Brain 141, 949–960. (doi:10.1093/brain/awx324) 8. What is Consciousness? with Stanislas Dehaene
Week 3 Tue Jan 26	**Theoretical approaches to the study of consciousness Part II** *Reading response due*	**Category: History** 1. Crick, F., & Koch, C. (1990). Towards a neurobiological theory of consciousness. In Seminars in the Neurosciences (Vol. 2, pp. 263-275). Saunders Scientific Publications. 2. Crick, F., & Koch, C. (2003). A framework for consciousness. Nature neuroscience, 6(2), 119. **Category: Review** 3. Koch, C., Massimini, M., Boly, M., & Tononi, G. (2016). Neural correlates of consciousness: progress and problems. Nature Reviews Neuroscience, 17(5), 307. **Category: Original Research** 4. Gelbard-Sagiv, H., Mudrik, L., Hill, M. R., Koch, C., & Fried, I. (2018). Human single neuron activity

		precedes emergence of conscious perception. Nature communications, 9(1), 2057. **Category: Method** 1. Krueger, G., & Granziera, C. (2012). The history and role of long duration stimulation in fMRI. *NeuroImage*, *62*(2), 1051-1055. **Category: Supplementary** 5. Koch, C., & Tsuchiya, N. (2007). Attention and consciousness: two distinct brain processes. Trends in cognitive sciences, 11(1), 16-22. 6. Tononi, G., & Koch, C. (2015). Consciousness: here, there and everywhere?. Phil. Trans. R. Soc. B, 370(1668), 20140167. 7. Consciousness (Christof Koch): MIT 6.S099: Artificial General Intelligence.
Week 4 Tue Feb 2	**Theoretical approaches to the study of consciousness Part III** *Reading response due*	**Category: History** 1. Cohen, M. A., & Dennett, D. C. (2011). Consciousness cannot be separated from function. Trends in cognitive sciences, 15(8), 358-364. 2. Chalmers, D. J. (2013). How can we construct a science of consciousness?. Annals of the New York Academy of Sciences, 1303(1), 25-35. **Category: Review** 3. Chalmers, D. (2018). The meta-problem of consciousness. Journal of Consciousness Studies, 25(9-10), 1-41. 4. Tsuchiya N, Wilke M, Frassle S, Lamme VA (2015) No-report paradigms: extracting the true neural correlates of consciousness. Trends Cognit Sci 19(12):757–770. doi:10.1016/j.tics.2015.10.0

		Category: Original Research 5. Michel, M., Beck, D., Block, N., Blumenfeld, H., Brown, R., Carmel, D., ... & Dehaene, S. (2019). Opportunities and challenges for a maturing science of consciousness. Nature human behaviour, 3(2), 104. **Category: Method** 6. Britton, J. W., Frey, L. C., Hopp, J. L., Korb, P., Koubeissi, M. Z., Lievens, W. E., ... & St, E. L. (2016). *Electroencephalography (EEG): An introductory text and atlas of normal and abnormal findings in adults, children, and infants*. American Epilepsy Society, Chicago. **Category: Supplementary** 7. Lamme VA. 2006 Towards a true neural stance on consciousness. Trends Cogn. Sci. 10, 494–501. (doi:10.1016/j.tics.2006.09.001) 8. Block's Overflow Argument. Pacific Philosophical Quarterly, 98, 65-70. 9. How do you explain consciousness? | David Chalmers 10. Daniel Dennett on the Evolution of the Mind, Consciousness and AI
Week 5 Tue Feb 9	**Theoretical approaches to the study of consciousness Part IV** *Reading response due*	**Category: History** 1. Shea, N., & Bayne, T. (2010). The vegetative state and the science of consciousness. The British journal for the philosophy of science, 61(3), 459-484. **Category: Review** 2. Shea, N., & Frith, C. D. (2016). Dual-process theories and consciousness: the case for 'Type Zero' cognition. Neuroscience of Consciousness, 2016(1).

