Government of Russian Federation

Federal State Autonomous Educational Institution of High Education

«National Research University Higher School of Economics»

Faculty of Social science
Department of Psychology

Syllabus for the course
«Cognitive Neuroscience»

37.04.01 «Cognitive sciences and technologies: from neuron to cognition»,
Master of Science

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Approved by Academic Council:

«_29_»__августа___2017 г., № _51_____

Academic supervisor of the «Cognitive sciences and technologies: from neuron to cognition»

Dr. Anna Shestakova _____

Moscow, 2017

This syllabus may not be used by other departments of the University and by any other institutions without permission of the Author.

1. Scope of Use

The present program establishes minimum demands of students' knowledge and skills, and determines content of the course.

The present syllabus is aimed at department teaching the course, their teaching assistants, and students of the Master of Science program 37.04.01 «Cognitive sciences and technologies: from neuron to cognition».

This syllabus meets the standards required by:

Educational standards of National Research University Higher School of Economics;

Educational program «Psychology» of Master's Degree Program 37.04.01;

University curriculum of the Master's program «Cognitive sciences and technologies: from neuron to cognition» in psychology (37.04.01) for 2017.

2. Learning Objectives

Learning objectives of the course "Cognitive Neuroscience" are to introduce students to the neurobiological basis of cognition, its foundation and connections to other branches of knowledge:

- Fundamental theory about neural processes that underlay high order cognitive functions;
- Recent progress in the field;
- Research Methods in neuroscience applicable to the fields.

3. Learning outcomes

After completing the study of the course "Cognitive Neuroscience" the student should:

- Know basis of neural processes that support high order functions;
- Know methods used to study the neuronal basis of cognition;
- Be able to distinguish the capacities and restrictions applied by brain structure and functioning to psychological processes;
- Possess skills for choosing appropriate neuroscience methods for psychological research;
- Posses skills to come up with own research proposals;
- Posses skills to understand and present scientific articles.

After completing the study of the discipline "Cognitive Neuroscience" the student should have the following competences:

Competence	Code	Code (UC)	Descriptors (indicators of achievement of the result)	Educative forms and methods aimed at generation and development of the competence
The ability to reflect on the methods of activity studied.	CK-1	CK-M1	The student is able to reflect on the methods of activity studied based on cognitive neuroscience approaches.	Seminars

The ability to propose a model to invent and test methods and tools of professional activity.	СК-2	СК-М2	The student is able to propose a model to invent and test methods and tools of cognitive neuroscience.	Seminars
The ability to independently become acquainted with new research methods, to change scientific profile of activity.	СК-3	СК-М 3	The student is able to independently become acquainted with new methods of cognitive neuroscience.	Tutorials, presentations.
The ability to improve and develop intelligent and cultural level, to build track of professional development and career.	SC-4	SC-M4	The student is able to improve and develop intelligent and cultural level, to build track of professional development and career based on the theories of cognitive neuroscience.	Lectures, group discussions, colloquium, projects in mini-groups, discussions of essays.
The ability to analyze, verify and assess the completeness of information during professional activity and work under ambiguity.	СК-6	СК-М 6	The student is able to analyze, verify and assess the completeness of information to solve cognitive neuroscience problems.	Tutorials, presentations, tests.
The ability to conduct professional (including research) activity in international environment.	SC-8	SC-M8	The student is able to conduct professional (including research) activity in international environment regarding main concepts of cognitive neuroscience.	Lectures, group discussions, colloquium, projects in mini-groups, discussions of essays.

