Simulation, Modeling and Applied Cognitive Science
Ph.D. Program Graduate Student Handbook
The Polytechnic School
poly.engineering.asu.edu/degrees
Simulation, Modeling, and Applied Cognitive Science PhD

Fall 2016

Contents

• General program information
  o Overview
  o Faculty
• Coursework
• Milestones
• Brown Bag Seminars
• Policies for Evaluation and Dismissal
• Campus Resources
General Program Information

Overview
Simulation, modeling and applied cognitive science describes a growing transdisciplinary field (including the disciplines of psychology, engineering and computer science) that explores how people interact with technological and social systems in contexts that include transportation, medicine, military, computing and other complex systems. Cognitive science provides the foundation necessary for integrating human capabilities and limitations into complex sociotechnical systems (i.e., the practice of cognitive engineering), and the application of cognitive science relies heavily on simulation and modeling methods.

Examples of possible research topics include:
• Development of intelligent agents
• Driver distraction
• Dynamical systems models of team interaction
• Business decision-making
• Cyber security analysis
• Cognitive modeling
• Modeling sociocultural systems
• Health care human factors
• Nuclear control room human system integration
• Pilot training research
• Tests of future airspace control concepts

This Ph.D. is designed to produce individuals who are well-grounded in cognitive science and skilled in its methods and applications. Employers (e.g., Department of Defense, Federal Aviation Administration, Nuclear Regulatory Commission, hospitals, industry) have an ever-increasing demand for personnel who can bridge the gap between rigorous science and solutions to real-world problems. The Ph.D. degree will provide transdisciplinary, research-driven training in applied cognitive science and human systems engineering.

Faculty
SMACS Executive Committee (EC)
Nancy Cooke (FSE TPS HSE), EC Chair
Vaughn Becker (FSE TPS HSE)
Mary Niemczyk (FSE TPS AMT)

SMACS Graduate Faculty

<table>
<thead>
<tr>
<th>Faculty Name</th>
<th>Faculty Department (if not same as PhD program)</th>
<th>Chair</th>
<th>Co-chair</th>
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<tbody>
<tr>
<td>Ahn, Gail-Joon</td>
<td>FSE - CIDSE</td>
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<tr>
<td>Name</td>
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<td>Amresh, Ashish</td>
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<td>Atkinson, Bob</td>
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<td>Aukes, Dan</td>
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<td>Becker, David Vaughn</td>
<td>FSE HSE (Human Systems Engineering)</td>
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<td>Bekki, Jennifer</td>
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<td>Mayyas, Abdel Ra'ouf</td>
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<td>McKenna, Ann</td>
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<td>Razdan, Anshuman</td>
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<td>Redkar, Sangram</td>
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<td>Ruddell, Ben</td>
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<td>Sodemann, Angela</td>
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<td>VanLehn, Kurt</td>
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Graduate Advisor:

Amy Wolsey, Graduate Advising Coordinator  
Wanner Hall – 2nd Floor  
Email: amy.wolsey@asu.edu  
Phone: 480-727-4723

Other Affiliated Faculty

These are faculty who may be appropriate for your PhD committee. To include them, they need to apply to be on the SMACS graduate faculty (involves sending a CV to the SMACS Executive Committee). Contact Nancy Cooke for more details.

Nia Amazeen, Psychology  
Eric Amazeen, Psychology  
Prasad Boradkar, Industrial Design  
Micki Chi, Psychology  
Kevin Gary, CIDSE FSE  
Art Glenberg, Psychology  
Steve Goldinger, Psychology  
Mark Henderson, FSE  
Don Homa, Psychology  
Tim Lindquist, CIDSE FSE  
Darryl Morrell, CIDSE FSE  
John Takamura, Industrial Design  
Kurt Van Lehn, CIDSE FSE
Coursework

54 credit hours are required beyond your 30 hours of master’s credits. We anticipate that this program can be completed in three years. Please note that this list is not comprehensive and that with the EC’s approval new courses can be added to this bank. The EC’s approval of a course does not, however, indicate that that particular course is ideal for a student’s program of study. The advisor should work with the student to ensure a viable program of study tailored to that student’s background and dissertation direction. The EC will be asked to weigh in when the IPOS is submitted for approvals.