		3. Bayne, T., Hohwy, J., & Owen, A. M. (2016). Are there levels of consciousness? Trends in cognitive sciences, 20(6), 405-413. **Category: Original Research** 4. Michel, M. (2017). Methodological artefacts in consciousness science. Journal of Consciousness Studies, 24(11-12), 94-117. **Category: Method** 5. Vaidya, A. R., Pujara, M. S., Petrides, M., Murray, E. A., & Fellows, L. K. (2019). Lesion studies in contemporary neuroscience. *Trends in Cognitive Sciences*, *23*(8), 653-671. **Category: Supplementary** 6. Chris Frith (University College London): "What's the Use of Consciousness?"
Week 6 Tue Feb 16	**Beyond the theories of Consciousness: Information Processing** *Reading response due* **Deadline for Topic Proposal**	**Category: History** 1. Block, N. (2018). If perception is probabilistic, why does it not seem probabilistic? Philosophical Transactions of the Royal Society B: Biological Sciences, 373(1755), 20170341. **Category: Review** 2. Naccache L, Marti S, Sitt JD, Tru¨butschek D, Berkovitch L. 2016 Why the P3b is still a plausible correlate of conscious access? A commentary on Silverstein et al., 2015. Cortex 85, 126–128. (doi:10.1016/j.cortex.2016.04.003) **Category: Original Research** 3. Silverstein BH, Snodgrass M, Shevrin H, Kushwaha R. 2015 P3b, consciousness, and complex unconscious processing. Cortex 73, 216–227. (doi:10.1016/j.cortex.2015.09.004)

		4. Koivisto M, Salminen-Vaparanta N, Grassini S, Revonsuo A. 2016 Subjective visual awareness emerges prior to P3. Eur. J. Neurosci. 43, 1601–1611. (doi:10.1111/ejn.13264) **<u>Category: Method</u>** 5. Laufs, H. (2012). A personalized history of EEG–fMRI integration. *Neuroimage*, *62*(2), 1056-1067. **<u>Category: Supplementary</u>** 6. Block, N. (2014). Rich conscious perception outside focal attention. Trends in Cognitive Sciences, 18(9), 445-447. 7. Koivisto M, Grassini S. 2016 Neural processing around 200 ms after stimulus-onset correlates with subjective visual awareness. Neuropsychologia 84, 235–243.
Week 7 Tue Feb 23	**Consciousness and Perception** *Reading response due*	**<u>Category: History</u>** 1. Pins D, Ffytche D (2003) The neural correlates of conscious vision. Cereb Cortex 13(5):461–474 **<u>Category: Original Research</u>** 2. Zmigrod, S., & Hommel, B. (2011). The relationship between feature binding and consciousness: Evidence from asynchronous multi-modal stimuli. Consciousness and cognition, 20(3), 586-593 3. Zou, J., He, S., & Zhang, P. (2016). Binocular rivalry from invisible patterns. Proceedings of the National Academy of Sciences, 113(30), 8408–8413. 4. Podvalny, E., Flounders, M. W., King, L. E., Holroyd, T., & He, B. J. (2019). A dual role of prestimulus spontaneous neural activity in visual object recognition. Nature communications, 10(1), 1-13. **<u>Category: Method</u>**