Capability to organize independent scientific, research, consulting and applied activity on the basis of juridical and professional standards and duties.	PC-1	ИК-М1.2п/н/и/к/пр_6.1	The student is able to organize independent scientific, research, consulting and applied activity on the basis of cognitive neuroscience approach.	Lectures, group discussions, colloquium, projects in mini-groups, discussions of essays.
The ability to communicate orally and in written form in English in the frame of professional and scientific intercourse.	ПК-2	ИК-М2.1_2.2._2.4.1_2.4.2	The student is able to discuss problems of cognitive neuroscience both orally and in written form.	Seminars, tests.
The ability to use modern IT technologies for search and processing of information, work with professional databases and net communication.	PC-4	ИК-М4.1_4.3_4.4	The student is able to use modern IT technologies for search and processing of information, work with professional databases and net communication to solve cognitive neuroscience problems.	Tutorials, group discussions, presentations.
The ability to describe the problems and situations of the professional activity using the language and the apparatus of the humanitarian, economical and social sciences for solving problems at the intersection of scientific fields, in related professional fields.	PC-5	ИК-М5.3_5.4_5.6_2.4.1	The student is able to use the language and terminology of cognitive neuroscience for solving problems at the intersection of scientific fields, in related professional fields.	Seminars, tests.

The ability to detect, transmit common goals in the professional and social activities.	PC-8	SPC-M3	The student is able to detect, transmit common goals of cognitive neuroscience.	Tutorials, group discussions, presentations.

4. Place of the discipline in the Master's program structure

The course "Cognitive Neuroscience" belongs to major basic disciplines in the Master's program "Cognitive sciences and technologies: from neuron to cognition".

Prerequisites:

The course is based on the knowledge in biology, physiology, anatomy and psychology. The following knowledge and competence are required to study the discipline:

- A good command of English language.
- Basic knowledge of brain anatomy.

Main competences developed after completing the study of this course are required for the study of the following disciplines of the Master's Program "Cognitive sciences & technologies: from neuron to cognition", including:

- Thinking and Emotional Modulation of Cognition
- Computational Neuroscience
- Memory, Learning and Cognitive Development
- Behavioral Genetics and Neurogenetics
- Decision Science and Neuroeconomics

5. Thematic Plan of the Course

№	Topic	Total hours	Class hours		Self-study
			Lectures	Seminars	
1.	Perception	23	4	5	14
2.	Attention	22	2	5	14
3.	Memory	28	3	7	20
4.	Language	11	4	4	6
5.	Emotions	8	2	2	4
6.	Mirror system	13	1	4	4
7.	Neurogenetics	9	2	3	4
Total:		**114**	**18**	**30**	**66**

6. Requirements and Grading

Type of grading	Type of work	1st year		Characteristics
		1	2	
Continuous	Paper presentation		*	Talk on the seminar on the topic related to the lectures, 60 minutes each.
Continuous	Research proposal		*	Choice of tasks that will help students to develop their own research ideas. Finally should be presented to the class.
Continuous	Attendance		*	Evaluation of attendance lectures and seminars
Final	Exam		*	Exam will include multiple choice questions, short answers questions and one essay question.

6.1. Course Grading Criteria

***Continuous assessment*:**

- **Paper presentations.** Students have to present one paper or to make a short literature review on the subject that is relevant to the course topics. Presentations can be made by groups of student but not more than 3 people in each group. Presentation should last 45 minutes and then 15 minutes discussions take place. Main criteria for evaluation are relevance of the topic, understanding of the material and presentation skills.

- **Research proposal.** As a homework students should choose one of the tasks described above.
  - *Media Critique (25%).* Students will find a news article of 500 words or more that reports on a neuroscientific finding relevant for course topic. Based on the news article (published since 1995) and the original journal article on which it is based, students are to prepare a 2-4 page (double-spaced) critique of the news article's claims and assess the degree to which it correctly represents the research finding and whether it might mislead the public's understanding of neuroscience and behavior.
  - *Research ideas (25%).* Students will write down a research proposal based their ideas related on the main sections of the course (Perception, Attention, Memory, Language, Emotion, Plasticity, Mirror System).They will introduce their hypothesis, methods, collecting data and expected results. Moreover if they will test their paradigm on a sample of subjects, they may get extra score.
  - *Commentary(25%).* Students will write down a Commentary paper on a recent original research published in the Cognitive Neuroscience field. Commentary is a critical paper that aim to highlight positive and negative aspect of the published research.

Work should be done in three parts:

1) Abstract;
2) Report in a written form;
3) Presentation of the work on the seminar. 15 minutes to present and 10 minutes for discussion.