FOUNDATIONS (12 credits)
SMC/HSE 540: Foundations of Applied Cognitive Science*
SMC/HSE 541/598: Foundations of Human Systems Engineering*
CSE 571: Artificial Intelligence
PSY 528: Sensation and Perception
PSY 535: Cognitive Processes
PSY 551: Advanced Social Psychology – Intrapersonal Process
PSY 560: Special Topics
PSY 562: Advanced Human Factors
CSE 561: Modeling & Simulation Theory and Application
CSE 575 Statistical Machine Learning
TEM 598: Advanced Analysis of Systems
AMT 533: Training Systems and Simulation

TOOLS AND METHODS (12 credits)
SMC/HSE 520: Methods and Tools in Applied Cognitive Science*
SMC/HSE 521/598: Methods and Tools in Human Systems Engineering*
PSY/HSE 598: Data Analytics
PSY 530: Intermediate Statistics
PSY 531: Multiple Regression in Psychological Research
PSY 561: Methods in Applied Psychology
PSY 534: Psychometric Methods
PSY 576: Dynamical Systems in Psychology
IEE 572: Design Engineering Experiments
AML 520: Agent-Based Modeling
CST 591: Interactive Graphics and Visual Analytics
CST 594: Advanced Software Design
PSY 539: Multi-level models in Psychological Research
PSY 532: Analysis of Multivariate Data
GIT 519: Advanced Scripting for Web

APPLICATIONS (example courses - 12 credits)
SER 594: Game Based Learning
PSY 437: Human Factors**
PSY 438: Human-Computer Interaction
HSE 422: Human Factors in Sport**
HSE 423: Human Factors in Transportation**
HSE 424: Human Automation Interaction**
HSE 425: Human Factors in Medical Systems**
HSE 426: Training and Expertise**
HSE 427: Designing for Learning**
HSE 428: Judgment and Decision Making**
HSE 429: Product Design and Evaluation**
HHE 510: Design and Health
PSY 560: Advances in Theoretical Psychology

RESEARCH AND SCHOLARSHIP (18 credits)
SMC/HSE 792: Research (6) or electives as selected by the PhD committee
SMC/HSE 799: Dissertation (12)*
*required
**Note that according to the Graduate College no more than 6 credit hours of 400-level coursework can be included on a graduate program of study.

Milestones

<table>
<thead>
<tr>
<th>Milestone Activity</th>
<th>Time Frame</th>
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<tbody>
<tr>
<td>1 Identify and address course deficiencies.</td>
<td>Identify: time of admission; Address: by the end of your first semester</td>
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<tr>
<td>2 Find a permanent faculty advisor</td>
<td>In the first semester (ASAP)</td>
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<tr>
<td>3 Engage in research – Early and Often</td>
<td>Start in first semester and continue through the program</td>
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<tr>
<td>4 Take the four foundation courses and obtain a “B” grade or better in each</td>
<td>Complete these foundation courses in the first three semesters</td>
</tr>
<tr>
<td>5 Complete the literature review that serves as your Qualifying Exam</td>
<td>Due before the beginning of the second academic year</td>
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<tr>
<td>6 Complete other coursework</td>
<td>Ideally by the end of your second year</td>
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<tr>
<td>7 Establish a PhD Committee</td>
<td>When you have settled on a dissertation topic with your faculty advisor (in second year).</td>
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<tr>
<td>8 Submit your Interactive Plan of Study (iPOS)</td>
<td>When you have a committee and have registered for (NOT completed) 50% of their coursework (likely in the second year).</td>
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<tr>
<td></td>
<td>Take your Comprehensive Exam (i.e., write a dissertation and grant proposal and defend it)</td>
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<tr>
<td>10</td>
<td>Complete your Dissertation Project and Thesis</td>
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1) Identify and Address Course Deficiencies
At the time of admission, the SMACS Executive Committee will work with you to identify any deficiencies in your previous coursework that may make particular core courses challenging. You may make up deficiencies in the fall in parallel with the SMC core courses or you may choose to take an approved course equivalent at your home institution during the summer. Please note that there may be tuition implications if you want to take a course at ASU the summer before you are officially enrolled. Contact the Graduate Advising Office if you want to take ASU classes before you are officially enrolled for details.

Cognitive Science
To succeed in HSE/SMC 540: Foundations of Applied Cognitive Science Core Course, you will need to have had some basic cognitive psychology, cognitive science, sensation and perception, or memory and cognition course. If you are missing a cognitive course you can enroll in HSE 323 or 324 which are offered on the Polytechnic campus or take an equivalent course at your home institution before you come to ASU. You may concurrently take these courses with HSE/SMC 540.