		5. Edlow, B. L., Mareyam, A., Horn, A., Polimeni, J. R., Witzel, T., Tisdall, M. D., ... & Tirrell, L. S. (2019). 7 Tesla MRI of the ex vivo human brain at 100 micron resolution. *Scientific data*, *6*(1), 1-10. **Category: Supplementary** 6. Aru, J., Axmacher, N., Do Lam, A. T., Fell, J., Elger, C. E., Singer, W., & Melloni, L. (2012). Local category-specific gamma band responses in the visual cortex do not reflect conscious perception. Journal of Neuroscience, 32(43), 14909-14914. 7. Chica AB, Valero-Cabre´ A, Paz-Alonso PM, Bartolomeo P (2014) Causal contributions of the left frontal eye field to conscious perception. Cereb Cortex 24(3):745–753. doi:10.1093/cercor/bhs357
Week 8 - SPRING BREAK		
Week 9 Tue Mar 9	**Theoretical approaches to the study of Attention** *Reading response due*	**Category: History** 1. Carrasco, M. (2011). Visual attention: The past 25 years. Vision research, 51(13), 1484-1525. 2. Desimone, R., & Duncan, J. (1995). Neural mechanisms of selective visual attention. Annual review of neuroscience, 18(1), 193-222. **Category: Review** 3. Petersen, S. E., & Posner, M. I. (2012). The attention system of the human brain: 20 years after. Annual review of neuroscience, 35, 73-89. 4. Reynolds, J. H., & Heeger, D. J. (2009). The normalization model of attention. Neuron, 61(2), 168-185. **Category: Original Research**

		5. Buschman, T. J., & Kastner, S. (2015). From behavior to neural dynamics: an integrated theory of attention. Neuron, 88(1), 127-144. **Category: Method** 6. Baillet, S. (2017). Magnetoencephalography for brain electrophysiology and imaging. Nature neuroscience, 20(3), 327. **Category: Supplementary** 7. Treisman, A. M., & Gelade, G. (1980). A feature-integration theory of attention. Cognitive psychology, 12(1), 97-136.
Week 10 Tue Mar 16	**The Neural Bases of Attention** *Reading response due* **Deadline Manuscript Draft**	**Category: Review** 1. Peelen, M. V., & Kastner, S. (2014). Attention in the real world: toward understanding its neural basis. Trends in cognitive sciences, 18(5), 242-250. **Category: Original Research** 2. Xuan, B., Mackie, M. A., Spagna, A., Wu, T., Tian, Y., Hof, P. R., & Fan, J. (2016). The activation of interactive attentional networks. NeuroImage, 129, 308-319. 3. Fiebelkorn, I. C., Pinsk, M. A., & Kastner, S. (2018). A dynamic interplay within the frontoparietal network underlies rhythmic spatial attention. Neuron, 99(4), 842-853. 4. Patel, G. H., Yang, D., Jamerson, E. C., Snyder, L. H., Corbetta, M., & Ferrera, V. P. (2015). Functional evolution of new and expanded attention networks in humans. Proceedings of the National Academy of Sciences, 112(30), 9454-9459. 5. Proskovec, A. L., Heinrichs-Graham, E., Wiesman, A. I., McDermott, T. J., & Wilson, T. W. (2018). Oscillatory dynamics in the dorsal and ventral

		attention networks during the reorienting of attention. Human brain mapping, 39(5), 2177-2190. **<u>Category: Method</u>** 6. Parvizi, J., & Kastner, S. (2018). Human intracranial EEG: promises and limitations. *Nature neuroscience*, *21*(4), 474. **<u>Category: Supplementary</u>** 7. Callejas, A., Shulman, G. L., & Corbetta, M. (2014). Dorsal and ventral attention systems underlie social and symbolic cueing. Journal of cognitive neuroscience, 26(1), 63-80. 8. Berger, A., Henik, A., & Rafal, R. (2005). Competition between endogenous and exogenous orienting of visual attention. Journal of Experimental Psychology: General, 134(2), 207.
Week 11 Tue Mar 23	**Consciousness and Attention** **Part I** *Reading response due*	**<u>Category: History</u>** 1. Posner MI (2012) Attentional networks and consciousness. Front Psychol 3:64. doi:10.3389/fpsyg.2012.00064 **<u>Category: Review</u>** 2. Tallon-Baudry, C. (2012). On the neural mechanisms subserving consciousness and attention. Frontiers in psychology, 2, 397. **<u>Category: Original Research</u>** 3. Sergent C, Wyart V, Babo-Rebelo M, Cohen L, Naccache L, Tallon-Baudry C. 2013 Cueing attention after the stimulus is gone can retrospectively trigger 16conscious perception. Curr Biol. 23, 150–155. (doi:10.1016/j.cub.2012.11.047) 4. Bichot, N. P., Xu, R., Ghadooshahy, A., Williams, M. L., & Desimone, R. (2019). The role of prefrontal