These continuous assessments will be evaluated with following criteria:

Ten-point grade	**Criteria**
0 – not accepted	Less 5%, or the test was not taken
1 – very bad	Not less than 5, but less than 15%
2 – bad	Not less than 15, but less than 25%
3 – no pass	Not less than 25, but less than 35%
4 – pass	Not less than 35, but less than 45%
5 – highly pass	Not less than 45, but less than 55%
6 – good	Not less than 55, but less than 65%
7 – very good	Not less than 65, but less than 75%
8 – almost excellent	Not less than 75, but less than 85%
9 – excellent	Not less than 85, but less than 95%

10 – perfect	Not less than 95% and greater

- **Attendance.** Attendance will be evaluated as a percentage of seminars and lectures that a student was present on.

Final assessment is the final exam. This exam will cover all topics that have been discussed during lectures and seminars. It will consist of multiple-choice, short answer questions and one essay question with opportunity to choose between topics. The main source to prepare the exam is slides from the lectures.

Ten-point grade	**Criteria**
0 – not accepted	No answer
1 – very bad	No criteria met
2 – bad	Less then 2 criteria met
3 – no pass	Less then 3 criteria met
4 – pass	At least 3 criteria are partially met
5 – highly pass	At least 3 criteria are met
6 – good	At least 4 criteria are partially met
7 – very good	At least 4 criteria are met
8 – almost excellent	All criteria are met.
9 – excellent	All criteria are met, and at least 3 criteria are fully met.
10 – perfect	All criteria are fully met

6.2. The cumulative grade formulae

Table of Grade Correspondence

Ten-point Grading Scale	**Five-point Grading Scale**	
1 - very bad 2 – bad 3 – no pass	Unsatisfactory – 2	**FAIL**
4 – pass 5 – highly pass	Satisfactory – 3	**PASS**
6 – good 7 – very good	Good – 4	
8 – almost excellent 9 – excellent 10 – perfect	Excellent – 5	

The final grade, which is the resultant grade for the course, goes to the certificate of Master's degree.

The current grade (Gtest) is given by the teacher as grade for control tests (5 questions for each topic).

The class grade (Gclass) is given by the teacher for attendance and activity during class hours.

The self reserch grade (Greserch) is given by the teacher for the results of scientific reserch.

The cumulative grade (Gcumulutive) for the student's achievements during the course is calculated by the end of the course on the basis of the current grade, the class grade, and the self reserch grade:

Gcumulutive = 0.3 *Gtest + 0.3 * Gclass + 0.4 * Greserch.

The examination grade (Gexam) is given by the teacher during the final examination.

The final grade (Gfinal) is calculated on the basis of the cumulative grade and the examination grade:

Gfinal = 0.6 * Gcumulutive (1 to 10) + 0.4 * Gexam (1 to 10)

The grades are rounded up arithmetically.

If the cumulative grade of a student equals 8, 9 or 10, the student can opt that the final grade be given equal to the cumulative grade:

Gfinal = Gcumulutive

If the student is eligible for this option, he/she has to inform the teacher about his/her decision concerning the final grade before the examination.

7. Course Content

TOPIC 1. PERCEPTION

- Anatomy of the visual system**:** Retina and Chiasm
- Visual cortex: Dorsal and Ventral stream
- Bottom up processing of object recognition
- Top-down processing of object recognition
- Physical characteristics of a visual stimulus: Spatial Frequencies
- Visual perception deficits: Visual Agnosia
- Object recognition and context valence
- Face recognition

Classes: 10 hours
Self-study: 18 hours

Obligatory reading:

The Oxford Handbook of Cognitive Neuroscience, Volume 1. Edited by Kevin Ochsner and Stephen M. Kosslyn. The Cutting Edge. Part 1, Perception: Chapter 2,3,4.

Intersubject synchronization of cortical activity during natural vision. Hasson U, Nir Y, Levy I, Fuhrmann G, Malach R. Science. 2004 Mar 12;303(5664):1634-40.