Research Methods
To succeed in HSE/SMC 520: Methods and Tools in Applied Cognitive Science, you need to have had an undergraduate course in research methods. This course should have covered such concepts as variables, validity, ethics, and experimental and correlational design. If you are missing this background, you should enroll in HSE 290, which is offered on the Polytechnic campus, PSY 290 which is offered on the Tempe campus, or take an equivalent course at your home institution before you come to ASU.

Statistics
To succeed in the program you also need to have had an advanced undergraduate course in statistics which has some coverage of Factorial ANOVA, repeated measures designs, and multiple regression. If you are missing this background, you should enroll in HSE 330, which is offered on the Polytechnic campus or take an equivalent course at your home institution before you come to ASU. You may take these courses concurrently with HSE/SMC 520.

2) Find a Faculty Advisor
You will be assigned a temporary advisor initially at the time of admissions. You should identify a permanent advisor as soon as possible. The advisor-advisee decision requires mutual agreement between the two parties; therefore, you are required to formally ask if the faculty member is willing to serve as your advisor. Those on the graduate faculty roster are currently
eligible to advise and may chair your committee if designated as “Chair.” However, other faculty not on the roster can apply to join the SMACS graduate faculty.

We have set up a number of events early in the semester and throughout to facilitate this process. We encourage you to take advantage of these opportunities.

1) Attempt to visit all faculty on the roster in the first few weeks of class – even if for 10 minutes – to learn about their research
2) Look at faculty websites, setup individual meetings with faculty, etc.
3) Attend the weekly brown bag seminars and other SMACS/HSE lectures
4) Attend the beginning of the year celebrations to meet faculty (and other students) on a more informal basis

3) Engage in Research – Early and Often
The PhD is focused on research much more than classes. You should engage quickly and often in research projects. You are encouraged to collaborate with faculty other than your advisor and with other graduate students. The goal is to spread the word—so publish and present at meetings as much as possible.

4) Take the Four Foundations Courses and Obtain a “B” or Better in Each.
It is expected that students will complete the four SMC/HSE foundation courses in their first year and a half. Grades of “B” or better in these core courses are required for continuation in the degree program.

5) Complete the Literature Review that Serves as Your Qualifying Exam
For the PhD Qualifying Exam, each student is required to write a literature review (approximately 20-40 pages in length) relevant to SMACS/HSE and potentially, your dissertation topic. A literature review is not an annotated bibliography which summarizes articles that you have read, but is a coherent narrative that provides analysis, synthesis and a critical evaluation of the area. There are many good resources that provide guidance on writing a literature review (e.g., http://www.duluth.umn.edu/~hrallis/guides/researching/litreview.html).

The literature review serves as the qualifying examination for progression toward the PhD and therefore should be the student’s independent work. High-level guidance on the topic may be sought from the advisor and other faculty and it is recommended that the students seek general feedback from peers, but the writing is to be an independent effort. Plagiarism of any written work is a violation of the ASU/Fulton Schools of Engineering code of ethics and is grounds for dismissal.

Ideally, this literature review would connect to the student’s dissertation, but this is not necessary. It should discuss an area that the student wishes to explore deeply within SMACS/HSE. The review is due to the student’s advisor and to the SMACS/HSE Executive Committee before the beginning of the second academic year. Students will be informed of the outcome of their exam within one month of submission of the literature review.
The student’s advisor and an EC member will review the document. Students can suggest reviewers. Reviewers will make comments in the document, use a rubric to evaluate it (given to students ahead of time), and will make a decision of pass, pass with minor revisions, pass with major revision, or fail. The final decision of the EC will be communicated to the student in writing within four weeks. Failing the qualifying exam prevents students from continuing in the program. Major revisions must be completed and judged satisfactory by the EC and the advisor by the beginning of the following semester. If revisions are not complete by then or are unsatisfactory students will not be permitted to continue in the program.

Criteria for evaluating the qualifying exam:
- Written exposition (grammar, flow, spelling, structure, organization)
- Topic relevant to SMACS/HSE.
- Narrative – a thesis, theme or argument that ties it all together and is carried through the review
- Completeness of literature review – any gaps, disciplines missed, research areas missed
- Analyzing the literature – summarizing for your purposes; appropriate level of detail, review is categorized with headings and subheadings and the categorical structure makes sense in light of your theme
- Synthesizing the literature – making connections, identifying common themes, reconciling differences
- Drawing novel conclusions, ideas, frameworks, etc.; going beyond mere summary and ideas of others

6) Complete other coursework
See credit hour requirements above

7) Establish a PhD Committee
Each student’s committee is to have a minimum of three faculty members. One is your advisor. If your advisor is listed as a co-chair on the graduate faculty list, you also need to add a member of the graduate faculty who is eligible to chair. In this case, both your advisor and the eligible chair will then co-chair your committee. At least one member of your committee should be a faculty member in the Human Systems Engineering program.