		cortex in the control of feature attention in area V4. *Nature communications*, *10*(1), 1-12. 5. Carrasco, M., & Barbot, A. (2019). Spatial attention alters visual appearance. *Current opinion in psychology*, *29*, 56-64. 6. Martín-Signes, M., Cano-Melle, C., & Chica, A. B. (2020). Fronto-parietal networks underlie the interaction between executive control and conscious perception: Evidence from TMS and DWI. *Cortex*, *134*, 1-15. **Category: Method** 7. Herff, C., Krusienski, D. J., & Kubben, P. (2020). The Potential of Stereotactic-EEG for Brain-Computer Interfaces: Current Progress and Future Directions. *Frontiers in Neuroscience*, *14*, 123. **Category: Supplementary** 8. Chica AB, Lasaponara S, Chanes L, Valero-Cabre´ A, Doricchi F, Lupianez J, Bartolomeo P (2011b) Spatial attention and conscious perception: the role of endogenous and exogenous 9. Botta F, Lupianez J, Chica AB (2014) When endogenous spatial attention improves conscious perception: effects of alerting and bottom-up activation. Conscious Cognit 23:63–73. doi:10.1016/ j.concog.2013.12.003
Week 12 Tue Mar 30	**Consciousness and Attention Part II** *Reading response due* **Deadline for Peer Review**	**Category: Review** 1. Frauscher, B., von Ellenrieder, N., Zelmann, R., Doležalová, I., Minotti, L., Olivier, A., ... & Dubeau, F. (2018). Atlas of the normal intracranial electroencephalogram: neurophysiological awake activity in different cortical areas. Brain, 141(4), 1130-1144.

Category: Original Research

1. Lu, S., Cai, Y., Shen, M., Zhou, Y., & Han, S. (2012). Alerting and orienting of attention without visual awareness. Consciousness and Cognition, 21(2), 928–938. http://dx.doi.org/10.1016/j.concog.2012.03.012.

2. Chica AB, Bayle DJ, Botta F, Bartolomeo P, Paz-Alonso PM (2016) Interactions between phasic alerting and consciousness in the fronto-striatal network. Sci Rep 6:31868. doi:10.1038/srep31868

3. Wu, Q., Lo Voi, J. T. H., Lee, T. Y., Mackie, M.-A., Wu, Y., & Fan, J. (2015). Interocular suppression prevents interference in a flanker task. Frontiers in Psychology, 6, 1110. http://dx.doi.org/10.3389/fpsyg.2015.01110.

4. Colás, I., Capilla, A., & Chica, A. B. (2018). Neural modulations of interference control over conscious perception. Neuropsychologia, 112, 40-49.

5. Baria, A. T., Maniscalco, B., & He, B. J. (2017). Initial-state-dependent, robust, transient neural dynamics encode conscious visual perception. PLoS computational biology, 13(11), e1005806.

Category: Method

6. Parkin, B. L., Ekhtiari, H., & Walsh, V. F. (2015). Non-invasive human brain stimulation in cognitive neuroscience: a primer. *Neuron*, *87*(5), 932-945.

Category: Supplementary

7. Woolgar, A., Duncan, J., Manes, F., & Fedorenko, E. (2018). Fluid intelligence is supported by the multiple-demand system not the language system. Nature Human Behaviour, 2(3), 200.

