

## CURRICULUM VITAE

### **Caroline GL Cao, PhD**

Professor of Biomedical, Industrial & Human Factors Engineering  
Professor of Mechanical and Materials Engineering  
College of Engineering and Computer Science, Wright State University  
and

Professor of Trauma Care and Surgery  
Boonshoft School of Medicine, Wright State University, Dayton Ohio

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*Currently (May-Dec 2019): Visiting Professor at Max-Planck-Institute for Intelligent Systems, Haptic Intelligence Department, Stuttgart, Germany*

### **LEADERSHIP EXPERIENCE**

#### **Founder & CEO (2016-)**

Endo Guidance Technologies LLC, Dayton, OH

Endo Guidance Technologies is a Dayton-based company that offers sensing and display technology for navigation in non-rigid environments. Our mission is to enable image guidance without the use of x-rays.

#### Responsibilities:

- Provide leadership for technical and business development
- Engage with industry partners, manufacturers, and regulatory agencies
- Engage with customers (OEM, physicians, and purchasers in hospitals and clinics)
- Engage with Board of Advisors and investors
- Recruit technical and business talent
- Fundraising (over \$515k)

#### **Director (2001-2011)**

Human Factors Engineering (HFE) Program, School of Engineering, Tufts University

The HFE Program is the first undergraduate major BS degree-granting program in Human Factors in the US. As an academic unit within the School of Engineering, it consisted of 2 full-time faculty members, 2 part-time lecturers, 3 affiliated faculty, and about 30 undergraduate majors and 10 MS students. It is a truly interdisciplinary program that serves both engineering and liberal arts students at Tufts.

#### Responsibilities:

- Provide leadership for teaching and research within program
- Engage with industry to promote visibility of program
- Interact with administrators and faculty in other departments and colleges to develop course offerings to support interdisciplinary program and cross-list courses
- Develop and update the undergraduate and graduate program curricula
- Develop, maintain and update the minor program curriculum
- Maintain and update certificate in Human-Computer Interaction
- Recruit, admit and advise undergraduate and graduate students
- Recruit and hire lecturers and a Professor-of-the-Practice
- Develop industry partnerships for Senior Capstone projects and **internships**
- Interact with alumni and industry leaders to promote growth of program
- Develop relationships with Alumni and local chapters of professional societies
- Advise Tufts Student Chapter of Human Factors and Ergonomics Society
- Develop and taught undergraduate and graduate courses
- Advise undergrad and graduate student thesis projects
- Day-to-day duties and program management including class scheduling, responding to internal

and external enquiries and requests, coordinating with program requirements in engineering, computer science and psychology

### **Human Factors and Ergonomics Society (HFES)**

The world's largest scientific association for human factors and ergonomics professionals, with more than 4,500 members around the world.

#### Responsibilities:

- *Secretary-Treasurer-Elect, 2018-19*
- *Chair, Election Committee, 2018-19*
- *Chair, Human Factors Prize Panel, 2016-present*
- *Chair, Committee of Technical Groups (COTG), 2012-13*
- *Chair, COTG Budget and Finance Committee, 2011*
- *Chair, Chapanis Student Paper Award Committee, 2007-14*
- *Chair, Health Care Technical Group, HFES, 2006-08*
- *Chair, Health Care Technical Group, Technical Program, 2004-06*
- *Co-Founder, Early Career Professionals Group*

### **Chair of Steering Committee (elected 2017-present)**

#### **Member of Steering Committee (elected 2015-present)**

College of Engineering and Computer Science, Wright State University

The Steering Committee coordinates **faculty governance** activities of the College and administers the functions of College faculty committees. It works alongside the Dean of the College in shared governance of the College.

#### Responsibilities:

- Coordinate and chair monthly committee meetings and college faculty meetings
- Supervise elections for elected committees of the College
- Appoint membership for all nonelected committees and committee chairs
- Supervise the activities of all standing and ad hoc committees
- Act in an advisory capacity to the Dean of the College on matters ranging from budget to accreditation (ABET) to enrollment and instructional support
- Review the fiscal affairs of the college at least annually
- Coordinate the revision of College bylaws, and policies and procedures
- Interact with Faculty Senate and administrators for approval of changes in College bylaws, and policies and procedures
- Supervise the review of the Dean by faculty and staff, and other matters requiring faculty representation
- Support the College budget re-alignment activities
- Communicate with College faculty and staff
- Promote collaboration between faculty, staff and administration in shared governance
- Facilitate problem resolution within collective bargaining and strong shared governance environment

### **Strategic Planning Steering Committee (2018-present), Wright State University**

Wright State University is in the midst of strategic planning to align resources with the university community's values, strengths, vision and mission. A multi-phased dialogue-based process involving all internal and external stakeholders is being executed.