Top-down facilitation of visual recognition. Bar M, Kassam KS, Ghuman AS, Boshyan J, Schmid AM, Dale AM, Hämäläinen MS, Marinkovic K, Schacter DL, Rosen BR, Halgren E. Proc Natl Acad Sci U S A. 2006 Jan 10;103(2):449-54. Epub 2006 Jan 3. Erratum in: Proc Natl Acad Sci U S A. 2006 Feb 21;103(8):3007. PMID: 16407167

TOPIC 2. ATTENTION

- What is attention?
- Selective attention : Dichotic listening, Stroop test, Visual Search
- Divided attention
- Sustained attention
- Neural correlates of attention: Orienting attention network, Executive attention network, Frontal eye Field, Pulvinar Nucleus, Superior Colliculus
- Attention impairments in every day life: attentional blindness
- Attention impairments in patients: blindsight and neglect
- Consciousness

Classes: 10 hours
Self-study: 18 hours

Obligatory reading:

The Oxford Handbook of Cognitive Neuroscience, Volume 1. Edited by Kevin Ochsner and Stephen M. Kosslyn. The Cutting Edge. Part 2, Attention: Chapter 11,12,16.

Attentional modulation of neural processing of shape, color, and velocity in humans. Corbetta M1, Miezin FM, Dobmeyer S, Shulman GL, Petersen SE.Watson C. et al. The Brain: An Introduction to Functional Neuroanatomy. Academic Press, 2010. Science. 1990 Jun 22;248(4962):1556-9.

Neural mechanisms of object-based attention. Science. Baldauf D1, Desimone R. 2014 Apr 25;344(6182):424-7. doi: 10.1126/science.1247003. Epub 2014 Apr 10.

TOPIC 3. MEMORY

- The Atkinson & Shiffrin's model
- The Alan Baddeley Model
- Sensory register
- Working Memory :Encoding, Short-term memory, Rehearsal
- Long Term Memory: Explicit and Implicit Memory (Declarative and Procedural memory), episodic memory, semantic memory, Skill Learning, Priming, Conditioning.
- Deep and shallow episodic encoding
- Consolidation processing
- Neural Correlates of memory
- Classical memory processes effects
- Long-term potentiation and long-term depression at a gross level and at a cellular level
- Gross level: Perceptual learning, Classical Conditioning, Instrumental Conditioning, Relational learning
- Role of Dopamine

- Role of Hippocampus
- Patient HM and his memory disorder.
- Interfering transiently with brain function (TMS and rTMS)
- The Baddeley "episodic buffer" model
- The H.E.R.A. model
- Anterograde and Retrograde Amnesia.

Classes: 12 hours
Self-study: 24 hours

Obligatory reading:

The Oxford Handbook of Cognitive Neuroscience, Volume 1. Edited by Kevin Ochsner and Stephen M. Kosslyn. The Cutting Edge. Part 3, Attention: Chapter 17,18,19,21,23.

The episodic buffer: a new component of working memory?
Baddeley A. Trends Cogn Sci. 2000 Nov 1;4(11):417-423. PMID: 11058819 Kandel E.R. et al. (Eds.) Principles of Neural Science, 5th Edition.

TMS interference with primacy and recency mechanisms reveals bimodal episodic encoding in the human brain. Innocenti I, Cappa SF, Feurra M, Giovannelli F, Santarnecchi E, Bianco G, Cincotta M, Rossi S. J Cogn Neurosci. 2013 Jan;25(1):109-16. doi: 10.1162/jocn_a_00304. PMID: 23198892

The role of the left inferior frontal gyrus in episodic encoding of faces: An interference study by repetitive transcranial magnetic stimulation. Feurra M, Fuggetta G, Rossi S, Walsh V. Cogn Neurosci. 2010 Jun;1(2):118-25. doi: 10.1080/17588921003660736. Epub 2010 Mar 18. PMID: 24168278

Event-related rTMS at encoding affects differently deep and shallow memory traces.
Innocenti I, Giovannelli F, Cincotta M, Feurra M, Polizzotto NR, Bianco G, Cappa SF, Rossi S. Neuroimage. 2010 Oct 15;53(1):325-30. doi: 10.1016/j.neuroimage.2010.06.011. Epub 2010 Jun 16. PMID: 2060100