Week 13 Tue Apr 6	**Consciousness, Default Mode Network, and sleep** *Reading response due*	**<u>Category: History</u>** 1. Raichle, M. E. (2015). The brain's default mode network. *Annual review of neuroscience*, *38*, 433-447. **<u>Category: Review</u>** 2. Mak et al 2017 - The Default Mode Network in Healthy Individuals A Systematic Review and Meta-Analysis **<u>Category: Original Research</u>** 3. Calabro RS, Cacciola A, Bramanti P, Milardi D (2015) Neural correlates of consciousness: what we know and what we have to learn! Neurol Sci 36(4):505–513. doi:10.1007/s10072-015-2072-x 4. Barttfeld P, Uhrig L, Sitt JD, Sigman M, Jarraya B, Dehaene S. 2015 Signature of consciousness in the dynamics of resting-state brain activity. Proc. Natl Acad. Sci. USA 112, 887–892. (doi:10.1073/pnas. 1418031112) 5. Spadone, S., Della Penna, S., Sestieri, C., Betti, V., Tosoni, A., Perrucci, M. G., ... & Corbetta, M. (2015). Dynamic reorganization of human resting-state networks during visuospatial attention. Proceedings of the National Academy of Sciences, 201415439. 6. Crittenden, B. M., Mitchell, D. J., & Duncan, J. (2015). Recruitment of the default mode network during a demanding act of executive control. Elife, 4, e06481. 7. Gonzalez-Garcia, C., Flounders, M. W., Chang, R., Baria, A. T., & He, B. J. (2018). Content-specific activity in frontoparietal and default-mode networks

		during prior-guided visual perception. Elife, 7, e36068. **<u>Category: Method</u>** 8. Bergmann, T. O., & Hartwigsen, G. (2020). Inferring Causality from Noninvasive Brain Stimulation in Cognitive Neuroscience. *Journal of Cognitive Neuroscience*, 1-29. **<u>Category: Supplementary</u>** 9. Baars, B. J. (2005). Global workspace theory of consciousness: toward a cognitive neuroscience of human experience. Progress in brain research, 150, 45-53.
Week 14 Tue Apr 13	**Minimally conscious states and neurological disorders** *Reading response due*	**<u>Category: Review</u>** 1. Schnakers, C., Hirsch, M., Noé, E., Llorens, R., Lejeune, N., Veeramuthu, V., ... & Chatelle, C. (2020). Covert cognition in disorders of consciousness: A meta-analysis. *Brain sciences*, *10*(12), 930. 2. Mashour, G. A., Roelfsema, P., Changeux, J. P., & Dehaene, S. (2020). Conscious processing and the global neuronal workspace hypothesis. *Neuron*, *105*(5), 776-798. **<u>Category: Original Research</u>** 3. Faugeras, F., Rohaut, B., Valente, M., Sitt, J., Demeret, S., Bolgert, F., ... & Demertzi, A. (2018). Survival and consciousness recovery are better in the minimally conscious state than in the vegetative state. Brain injury, 32(1), 72-77. 4. Demertzi, A., Tagliazucchi, E., Dehaene, S., Deco, G., Barttfeld, P., Raimondo, F., ... & Schiff, N. D. (2019). Human consciousness is supported by dynamic

		complex patterns of brain signal coordination. *Science advances*, *5*(2), eaat7603. 5. Hermann, B., Raimondo, F., Hirsch, L., Huang, Y., Denis-Valente, M., Pérez, P., ... & Rohaut, B. (2020). Combined behavioral and electrophysiological evidence for a direct cortical effect of prefrontal tDCS on disorders of consciousness. *Scientific reports*, *10*(1), 1-16. **Category: Method** 6. Engemann, D. A., Raimondo, F., King, J. R., Rohaut, B., Louppe, G., Faugeras, F., ... & Laureys, S. (2018). Robust EEG-based cross-site and cross-protocol classification of states of consciousness. Brain, 141(11), 3179-3192. **Category: Supplementary** 7. Kinsbourne, M. (2006). From unilateral neglect to the brain basis of consciousness. Cortex, 42(6), 869-874.
Week 15 Tue Apr 20th	**Deadline for Final Submission**	

Course Requirements:

1. **Class preparation and participation:** The assigned readings are designed to expand your knowledge on the latest advancement in the field of neuroscience of consciousness and to hone your critical thinking skills. The topics discussed during the seminars are complex, leaving plenty of space to discuss and debate. Strong preparation and participation will enable us to have high-level, thought-provoking discussion.
2. **Reading Response:** The day before each class period you will be asked to submit a short (one-paragraph) reading response to CourseWorks by 5:00pm. Goals of these reading responses are to help you keep current on course topics and to help me understand where students may have had difficulty with the readings and which topics students were most intrigued by and, therefore, which areas may warrant more focus during class time. Each reading response should be no more than a short paragraph, either discussing something interesting you found in the readings or asking

substantive questions about concepts in the reading you found challenging. As the goal of these assignments is to keep you up to speed and to help guide my teaching and our class discussions, the assignments will just be graded on a pass/fail basis. (I can only accept responses submitted before the deadline.)

3. **Participate in Discussion:** Thorough reading enables thoughtful discussion. It is important to engage with the material during class discussions, since your active participation in these discussions will contribute to your final grade. If you feel that regularly contributing to class discussions is difficult for you, you should raise this issue with me as soon as possible. In such cases, we might be able to work out a way for you to participate thoughtfully through your reading responses.

Generally speaking, effective class preparation and participation could include:

- Asking insightful or clarifying questions.
- Connecting the reading to other reading we've done in the course or reading you've done on your own, drawing parallels and/or contrasts among findings.
- Actively listening to fellow classmates and responding to their ideas.
- Offering thoughtful critiques of the research methodology and providing suggestions for how it might be improved.
- Bringing in outside sources – potentially from the news media or other sources – that shed light on neuroscience findings or that illustrate ways in which these findings are interpreted and applied.

4. **Presentation and Leading discussions:** <u>You will be responsible for presenting two articles and leading a follow-up class discussion at meetings.</u> I'll provide more information and give a demonstration of the sort of presentation I'm looking for in the first week of class. But, briefly, you'll walk us through your assigned article, describing the methods and results, highlighting any strengths or weaknesses of the study design, and giving your thoughts on the meaning and importance of the findings. Note important info below:
    a. You must send your presentation to the Instructor ahead of time (deadline for full credit is the Saturday before your presentation day), so that I can provide feedback in advance of your actual presentations.
    b. You are expected to implement that feedback in your presentation, therefore making your slides clearer and more accessible.
    c. Also, Upload the slides on Piazza the night before class, so that everyone has the slides beforehand.

As the goal is for you to become more skilled in presenting research findings and leading discussions, in calculating grades, successive presentations will be weighted more heavily than the previous (see grading scheme).

5. **Research manuscript:** The culmination of this course is the creation of a novel research proposal relating to the material of the class. Good writing is good thinking, and a primary goal of this assignment is to help you hone your writing and critical thinking skills. The process of writing the research paper happens entirely on Coursework and follows three steps:
   a) **Topic Proposal:** Early in the course you will be asked to identify a topic related to the class. As soon as you identify it, you are expected to post on the associated page on CourseWork your research topic, so that together we can decide whether it is appropriate. Such topic proposals should include a short paragraph about your intended topic and a list of at least five (and no more than 10) references you intend to use. I will make suggestions regarding focus, potential sources, etc. **Deadline for Topic Proposal is set to Tuesday February 16th at 11:59 PM.**
   b) **Manuscript Draft:** Once your topic is approved, you will begin work on a first draft of the paper. Generally, you want to choose a topic that is appropriately narrow to address in an 8-10 pages paper (not including references). The paper will first introduce the topic, then review recent knowledge and advancements in the field, and then discuss future directions / breakthroughs you identify. **Deadline for the Manuscript Draft is set to Tuesday March 16th at 11:59 PM.** You will receive comments from the Instructor within a two-week time-frame from your submission.
   c) **Anonymous Peer Review:** In order to make this activity also an opportunity for students to actively learn, one of the steps in the revision process will be a round of "anonymous peer review," in which each student will be asked to review the drafts of at least two of their colleagues. This will put each student in the position of the "reviewer," by critically analyzing and understanding pitfalls, shortcomings, but also strengths of the writing of their peers; this is expected to influence also the student's own writing by adjusting the focus and clarifying potential issues. Students will be randomly assigned to anonymously peer review the drafts written by two other students. Comments and suggestions from the peer-review process should be appropriately considered when writing the final manuscript based on the student's judgment. Students will be evaluated on their own writing, the feedback provided to other students, as well as their ability to incorporate the feedback into their work. Make sure you provide valuable feedback to your peers in order to get full points on the final writing assignment. **Deadline for the Anonymous Peer Review to Tuesday March 30th at 11:59 PM.**
   d) **Final Submission:** Towards that end, I will provide comments and suggestions on your first draft, and you will be expected to make substantive changes – not just copyediting, but rather larger edits such as, reworking entire sections, drawing on new sources, and providing more analysis. The final draft of the paper will be graded not only as a standalone paper but also in how it demonstrates improvement upon the earlier draft. **Deadline for the Final Submission is Tuesday April 20th.**