#### Responsibilities:

- Guide the strategic planning process to include all stakeholders
- Engage with internal stakeholders from units across the university campus in planning meetings, open forums, workshops, and leadership summits
- Engage with external stakeholders such as community leaders and alumni in conversation using the appreciative inquiry approach
- Identify core identity, values and strategic goals for the university
- Define metrics for measuring success in strategic focus areas

- Formulate plans to acquire resources for strategic goals
- (*future*) Continue to engage in dialogue to evaluate and adjust strategic plan and execution

**Co-Chair of Advisory Council (elected 2014-18), Women in STEMMS Mentoring Circles/ Women in Science Giving Circles/ Women in STEM Leadership Institute (ongoing)**

Wright State University

As one of three tenured female full professors in the College of Engineering and Computer Science at WSU, I consider it my duty to advocate and promote women in Science, Technology, Engineering, Math, Medicine, and Social Sciences.

Activities:

- Promote women in STEM at all levels from high school to faculty
- Collaborate with Air Force Research Laboratory (AFRL) and Air Force Institute of Technology (AFIT) to host events (e.g., 2016 Research Symposium to showcase research achievements of women in STEM, with best poster cash prizes, and keynote speaker from academe (Dr. Ayse Sahin, professor of mathematics), industry (Dr. Revonna Smith, entrepreneur and anaesthesiologist) and government (Melissa Flagg, Deputy Assistant Secretary of Defense for Research)
- Engage in peer mentoring
- Fundraise to provide research fellowships to students and faculty
- Organize professional development workshops with invited speakers

**LEADERSHIP TRAINING**

Executive Leadership in Academic Technology and Engineering (ELATE), Drexel University, 2017-18  
(IAP Topic: Building an Entrepreneurship Ecosystem at WSU and Beyond)

American Council on Education (ACE) Women's Network – Ohio Annual Conference, 2013, 2016

American Association of University Professors (AAUP) Summer Institute, Portland OR, 2016

Higher Education Resource Services (HERS) Summer Institute, Bryn Mawr College, 2013

**EDUCATION**

MBA courses, Raj Sooin School of Business, Wright State University, 2016-

PhD, Mechanical & Industrial Engineering, University of Toronto, 2002

Strategic Technology Management Certificate, Politecnico Di Milano, Italy & Helsinki University of Technology, Finland, 1999

MSc, Kinesiology (motor control), Simon Fraser University, 1996

Post-Baccalaureate Diploma in Occupational Science, Simon Fraser University, 1994

BSc, Biochemistry (major; *co-op* program), Kinesiology (minor), Simon Fraser University, 1991

**ACADEMIC POSITIONS AND EXPERIENCE**

**Max-Planck-Institute for Intelligent Systems**

*Visiting Professor in Haptic Intelligence Department, May 2019-present*

Responsibilities:

- Investigate applications of haptics and affect communication to enhance robot mechanical and computational design
- Advise on experimental design and analysis
- Engage in scientific discourse and cultural exchange
- Develop new research projects

**Wright State University**

*Professor (tenured) of Biomedical, Industrial & Human Factors Engineering, 2012-present*

Accomplishments:

- Established the WSU Ergonomics in Remote Environments Laboratory (EREL)
- Directed research program in medical technology for minimally invasive surgery

- Managed over \$1M research funding from the NSF, NIH, ONR, Ohio Third Frontier, WSU
- Supervised 9 graduate students, 21 undergraduate students, 5 postdocs, 18 research associates
- Developed and taught undergrad and grad courses in Medical Device, Human Factors Engineering, Research Methods
- Negotiated Dual-PhD Degree (COTUTELLE) MOU between WSU and 2 French Universities (Ecole Centrale de Nantes and Ecole des Mines de Nantes)
- Elected as Faculty Senator, Professor-at-Large on University P&T Committee, College of Engineering and Computer Science Steering Committee (member and Chair), PhD in Engineering Program Focus Area Chair, College Rep on Research Council, Graduate Faculty Membership Committee, International Student Recruitment and Outreach Committee
- Served on Steering Committee for University Strategic Plan
- Serving as Coordinator of Biomedical Engineering Undergraduate Program
- Serving as Chair of Curriculum Matters in the Biomedical Engineering Program
- Serving as Chair of Petitions Committee

*Ohio Research Scholar (endowed), Ohio Imaging Research and Innovation Network (OIRAIN) 2012-15*  
The Ohio Imaging Research and Innovation Network is a consortium of three universities in the State of Ohio (Wright State University, Case Western Reserve University, and the Ohio State University) for the creation of intellectual property, commercialization, and job creation in Ohio in the field of medical imaging through research and education.