TOPIC 4. LANGUAGE

- Language Comphrension
- Language Production
- Relevance of context and top-down processing in language comphrension
- Digressions on the relationship between language and culture: Pragmatics, Linguistic relativity
- Relationship between sensory processing and language
- Hebbian Cell Assembly
- Timing of linguistic brain processes
- Serial model
- Comphrension of written text
- Different types of Aphasia
- Language production: speaking, writing

- Word learning processes
- Non-verbal communication: Embodied Cognition
- Neuroanatomy of Broca aphasia.
- Dislexia
- Language fluency and age of second language acquisition.
- Problems in studying spoken language understanding
- Use of MMN in neurolinguistic studies
- TMS studies of action verbs
- Differences for bilingual people

Classes: 8 hours
Self-study: 10 hours

Obligatory reading:

The Oxford Handbook of Cognitive Neuroscience, Volume 1. Edited by Kevin Ochsner and Stephen M. Kosslyn. The Cutting Edge. Part 4, Language: Chapter 24, 25, 26, 27, 28.

Brain mechanisms linking language and action. F Pulvermüller, 2005. Nature Reviews Neuroscience 6, 576-582 . Doi:10.1038/nrn1706

Genetics and language: a neurobiological perspective on the missing link (-ing hypotheses) David Poeppel. J Neurodev Disord. 2011 Dec; 3(4): 381–387. doi: 10.1007/s11689-011-9097-0

TOPIC 5. EMOTIONS

- What is emotion?
- Methods to study physiological changes.
- Relationship between physiological changes and Six basic emotions
- Reasoning
- Neurobiology of emotions: amygdala, hypothalamus, Limbic System, Brainstem
- Emotion regulation

Classes: 4 hours
Self-study: 8 hours

Obligatory reading:

The Oxford Handbook of Cognitive Neuroscience, Volume 2. Edited by Kevin Ochsner and Stephen M. Kosslyn. The Cutting Edge. Part 1, Emotions: Chapter 2

TOPIC 6. MIRROR NEURONS SYSTEM

- The mirror-neuron system in monkey
- Relation between their visual and motor properties
- Time-course of human mirror-effect
- The mirror-neuron system in humans: anatomy
- Properties
- Mirror System and Autism
- Cortico-cortical connectivity of motor imagery and action observation
  Plasticity of motor and sensory brain maps
- Mirror therapy(MT) in neurorehabilitation
- History of MT
- Methodology of MT
- Clinical use of MT
- Physiological mechanisms of MT

Classes: 8 hours
Self-study: 10 hours

Obligatory reading:

The Oxford Handbook of Cognitive Neuroscience, Volume 2. Edited by Kevin Ochsner and Stephen M. Kosslyn. The Cutting Edge. Part 2, Self and social cognition: Chapter 16

The mirror-neuron system. Rizzolatti G1, Craighero L. 2004. Annu Rev Neurosci. 27:169-92.

Impairment of actions chains in autism and its possible role in intention understanding. Cattaneo L1, Fabbri-Destro M, Boria S, Pieraccini C, Monti A, Cossu G, Rizzolatti G. 2007. Proc Natl Acad Sci. 104(45):17825-30. Epub 2007 Oct 26.

Brain 2009 The use of visual feedback, in particular mirror visual feedback, in restoring brain function. V. S. Ramachandran , Eric L. Altschuler . DOI: http://dx.doi.org/10.1093/brain/awp135 1693-1710

Neuroimage. 2014 The mirror illusion induces high gamma oscillations in the absence of movement. Butorina A, Prokofyev A, Nazarova M, Litvak V, Stroganova T doi: 10.1016/j.neuroimage.2014.09.024

TOPIC 7. NEUROGENTICS AND BRAIN STIMULATION

- Introduction to Neurogenetics of Learning and Memory
- Genetic influence on brain plasticity
- The val66met polymorphism
- The BDNF influence on Brain Stimulation effects

Classes: 4 hours

Self-study: 8 hours

Obligatory reading:

Chaieb L, Antal A, Ambrus GG, Paulus W (2014) Brain-derived neurotrophic factor: its impact upon neuroplasticity and neuroplasticity inducing transcranial brain stimulation protocols. Neurogenetics 15:1-11.