8) Submit your Interactive Plan of Study (iPOS)
Submit a Program of Study (iPOS) as soon as you have formed a PhD committee. Email the Executive Committee Chair whenever you submit changes to your iPOS (including petitions and committee approvals).

Contact the Graduate Advisor for assistance with submitting the iPOS online and getting it approved.

9) Take your Comprehensive Exam (i.e., write a grant proposal/dissertation proposal and successfully defend it).
Once the student has passed the comprehensive exam, he or she is eligible to pursue the dissertation project proposed and is considered an official doctoral candidate. It is expected that the comprehensive exam will be completed by the end of the second year and no later than the third year. The SMACS/HSE comprehensive exam involves the following steps: 1) development of a dissertation proposal, 2) submission of the proposal to your PhD committee for feedback followed by the creation of a written response to that feedback 3) the submission of the proposal or some version of it to an agency, and 4) the successful defense of that proposal to the committee. Once these steps have been completed the student is officially advanced to PhD candidacy. Note that steps 1, 2, and 4 can take place before or after Step 3, but all steps must be completed prior to official advancement to candidacy.

Students should prepare a dissertation proposal that represents the student’s planned dissertation topic and includes a review of the relevant literature (often, but not necessarily, based on the student’s qualifying exam), and a detailed description of methods, planned analysis and implications. The proposal is the student’s independent work with continual guidance received from the advisor. The student should expect several iterations of the proposal and proposal parts with the advisor. Once the student and advisor believe that the proposal is ready, he or she will submit it to his or her PhD committee (assembled once the topic is selected) who will provide written feedback on the proposal to the student within two weeks, much as a grant review panel would do. The student will then be required to respond in writing to the committee’s concerns and make changes accordingly to the proposal. The student’s response must be submitted to the committee within one week of receiving the committee’s feedback (or three weeks from the original submission of the proposal to the committee). Also at this point the student’s advisor decides whether or not the proposal needs additional work or is ready for the defense. If the advisor decides it is ready then the student schedules a two-hour proposal defense/comprehensive exam at a time that is mutually convenient for the committee and student. Note that the proposal to the agency does not require committee approval or feedback, but faculty can provide feedback if they wish.

On the day of proposal defense/exam, the committee chair should bring the comprehensive exam form. The committee should first meet without the student to determine the exam questioning format (e.g., are questions permitted during the presentation or only following; will the questioning follow a round robin format?). During the defense/exam, the student presents an approximately 45 minute summary of the proposal. Either following or during (depending on the agreement made by the committee prior to the student presentation), questions about the proposal itself and/or any comprehensive topics relevant to the degree that the committee deems appropriate may be asked. At the conclusion of questioning, the student leaves the room at which time the committee discusses and agrees upon on one of the following outcomes for the exam: pass, pass with revisions or fail. If there are revisions, the committee chair is to document them on the comments part of the form, and it is expected that these will be fully addressed prior to the student officially passing the comprehensive exam.

Submitting the proposal to an agency:
This step must also be complete in order to complete the comprehensive exam. Students are required to work with their advisor to generate a proposal following the format from a federal
funding agency of their choice (e.g., NSF, NIH, DoD). Students should work with their advisors to target a proposal topic that fits with a call for proposals from a federal agency that is likely to fund the proposal’s project idea. The proposal may require that preliminary data be collected of the kind necessary for a competitive grant proposal. Students should work with their advisor to apply for IRB approval (if necessary). In some cases, the submitted proposal may be the same as the dissertation proposal. In other cases, the grant proposal for the agency may be slightly different and may include other investigators (e.g., advisor, other faculty or students).