Accomplishments:

- Launched a technology startup in medical devices
- Employed 4 graduate students (2 Ph.D., 2 M.S.), 2 research engineers

**Tufts University**

*Director, Human Factors Engineering Program, School of Engineering, 2001-11*

The HFE Program is the first undergraduate major BS degree-granting program in Human Factors in the US, with 2 full-time faculty members, 2 part-time lecturers, 1 affiliated faculty, and about 30 majors. It is a truly interdisciplinary program that serves both engineering and liberal arts students at Tufts.

Accomplishments:

- Revived undergraduate major program
- Established minor program in human factors engineering
- Updated undergraduate major curriculum for engineering and psychology students
- Updated graduate curriculum for Master's program in human factors engineering
- Updated certificate program in human-computer interaction
- Recruited adjunct lecturer and Professor-of-the-Practice and doubled the faculty size
- Developed industry partnerships for Senior Capstone projects

*Associate Professor (tenured) of Mechanical Engineering, 2008-12*

*Assistant Professor of Mechanical Engineering, 2001-08*

Accomplishments:

- Founded the Tufts Ergonomics in Remote Environments Laboratory (EREL)
- Directed research program in medical technology for minimally invasive surgery
- Managed \$2.1M research funding from the NSF (Early Career Award), NIH, ONR, Broad Medical Foundation, SAGES, Tufts
- Supervised 27 graduate students, 5 undergraduate honors theses, 2 postdocs, 1 research associate
- Developed and taught undergrad and grad courses in Medical Device, Analytical Methods, Human Factors Engineering, and Biomechanics

**Simon Fraser University**

Research Coordinator, Human Motor Systems Laboratory, 1996-97

Activities:

- Write grant proposals

- Supervise student research assistants
- Recruit and prepare human subjects for human performance studies
- Collect and analyse qualitative and quantitative experimental data
- Prepare and present study results in verbal and written form for publication

## **HONORS AND AWARDS**

Service Excellence Award, College of Engineering and Computer Science, Wright State University, 2019  
Fellow, Human Factors and Ergonomics Society, elected 2018  
Science Policy Fellow, Human Factors and Ergonomics Society, 2018-  
ELATE Fellow, nominated and selected 2017-18  
US Fulbright Scholar (host: Vietnam), USA Department of State, 2016-17  
Eminent Engineer (honorary member), Tau Beta Pi Ohio Mu Chapter, elected 2016  
HERS Fellow, nominated and selected 2013  
Distinguished Visiting Scientist, Australian e-Health Research Centre, The Commonwealth Scientific and Industrial Research Organisation (CSIRO), Brisbane, Australia, 2013  
Ohio Research Scholar, Ohio Imaging Research and Innovation Network (OIRAIN), 2012-2015  
Chaire Régionale de Chercheur Étranger de la Région Pays de la Loire (Research Chair of Loire Region), Nantes, France, 2009-2011  
Mellon Foundation Research Grant, Tufts University, 2006  
NSF Early CAREER Award, National Science Foundation, 2003  
Chapanis Best Student Paper Award, Finalist, Human Factors and Ergonomics Society, 2001  
Claudette MacKay-Lassonde Scholarship (Women in Engineering), U of T Nominee, Canadian Engineering Memorial Foundation, 2000  
Ontario Graduate Scholarship, University of Toronto, 1999-2001  
University of Toronto Graduate Fellowship, 1997-99  
Gordon Diewert Fellowship, SFU, 1997 (declined)  
SFU Graduate Fellowship, SFU, 1997 (declined)  
Gordon M. Shrum Scholarship, SFU, 1985-1988  
MacKenzie King Entrance Scholarship, UBC, 1985 (declined)  
Vancouver Citizenship Award, 1985  
BC Scholar, 1985