Fritsch B, Reis J, Martinowich K, Schambra HM, Ji Y, Cohen LG, Lu B (2010) Direct current stimulation promotes BDNF-dependent synaptic plasticity: potential implications for motor learning. Neuron 66:198-204.

Pezawas L, Verchinski BA, Mattay VS, Callicott JH, Kolachana BS, Straub RE, Egan MF, Meyer-Lindenberg A, Weinberger DR (2004) The brain-derived neurotrophic factor val66met polymorphism and variation in human cortical morphology. J Neurosci 24:10099-10102.

Sakata K, Martinowich K, Woo NH, Schloesser RJ, Jimenez DV, Ji Y, Shen L, Lu B (2013) Role of activity-dependent BDNF expression in hippocampal-prefrontal cortical regulation of behavioral perseverance. Proc Natl Acad Sci U S A 110:15103-15108.

Shpektor A, Bartres-Faz D, Feurra M (2015) Commentary: Duration-dependent effects of the BDNF Val66Met polymorphism on anodal tDCS induced motor cortex plasticity in older adults: a group and individual perspective. Front Aging Neurosci 7:183.

8. Educational Technology

The following educational technologies are used in the study process:

- Lectures involving continuous use of multimedia presentations and educational movies
- Seminars involving paper presentations
- Seminars involving development and presentation of own research ideas
- Self-study of presentation
- Self-study of recommended literature

8.1. Recommendations for course lecturer

Course lecturer is advised to use interactive learning methods, which allow participation of the students, such as discussions and developing of own ideas. It is also expected that multimedia presentations and video materials will be intensively used for the study process.

8.2. Recommendations for Students

Students are required to study the lecture presentations and the recommended reading. Students are required to actively participate in seminars presentations.

9. Grading

9.1. Final exam: sample of "true or false" questions:

Decide whether the statement is true or false:

1. Short-term memory is a sub-component of long term memory

2. Broca area is involved in comprehension processes

3. Action observation activate mirror neurons of the primary motor cortex

4. The role of BDNF in memory performance

5. Neglect is an attentional deficit

6. Prosopagnosia is a memory deficit

9.2. Final exam essay questions (contents) :

1. Anatomy of the visual system**:** Retina and Chiasm
2. Visual cortex: Dorsal and Ventral stream
3. Bottom up processing of object recognition
4. Top-down processing of object recognition
5. Visual perception deficits: Visual Agnosia and prosopagnosia
6. Object recognition and context valence
7. Face recognition
8. Selective attention: Dichotic listening, Stroop test, Visual Search
9. Divided attention
10. Sustained attention
11. Neural correlates of attention: Orienting attention network, Executive attention network, Frontal eye Field, Pulvinar Nucleus, Superior Colliculus
12 Attention impairments in every day life: inattentional blindness
13. Attention impairments in patients: blindsight and neglect
14. The Atkinson & Shiffrin's model
15. The Alan Baddeley Model
16. Working Memory : Encoding, Short-term memory, Rehearsal
17. Long Term Memory: Explicit and Implicit Memory (Declarative and Procedural memory), episodic memory, semantic memory, Skill Learning, Priming, Conditioning.
18. Deep and shallow episodic encoding
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22. Patient HM and his memory disorder.
23. Interfering transiently with brain function (TMS and rTMS)
24. The Baddeley “episodicbuffer” model
25. The H.E.R.A. model
26. Anterograde and Retrograde Amnesia.
27. Language Comphrension
28. Language Production
29. Timing of linguistic brain processes
30. Different types of Aphasia
31. Non-verbal communication: Embodied Cognition
32. Neuroanatomy of Broca aphasia.

33. TMS studies of action verbs
34. Differences for bilingual people
35. The mirror-neuron system in monkey
36. The mirror-neuron system in humans: anatomy
37. Mirror System and Autism
38. Cortico-cortical connectivity of motor imagery and action observation
39. Mirror therapy(MT) in neurorehabilitation
40. Clinical use of MT
41. Physiological mechanisms of MT
42. The BDNF effects on memory performance
43. The Val66met polymorphism

10. Reading and Materials

10.1. Obligatory reading

The Oxford Handbook of Cognitive Neuroscience, Volume 1. Edited by Kevin Ochsner and Stephen M. Kosslyn. The Cutting Edge. Part 1, Perception: Chapter 2,3,4.

