Cognitive Science Concentration

Symbolic Systems majors completing the new Core requirements effective for 2020-2021 must complete the following requirements to qualify for a Concentration in Cognitive Science. 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.

1. **Cognitive Neuroscience.** One of the following:
   - PSYCH 30: Introduction to Perception [*Cognition Language & Neuroscience*]
   - PSYCH 45: Introduction to Learning and Memory [*Cognition Language & Neuroscience*]
   - PSYCH 50: Introduction to Cognitive Neuroscience [*Cognition Language & Neuroscience*]

2. **Inferential Statistics.** One of the following:
   - ANTHRO 116: Data Analysis for Quantitative Research (ANTHRO 216)
   - MS&E 125: Introduction to Applied Statistics
   - MS&E 226: Fundamentals of Data Science: Prediction, Inference, Causality
   - PSYCH 10: Introduction to Statistical Methods: Precalculus (STATS 60, STATS 160)
   - PSYCH 253: Advanced Statistical Modeling [*Cross-Area Requirement*]
   - SOC 180B: Introduction to Data Analysis (CSRE 180B, SOC 280B)
   - STATS 110: Statistical Methods in Engineering and the Physical Sciences [*Probability and Statistics*]
   - STATS 191: Introduction to Applied Statistics
   - STATS 101: Data Science 101
   - STATS 200: Introduction to Statistical Inference
   - STATS 202: Data Mining and Analysis

3. **Research Methods.** A course on research practices and/or methods that are commonly used for studying cognition, language, and the brain. For example, one of the following:
   - CS 107: Computer Organization and Systems [*Post-CS 106B Computation*]
   - CS 129: Applied Machine Learning [*Post-CS 106B Computation*]
   - CS 229: Machine Learning (STATS 229) [*Post-CS 106B Computation, Cross-Area Requirement*]
   - LINGUIST 180: From Languages to Information (CS 124, LINGUIST 280) [*Cross-Area Requirement*]
   - LINGUIST 188: Natural Language Understanding (CS 224U, LINGUIST 288, SYMSYS 195U) [*Practicum, integrative Requirement*]
4. **Cognitive Science Depth.** For example, one of the following courses (categories are for guidance only):
   - **Language**
     - CS 224N: Natural Language Processing (LINGUIST 284) [*Practicum, integrative Requirement]*
     - LINGUIST 110: Introduction to Phonetics and Phonology [*Linguistic Theory]*
     - LINGUIST 140: Language Acquisition I (same as LINGUIST 240)
     - LINGUIST 180: From Languages to Information (CS 124, LINGUIST 280) [*Cross-Area Requirement]*
     - LINGUIST 188: Natural Language Understanding (CS 224U, LINGUIST 288, SYMSYS 195U) [*Practicum, integrative Requirement]*
     - LINGUIST 236: SEM IN SEMANTICS: Reasoning With Quantifiers (same as PSYCH 236C) [*ASSR]*
     - LINGUIST 248: Seminar in Developmental Psycholinguistics [*ASSR]*
     - PHIL 181: Philosophy of Language (PHIL 281) [*Advanced Philosophy, Cross-Area Requirement]*
     - PHIL 194D: Capstone Seminar: Analyticity [*ASSR]*
     - PHIL 385D: Topics in Philosophy of Language  [*ASSR]*
     - PSYCH 140: Introduction to Psycholinguistics (LINGUIST 145) [*Cognition Language & Neuroscience]*
### Perception
- CS 131: Computer Vision: Foundations and Applications
- CS 231A: Introduction to Computer Vision
- LINGUIST 105: Phonetics (same as LINGUIST 205A)
- MUSIC 251: Psychophysics and Music Cognition
- PSYCH 30: Introduction to Perception [*Cognition Language & Neuroscience*]
- PSYCH 221: Image Systems Engineering (SYMSYS 195I) [*Practicum, integrative Requirement*]
- PSYCH 250: High-Level Vision: From Neurons to Deep Neural Networks

### Higher Cognition
- COMM 108: Media Processes and Effects
- COMM 322: Advanced Studies in Behavior and Social Media [*ASSR*]
- CS 227B: General Game Playing
- CS 228: Probabilistic Graphical Models: Principles and Techniques
- CS 238: Decision Making under Uncertainty (AA 228) [*Cross-Area Requirement*]
- EDUC 368: Cognitive Development in Childhood and Adolescence
- PHIL 184: Formal and Informal Epistemology (PHIL 284) [*Advanced Philosophy*]
- PHIL 186: Philosophy of Mind (PHIL 286) [*Advanced Philosophy*]
- PHIL 187: Philosophy of Action (PHIL 287) [*Advanced Philosophy*]
- PHIL 194A: Rationality Over Time [*ASSR*]
- PHIL 386: Topics in Philosophy of Mind [*ASSR*]
- PSYCH 45: Introduction to Learning and Memory [*Cognition Language & Neuroscience*]
- PSYCH 70: Introduction to Social Psychology [*Cognition Language & Neuroscience*]
- PSYCH 75: Introduction to Cultural Psychology [*Cognition Language & Neuroscience*]
- PSYCH 141: Cognitive Development [*Cognition Language & Neuroscience*]
- PSYCH 154: Judgment and Decision Making [*Cognition Language & Neuroscience*]
- PSYCH 160: Seminar on Emotion (same as PHIL 375G, PSYCH 260) [*ASSR*]
- PSYCH 169: Advanced Seminar on Memory [*ASSR*]
- PSYCH 175: Early Learning and Social Cognition
- PSYCH 205: Foundations of Cognition
- PSYCH 266: Current Debates in Learning and Memory [*ASSR*]
- PSYCH 285: Graduate Seminar on Theory of Mind [*ASSR*]
SYMSYS 203: Cognitive Science Perspectives on Humanity and Well-Being [ASSR]

