Learning Concentration

Symbolic Systems majors completing the new Core requirements effective for 2020-2021 must complete the following requirements to qualify for a Concentration in Learning. All courses must be taken for 3 units of more. Notes: Core requirements fulfilled by a course are noted in brackets "[]". "ASSR" denotes courses that fulfill the Advanced Small Seminar Requirement.

Students in the Learning Concentration must complete four courses from areas 1-3 below with at least one from each area, plus one course from area 4. If any of requirements 1-4 are fulfilled with courses taken for Core requirements, then additional approved Contingent Elective courses (see area 5) must be completed to total 5 courses beyond those that are taken for the Core.

1. **Computational Learning.**
   - CS 205L: Continuous Mathematical Methods with an Emphasis on Machine Learning
   - CS 221: Artificial Intelligence: Principles and Techniques [Post-CS 106B Computation]
   - CS 224N: Natural Language Processing (LINGUIST 284, SYMSYS 195N) [Practicum, Integrative Requirement]
   - CS 228: Probabilistic Graphical Models: Principles and Techniques
   - CS 230: Deep Learning
   - CS 234: Reinforcement Learning
   - CS 236: Deep Generative Models
   - CS 325B: Data for Sustainable Development (EARTHSYS 162, EARTHSYS 262)
   - EE 104: Introduction to Machine Learning
   - EE 376A: Information Theory (STATS 376A)
   - LINGUIST 180: From Languages to Information (CS 124, LINGUIST 280) [Cross-Area Requirement]
   - MS&E 234: Data Privacy and Ethics
   - PSYCH 204: Computation and Cognition: The Probabilistic Approach [Cross-Area Requirement]
   - PSYCH 209: Neural Network and Deep Learning Models for Cognition and Cognitive Neuroscience [Cross-Area Requirement]
   - PSYCH 249: Large-Scale Neural Network Modeling for Neuroscience (same as CS 375) [Cross-Area Requirement]
   - STATS 315A: Modern Applied Statistics: Learning
   - STATS 315B: Modern Applied Statistics: Data Mining
   - STATS 101: Data Science 101
2. **Human Learning.**
- EDUC 101: Introduction to Teaching and Learning
- EDUC 115N: How to Learn Mathematics
- EDUC 218: Topics in Cognition and Learning
- EDUC 266: Educational Neuroscience
- EDUC 368: Cognitive Development in Childhood and Adolescence
- LINGUIST 140: Language Acquisition I (LINGUIST 240)
- PSYCH 45: Introduction to Learning and Memory [*Cognition Language & Neuroscience*]
- PSYCH 50: Introduction to Cognitive Neuroscience [*Cognition Language & Neuroscience*]
- PSYCH 60: Introduction to Developmental Psychology [*Cognition Language & Neuroscience*]
- PSYCH 141: Cognitive Development [*Cognition Language & Neuroscience*]
- PSYCH 169: Advanced Seminar in Memory [ASSR]
- PSYCH 175: Social Cognition in Early Childhood
- PSYCH 202: Cognitive Neuroscience
- PSYCH 204: Computation and Cognition: The Probabilistic Approach [*Cross-Area Requirement*]
- PSYCH 209: Neural Network and Deep Learning Models for Cognition and Cognitive Neuroscience [*Cross-Area Requirement*]
- PSYCH 249: Large-Scale Neural Network Modeling for Neuroscience (same as CS 375) [*Cross-Area Requirement*]
- PSYCH 251: Experimental Methods (SYMSYS 195E) [*Practicum, Integrative Requirement*]
- PSYCH 265: Social Psychology and Social Change (EDUC 371)
- PSYCH 266: Current Debates in Learning and Memory [ASSR]

3. **Learning Environment Design.**
- COMM 322: Advanced Studies in Behavior and Social Media
- CS 147: Introduction to Human-Computer Interaction Design
- CS 194H: User Interface Design Project
- EDUC 230: Learning Experience Design
- EDUC 236: Beyond Bits and Atoms: Designing Technological Tools (CS 402)
- EDUC 211: Beyond Bits and Atoms - Lab (CS 402L)
- EDUC 333A: Understanding Learning Environments
- EDUC 342: Child Development and New Technologies
- EDUC 303: Designing Learning Spaces
- EDUC 391: Engineering Education and Online Learning (ENGR 391)
- EDUC 281: Technology for Learners
- MUSIC 257: Neuroplasticity and Musical Gaming
- EDUC 328: Topics in Learning and Technology: Core Mechanics for Learning
- EDUC 426: Maximizing Personal Potential: Behavioral Science and Design Thinking Applied to Self
- MUSIC 257: Neuroplasticity and Musical Gaming
- PSYCH 287: Brain Machine Interfaces: Science, Technology, and Application (same as NSUR 287)
- SYMSYS 245: Cognition in Interaction Design [ASSR]

4. **Integrative Requirement.** Must be completed no earlier than the Junior Year:
   - Any of the **Standard Options** for all Concentrations specified under the Core Capstone requirement, or
   - A **Concentration-Specific Integrative Course** -- a course that integrates the themes of the Concentration with the Core requirements. One of the following [with more options to be added as they are approved -- some options may be removed if they are included in the list of SYMSYS 195* project courses, in order to avoid redundancy with the Standard Options]:
     - COMM 326: Advanced Topics in Human Virtual Representation [ASSR]
     - CS 181: Computers, Ethics, and Public Policy [Cross-Area Requirement]
     - CS 182: Ethics, Public Policy, and Technological Change (COMM 180, ETHICSOC 182, PHIL 82, POLISCI 182, PUBLPOL 182) [Introductory Philosophy, Cross-Area Requirement]
     - CS 221: Artificial Intelligence: Principles and Techniques [Post-CS 106B Computation]
     - CS 228. Probabilistic Graphical Models: Principles and Techniques
     - CS 230: Deep Learning
     - CS 231A: Computer Vision: From 3-D Reconstruction to Recognition
     - CS 234: Reinforcement Learning
     - CS 379C: Computational Models of the Neocortex
     - EE 104: Introduction to Machine Learning
     - LINGUIST 180: From Languages to Information (CS 124, LINGUIST 280) [Cross-Area Requirement]
     - PSYCH 204: Computation and Cognition: the Probabilistic Approach [Cross-Area Requirement]
     - PSYCH 209: Neural Network and Deep Learning Models for Cognition and Cognitive Neuroscience [Cross-Area Requirement]
     - PSYCH 242: Theoretical Neuroscience (same as APPPHYS 293) [Cross-Area Requirement]
     - PSYCH 247: Topics in Natural and Artificial Intelligence [ASSR]
     - PSYCH 249: Large-Scale Neural Network Modeling for Neuroscience (same as CS 375) [Cross-Area Requirement]
     - SYMSYS 245: Cognition in Interaction Design [ASSR]
5. **Contingent Electives.** If any of requirements 1-4 are fulfilled with courses taken for Core requirements, then additional approved Contingent Elective courses must be completed to total 5 courses beyond those that are taken for the Core. These electives can be one or more courses from any of the areas above, or which are approved for a Core requirement that the student has fulfilled with a different course, or any of the following:

- More courses may be added here as they are approved.