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Top-down facilitation of visual recognition. Bar M, Kassam KS, Ghuman AS, Boshyan J, Schmid AM, Dale AM, Hämäläinen MS, Marinkovic K, Schacter DL, Rosen BR, Halgren E. Proc Natl Acad Sci U S A. 2006 Jan 10;103(2):449-54. Epub 2006 Jan 3. Erratum in: Proc Natl Acad Sci U S A. 2006 Feb 21;103(8):3007. PMID: 16407167

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Attentional modulation of neural processing of shape, color, and velocity in humans. Corbetta M1, Miezin FM, Dobmeyer S, Shulman GL, Petersen SE.Watson C. et al. The Brain: An Introduction to Functional Neuroanatomy. Academic Press, 2010. Science. 1990 Jun 22;248(4962):1556-9.

Neural mechanisms of object-based attention. Science. Baldauf D1, Desimone R.
2014 Apr 25;344(6182):424-7. doi: 10.1126/science.1247003. Epub 2014 Apr 10.
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TMS interference with primacy and recency mechanisms reveals bimodal episodic encoding in the human brain. Innocenti I, Cappa SF, Feurra M, Giovannelli F, Santarnecchi E, Bianco G, Cincotta M, Rossi S. J Cogn Neurosci. 2013 Jan;25(1):109-16. doi: 10.1162/jocn_a_00304. PMID: 23198892

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The Oxford Handbook of Cognitive Neuroscience, Volume 2. Edited by Kevin Ochsner and Stephen M. Kosslyn. The Cutting Edge. Part 2, Self and social cognition: Chapter 16

Brain 2009 The use of visual feedback, in particular mirror visual feedback, in restoring brain function. V. S. Ramachandran , Eric L. Altschuler DOI: http://dx.doi.org/10.1093/brain/awp135 1693-1710

Neuroimage. 2014 The mirror illusion induces high gamma oscillations in the absence of movement. Butorina A, Prokofyev A, Nazarova M, Litvak V, Stroganova T doi: 10.1016/j.neuroimage.2014.09.024

The Oxford Handbook of Cognitive Neuroscience, Volume 1. Edited by Kevin Ochsner and Stephen M. Kosslyn. The Cutting Edge. Part 1, Perception: Chapter 7.

Brain mechanisms linking language and action. F Pulvermüller, 2005. Nature Reviews Neuroscience 6, 576-582 . Doi:10.1038/nrn1706

Genetics and language: a neurobiological perspective on the missing link (-ing hypotheses) David Poeppel. J Neurodev Disord. 2011 Dec; 3(4): 381–387. doi: 10.1007/s11689-011-9097-0

The mirror-neuron system. Rizzolatti G1, Craighero L. 2004. Annu Rev Neurosci. 27:169-92.

Impairment of actions chains in autism and its possible role in intention understanding. Cattaneo L1, Fabbri-Destro M, Boria S, Pieraccini C, Monti A, Cossu G, Rizzolatti G. 2007. Proc Natl Acad Sci. 104(45):17825-30. Epub 2007 Oct 26.

Brain 2009 The use of visual feedback, in particular mirror visual feedback, in restoring brain function. V. S. Ramachandran , Eric L. Altschuler . DOI: http://dx.doi.org/10.1093/brain/awp135 1693-1710

Neuroimage. 2014 The mirror illusion induces high gamma oscillations in the absence of movement. Butorina A, Prokofyev A, Nazarova M, Litvak V, Stroganova T doi: 10.1016/j.neuroimage.2014.09.024

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10.2. Additional reading

As additional reading students will receive papers presented on the seminars. These papers will be chosen by students and will vary from year to year.

11. Course telemaintenance

All materials of the discipline are posted in informational educational site at NRU HSE portal www.hse.ru . Students are provided with links on relevant papers, tests, electronic books, articles, etc.

12. Equipment

The course requires a computer or laptop, projector, and acoustic systems for multimedia presentations and video.