## **PROFESSIONAL SOCIETY LEADERSHIP AND SERVICE**

Human Factors and Ergonomics Society (HFES)  
*Fellow (elected), 2018*  
*Science and Policy Fellow, 2018-19*  
*Secretary-Treasurer-Elect, 2018-19*  
*Finance subcommittees: Reserves; Investments, 2019-present*  
*Chair, Nominations and Elections, 2018-19*  
*Chair, Human Factors Prize Panel, 2016-present*  
*Chair, Committee of Technical Groups (COTG), 2012-13*  
*Chair, COTG Budget and Finance Committee, 2011*  
*Chair, Chapanis Student Paper Award Committee, 2007-14*  
*Chair, Health Care Technical Group, HFES, 2006-08*  
*Chair, Health Care Technical Group, Technical Program, 2004-06*  
*Co-Founder, Early Career Professionals Group*  
Associate Editor, Human Factors, 2017-present  
Associate Editor, Journal of Advances in Human-Computer Interaction, 2007-present  
American College of Surgeons (ACS), Division of Education, Ergonomics Task Force, 2018-  
Associate Editor, IEEE Transactions on Human-Machine Systems (formerly SMC, Part A: Systems and Humans), 2012-16  
Associate Editor, IEEE Transactions on Systems, Man and Cybernetics, Part A: Systems and Humans), 2008-12

Ohio Order of Engineers, 2013-present  
Society of American Gastrointestinal and Endoscopic Surgeons (SAGES), 2006-present  
*SAGES Committees: Technology; Fundamentals of Laparoscopic Surgery, 2011-present*  
American Society of Mechanical Engineers (ASME), 2003-present  
*Track co-chair, Technical programme committee, ASME ESDA 2012, 11<sup>th</sup> biennial conference on engineering systems design and analysis, 2-4 July 2012, Nantes, France*  
IEEE, 2003 to present  
*Chair, Human-Computer Interaction Technical Committee, SMC, 2015-2018*  
Board of Directors, Charter Member (2002), Human Factors and Ergonomics Society, New England Chapter, 2002-05  
North American Society for the Psychology of Sport and Physical Activity (NASPSA), 1993-2006  
Societe Canadienne D'Apprentissage Psychomotor et de Psychologie du Sport (SCAPPS), 1993-96

Reviewer of scientific journals: Applied Ergonomics, ACM Transactions on Computer-Human Interaction, Behaviour & Information Technology, British Medical Journal – Quality and Safety in Health Care, Human Factors, IEEE Transactions on Systems, Man, and Cybernetics – Part A: Systems and Humans, IEEE Transactions on Haptics, Journal of Applied Research in Memory and Cognition, Journal of Cognitive Engineering and Decision Making, Surgical Endoscopy, Surgical Innovation

Reviewer for funding agencies: French National Research Agency (ANR), Natural Sciences and Engineering Research Council of Canada (NSERC), National Science Foundation (NSF), National Institute of Health (NIH) – NCI, SBIB, NIBIB, SBIR, Technology Foundation STW (Netherlands funding agency for academic research in applied sciences), The US Military (Army Medical Research Acquisition Activity (USAMRAA), United Kingdom Research and Innovation Medical Research Council.

Reviewer for technical conferences: Human Factors and Ergonomics Society Conference, Design of Medical Devices (DMD), SAGES, IEEE SMC

Reviewer for publishers: CRC Press, Taylor & Francis, Lawrence Erlbaum Associates Publishers

Consultant for: St. Jude Medical, Inc., Charles River Analytics, Inc., Cambridge Health Alliance Hospital

## **UNIVERSITY COMMITTEE LEADERSHIP AND SERVICE**

### **Wright State University, 2012-**

#### **University Committees (WSU)**

Faculty Senate

*Graduate Faculty Membership Committee, 2018-*

*International Education Advisory Committee, Recruiting and Outreach, 2018-*

*Buildings and Grounds Committee, 2016-17*

*Ad hoc Select Committee on Research Initiatives at WSU, 2015-16*

*Chair, ad hoc committee for graduate student success, 2014-15*

*Senator (elected), 2014-16*

University Strategic Plan Steering Committee, 2018-

Professor-at-Large (elected), University Promotion & Tenure Committee, 2015-17

Engineering Faculty Representative (elected), Research Council, 2013-15

Co-Chair, Advisory Council for the WSU STEMMS Mentoring Circles, 2014-16

Faculty Advisor, Engineers Without Borders, Wright State University Chapter, 2014-16

Faculty Advisor, Postdoctoral Association, Wright State University Chapter, 2012-