○ Neuroscience
  ■ BIO 150: Human Behavioral Biology (BIO 250, HUMBIO 160) [Cognition Language & Neuroscience]
  ■ EDUC 266: Educational Neuroscience
  ■ NBIO 206: The Nervous System [counts as two courses]
  ■ NBIO 258: Information and Signaling Mechanisms in Neurons and Circuits
  ■ PHIL 167D: Philosophy of Neuroscience (PHIL 267D, SYMSYS 206A) [Advanced Philosophy, Cross-Area Requirement]
  ■ PHIL 360: Grad Seminar: Philosophy of Neuroscience [ASSR]
  ■ PSYCH 50: Introduction to Cognitive Neuroscience [Cognition Language & Neuroscience]
  ■ PSYCH 162: Brain Networks (same as PSYCH 267) [ASSR]
  ■ PSYCH 164: Brain Decoding [Cross-Area Requirement]
  ■ PSYCH 202: Cognitive Neuroscience
  ■ PSYCH 204A: Human Neuroimaging Methods
  ■ PSYCH 204B: Computational Neuroimaging: Analysis Methods
  ■ PSYCH 209: Neural Network and Deep Learning Models for Cognition and Cognitive Neuroscience [Cross-Area Requirement]
  ■ PSYCH 232: Brain and Decision Making [ASSR]
  ■ PSYCH 249: Large-Scale Neural Network Modeling for Neuroscience (CS 375) [Cross-Area Requirement]
  ■ PSYCH 254: Affective Neuroscience (formerly offered as PSYCH 251)
  ■ PSYCH 287: Brain Machine Interfaces: Science, Technology, and Application (same as NSUR 287)

○ Theoretical Foundations
  ■ CS 154: Introduction to Automata and Complexity Theory [Theory of Computation, Cross-Area Requirement]
  ■ CS 234: Reinforcement Learning
  ■ ECON 160: Game Theory and Economic Applications
  ■ EE 376A: Information Theory (same as STATS 376A)
  ■ PHIL 82T: Philosophy of Cognitive Science
  ■ PHIL 152: Computability and Logic (PHIL 252) [Cross-Area Requirement]
  ■ PHIL 153L: Computing Machines and Intelligence (same as PHIL 253L)
  ■ PHIL 154: Modal Logic (PHIL 254) [Cross-Area Requirement]
  ■ PHIL 351D: Measurement Theory
  ■ PSYCH 204: Computation and Cognition: The Probabilistic Approach [Cross-Area Requirement]
  ■ SYMSYS 207: Conceptual Issues in Cognitive Science [ASSR]
  ■ SYMSYS 208: Computer Machines and Intelligence [ASSR]
5. **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 131: Computer Vision: Foundations and Applications
     - 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 227B: General Game Playing
     - CS 228. Probabilistic Graphical Models: Principles and Techniques
     - CS 229: Machine Learning [*Post-CS 106B Computation, Cross-Area Requirement*]
     - CS 230: Deep Learning
     - CS 231A: Computer Vision: From 3-D Reconstruction to Recognition
     - CS 234: Reinforcement Learning
     - CS 238: Decision Making under Uncertainty (AA 228) [*Cross-Area Requirement*]
     - CS 325B: Data for Sustainable Development (same as EARTHSYS 162, EARTHSYS 262) [ASSR]
     - 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*]
     - MUSIC 220C: Research Seminar in Computer-Generated Music [ASSR]
     - MUSIC 257: Neuropasticity and Musical Gaming
     - NBIO 101: Social and Ethical Issues in the Neurosciences (same as NBIO 201)
     - PHIL 356C: Logic and Artificial Intelligence [ASSR]
     - PHIL 357: Research Seminar in Logic and Cognition [ASSR]
     - PHIL 359: Topics in Logic, Information, and Interaction [ASSR]
     - PSYCH 164: Brain Decoding [*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 202: Theories of Consciousness [ASSR]
- SYMSYS 205: The Philosophy and Science of Perception [ASSR]
- SYMSYS 208: Computer Machines and Intelligence [ASSR]

6. **Contingent Electives.** If any of requirements 1-5 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.