Grading

Grades will be calculated based on the percentages outlined below.

Class preparation and participation……20%

Reading responses 50%

Contribution to class discussion 50%

Presentation and Discussion leading……40%

First presentation 40%

Second presentation 60%

Research Manuscript……40%

Proposal 10%

First draft 20%

Peer Review 20%

Final draft 50%

Class policies: Important Information below – please read carefully!

- Special needs: If you are a student with special needs and require any type of accommodation, please make an appointment with me before the first class to discuss your needs. You should also contact the office of Disability Services (https://health.columbia.edu/disability-services) before the first class to register for specific accommodations. If you have problems reading specific kinds of text (e.g., based on font or text size), please see me so I can make you exams (and a syllabus, and anything else you need) that you can more easily read.

- Religious observances: If you are going to miss class(es) due to religious holidays, you must notify me during the first week of class so that accommodations may be made.

- Academic integrity: As members of this academic community, we are responsible for maintaining the highest level of personal and academic integrity: "Each one of us bears the responsibility to participate in scholarly discourse and research in a manner characterized by intellectual honesty and scholarly integrity…. The exchange of ideas relies upon a mutual trust that sources, opinions, facts, and insights will be properly noted and carefully credited. In practical terms, this means that, as students, you must be responsible for the full citations of others' ideas in all of your research papers and projects… [and] you must always submit your own work and not that of another student, scholar, or internet agent" (from the Columbia University Faculty Statement on Academic Integrity) http://www.college.columbia.edu/academics/academicintegrity . Cheating and plagiarism – whether intentional or inadvertent – is a serious violation of academic integrity. Plagiarism is the practice of claiming or implying original authorship of (or incorporating materials from) someone else's written or creative work, in whole or in part, without adequate acknowledgement. If you have any questions about what constitutes plagiarism and/or how to properly cite sources, please come to me. I am more than happy to help. Similarly, if you put yourself in a situation in which you think your best option might be to cut some corners, see me.

If you feel like you are falling behind, don't understand the material, or are not confident about your ability to take tests, talk to me as soon as possible instead of taking measures that go against principles of academic integrity. We are here to learn, not to merely judge. It is a far better option to come talk to me than compromise your academic integrity and potentially put your academic standing in jeopardy.

- Sexual Respect: Any form of gender-based misconduct will not be tolerated. Columbia University is committed to fostering an environment that is free from gender-based discrimination and harassment, including sexual assault and all other forms of gender-based misconduct. Visit this website for more information: http://sexualrespect.columbia.edu/

- Attendance: Coming to class is meaningless if class time is spent inappropriately. Chatting with friends, watching videos online, and browsing social media are not appropriate activities for the classroom. Also, remember to silence your cell phone before class. Generally, eliminate distractions as much as possible to respect your classmates, as well as increase your chance of staying focused and learning the material during class.

Changes to the Syllabus might happen during the course. The most recent version will always be posted to Courseworks.