Member, Women in Science Giving Circle, 2013-

#### **College of Engineering and Computer Science Committees (CECS)**

Steering Committee (elected), 2015-19

Chair 2017-19

Faculty Development Committee (P&T) (elected), 2013-16, 2018-20

Graduate Studies Committee, 2012-14  
PhD in Engineering Program Affairs Committee, 2013-15  
Focus Area Chair (Industrial and Human Systems) (elected)  
Dean's Recruitment Fellow, 2013-2015

**Department of Biomedical, Industrial and Human Factors Engineering Committees (BIE)**

Chair, Faculty Teaching Evaluation Committee, 2015-  
Faculty Development Committee (P&T), 2012-  
Biomedical Engineering Programme Committee, 2012-  
Chair, BME Curriculum Committee, 2018-  
Industrial & Human Factors Engineering Programme Committee, 2012-  
Chair, Petitions Committee, 2017-  
Search Committee, Imaging Scholar Search, 2013-15

**Tufts University, 2001-2011**

**University Committees (Tufts)**

Member, Committee on Committees, 2011  
Member, Search Committee for Director of Tisch Library, 2010-2011  
Member, Academic Awards Committee, 2010-2011  
Member, Institutional Review Board, 2002-2004  
Chair, Academic Standing Committee, 2003-2009  
Research Director, Tufts Medical Centre for Human Factors and Surgical Skills Research, 2003-2011

**School of Engineering Committees (SOE)**

Director, Human Factors Program, 2001-2011  
Director, Usability Laboratory, 2001-2011  
Faculty advisor, Student Chapter of Human Factors and Ergonomics Society, 2001-2011  
Faculty advisor, Human-Computer Interaction Certificate Program, 2001-2011  
Faculty advisor, CSEMS scholars program, 2002-2009  
Faculty advisor, Robotics Academy, 2002-2006  
Member, Graduate Studies Committee - 2001-2011

**Department of Mechanical Engineering Committees (ME)**

Member, Search Committee for Chair of Department of Mechanical Engineering, 2010-2011  
Chair, Graduate Curriculum Committee, 2007-2009  
Chair, Graduate Program Committee, 2008-2009  
Advisor, undergraduate and graduate students in mechanical engineering, human factors engineering and engineering psychology, 2001-2011

**EXTRAMURAL GRANTS AWARDED**

**Focus Area 1: Technology Commercialization**

1. EndoGPS – Technology Validation and Startup Fund (TVSF Phase 2), Ohio Third Frontier Commission (\$150,000) – PI, 2019-2020.
2. University Technology Commercialization Pilot – US Department of Defence Office of Economic Adjustment (\$150,000) – PI, 2018.
3. Ohio@ICorps Program – Ohio Department of Higher Education (\$15,000) – PI, 05/01/2016 – 04/30/2017.

**Focus Area 2: Biomaterials**

4. Advanced biomaterial Characterization – AFRL/DAGSI Ohio Student-Faculty Research Program (\$44,130) – Faculty PI – 08/27/2018-08/26/2019

**Focus Area 3: Development of Technology for Minimally Invasive Surgery**

5. Human factors for medical technologies (FaMe) – NEXT Health and Engineering Integrative Research Clusters, Nantes, France (210,000 €) – Scientific Advisor – 07/2018-06/2021 (Multi-

institutional project; lead institution Universite de Nantes & Laboratoire des Sciences du Numerique de Nantes)