10) **Complete Your Dissertation Project and Thesis**
- Define research questions
- Develop appropriate methodology for investigating questions
- Collect and analyze data
- Write thesis
- See graduate.asu.edu/graddeadlines.html for graduation deadlines
- Your advisor/committee chair determines that the dissertation is ready to defend.
- Determine mutually convenient date/time for you and your committee for a defense. Prepare for at least two hours.
- Send your dissertation document to your committee at least 10 days prior to your defense.
- Schedule oral defense with Graduate College at least 10 days before defense date. See [https://graduate.asu.edu/graddeadlines.html?destination=node%2F12](https://graduate.asu.edu/graddeadlines.html?destination=node%2F12) for the 10 working day calendar that includes scheduled blackout dates for defenses.
- Submit dissertation to Graduate College for format approval and to committee members at least 10 days before the scheduled defense
- Prepare abstract, title, and bio announcement and email to your advisor for dissemination across the school. The defense is open to the public.
- Hold an oral defense; The committee chair should bring the appropriate form to the defense. Before the defense/exam begins, the committee should meet without the student and public attendees to discuss and agree upon the questioning format. During the defense, the student presents an approximately 45 minute summary of the dissertation work. Questions of clarification can be asked throughout. Committee questioning on substantive issues will follow the presentation and questions from the public. When there are no more questions from the committee, the student and public leave the room and the committee comes to consensus on the defense outcome: pass, pass with revisions or fail. If there are revisions, they are documented on the form, and a plan is made for addressing them.
- Submit final dissertation to UMI/ProQuest

**Brown Bag Seminars**
These are held weekly and they are open to the public (registration not necessary to attend). But these are for you! They are intended to give you exposure to different research areas and career possibilities, provide an opportunity to present your research, help you make connections, etc. It is the one time a week that the SMACS graduate faculty and students come together. They have
been taking place on Wednesdays at noon. The day and time may change. You will receive
details weekly through email. Attendance is mandatory. (If you are unable to attend face to
face there is an on-line attendance option, but in-person attendance is preferred.

**Policies for Evaluation and Dismissal**

Students should familiarize themselves with the ASU Graduate College policies:
http://graduate.asu.edu/faculty_staff/policies especially regarding degree requirements, academic
integrity, maintaining progress, and appeals.

Satisfactory academic progress will be defined by the quality of the student’s work (classroom,
research, service) in the SMACS program and the student’s ability to achieve milestones in a
timely fashion, as judged by the advisor, SMACS Executive Committee, and eventually the
student’s PhD committee. Students will complete a progress report at the end of every academic
year and will be provided with written feedback by the SMACS EC (drawing from other relevant
faculty) soon thereafter. In the case of unsatisfactory progress, the feedback will explicitly
provide objectives to be met to avoid dismissal from the program.

**Campus Resources**

The Polytechnic campus has various resources for students. Because hours, services, and student
needs vary, it is up to you to investigate all application options. Some noteworthy resources are
as follows:

1. **Graduate and Professional Student Association (GPSA)**
   The GPSA is the graduate student government organization at ASU. They offer a variety of
   services including limited funding opportunities for research and traveling to conferences.
   The GPSA at Poly is located in the Admin Building. For more information, visit their
   website: http://gpsa.asu.edu/.

2. **Polytechnic Library**
   The library on our campus is located on the lower level of the Center Building.

3. **Graduate Advising Office**
   Graduate students have two advisors: a faculty advisor and a college advisor. The faculty
   advisor (committee chair) serves as the student’s academic mentor and oversees the research
   and dissertation progress. The college advisor (Amy Wolsey) is our college’s liaison with
   the ASU Graduate College. Graduate Students are held to certain departmental standards as
   well as university standards. The college advisor’s role is to answer policy and procedural
   questions related to the Graduate College and to refer students to appropriate departments or
   resources. The Graduate Advising Office is located on the second floor of Wanner Hall.
   Appointments are made by calling Amy Wolsey at 480-727-4723 or emailing her at
   amy.wolsey@asu.edu.

4. **Student Financial Aid Office at Polytechnic**
   The Polytechnic Financial Aid Office is located in the Admin Building. For more information,
   visit their website: https://students.asu.edu/contact/financialaid.
5. **Student Organizations**

There are various student organizations at ASU. You can join as many as you want and you’re not bound by campus affiliation. If you don’t see a club you’d like to be a part of, start your own. For details and a list of organizations, go to [https://students.asu.edu/clubs](https://students.asu.edu/clubs). FYI, there is a student chapter of the Human Factors and Ergonomics.

*On behalf of the SMACS Graduate Faculty we wish you a productive and successful graduate career. Please let us know if there is anything we can do to better support your progress through the program.*

*Nancy J. Cooke*  
*Chair, SMACS Executive Committee*