6. Development and validation of a Virtual Airway Skill Trainer (VAST) – National Institute of Health (NHLBI 1R01HL119248-01A1, \$2,962,918) – CoI – 04/2014-03/2018 (\$401,428) (Multi-institutional project with RPI and BIDMC; lead institution RPI)
7. Feasibility study of ICG imaging in cholecystectomy – WSU Research Initiation Grant (\$20,000) – PI – 2013-2014
8. Development and validation of The *Virtual Electrosurgical Skill Trainer (VEST)* – National Institute of Health (NIBIB 1R01EB014305-01; \$3,600,000) – PI – 09/2012-08/2017 (\$475,053) (Multi-institutional project with RPI and BIDMC; lead institution RPI)
9. Physically Realistic Virtual Surgery (GEN2) – National Institute of Health (NIBIB R01 2R01EB005807-05A1; \$3,500,000) – PI – 08/2011-07/2016 (\$444,500). (Multi-institutional project with RPI and BIDMC; lead institution RPI)
10. Developing Physics-Based Virtual Simulation Technology for Natural Orifice Translumenal Endoscopic Surgery (NOTES) – National Institute of Health (NIBIB 1R01EB009362-01A2; \$3,535,278) – PI – 05/2011-04/2016 (\$395,125). (Multi-institutional project with RPI and BIDMC; lead institution RPI)
11. Laparoscopic Surgery Training System (LASTS) – US Office of Naval Research & TATRC (SBIR Phase II; \$750,000) – CoPI – 2011-2013 (\$265,082). (Lead institution Charles River Analytics, Inc.)
12. Laparoscopic Surgery Training System (LASTS) – US Office of Naval Research (SBIR Phase I; \$70,000) – CoPI – 2010 (\$10,000). (Lead institution Charles River Analytics)
13. Development and Validation of a Virtual Basic Laparoscopic Skill Trainer (VBLaST) – National Institute of Health (NIBIB 1R01EB10037-01; \$2,160,000) – PI – 06/2010-05/2015 (\$417,040). (Multi-institutional project with RPI and BIDMC; lead institution RPI)
14. A Phase I Trial of Continuous Low-Irradiance Photodynamic Therapy for Post-Mastectomy Chest Wall Recurrences of Breast Cancer – Susan G. Komen Breast Cancer Foundation (\$264,233) – CoPI – 2007-2010. (Lead institution Tufts Medical Centre)
15. Image-Guidance Research in Colonoscopy to Improve Diagnosis of IBD – Broad Foundation Medical Research Grant (\$217,832) – PI – 2007-2009.
16. Adapting to Technology in Minimally Invasive Surgery – **National Science Foundation Career Award** – NSF Grant IIS-0238284 (\$651,361) – PI – 2003-2008.
17. Surgical Skills in Robotic Surgery - Tufts University Faculty Research Award (\$5,000) – PI – 2002.

#### **Focus Area 4: Haptics in Surgical Applications**

18. Haptic Evaluation Procedure – AtlanSTIC 2009 (CNRS FR2819, France) (9,100€) – CoPI – 2010. (PI: Dumas, Ecole des Mines de Nantes)
19. Soft Tissue Measurement and Modelling for Surgical Simulation and Visualisation – Tufts University School of Engineering Research Funding (\$5,000) – PI – 2008-2009.
20. Smart Codec with Telesurgery Capability – Department of Defence Telemedicine and Advanced Technology Research Centre (SBIR Phase II; \$750,000) – Participant – 2007-2009. (Lead institution Energid, Inc.)
21. Role of Haptic Feedback and Cognitive Load in Laparoscopic Surgery Performance – Society of American Gastrointestinal and Endoscopic Surgeons (SAGES) Research Grant (\$20,000) – PI – 2007-2008.
22. The Vanderbilt Reynolds Geriatrics Centre – D.W. Reynolds Foundation (\$1,999,798) – Participant, 2006-2008. (PI: Powers, Vanderbilt Medical Centre)
23. Soft Tissue Strength Measurement - Tufts University Faculty Research Award (\$5,500) – PI – 2003.

#### **Focus Area 5: Equipment Grants**

24. Acquisition of a Scientific Visualization Facility – National Science Foundation (\$350,000) – Senior Personnel, 2006. (PI: Boghosian)
25. Integrated Information Display for OR Team – Tufts University Faculty Research Award (Mellon), Junior Research Semester Fellowship (semester leave) – PI – 2006.
26. Human Factors Usability Laboratory at Tufts - Tufts University Academic Technology Faculty Grant (\$30,000 equivalent) – PI – 2002-2003.

27. Biomedical MEMS Microfabrication Facility and Biomedical Device Design, Evaluation and Usability Laboratory – Lufkin Memorial Fund (\$200,000) – Primary Contributor – 2002-2003.

**Focus Area 6: Education & Student Success**

28. The CECS Student Success Scholarship Program: Leveraging Curricular Innovation in Engineering and Computer Science Education – National Science Foundation (NSF DUE-1356518, \$614,096) – CoPI – 06/01/2014-05/31/2019
29. Tufts-CSEMS Scholars Program – National Science Foundation – NSF Grant DUE-0631054 (\$499,560) – CoI – 2006-2010. (PI: Souvaine, Tufts University)
30. Tufts-CSEMS Scholars Program – National Science Foundation – NSF Grant DUE-0220651 (\$385,000) – CoPI – 2002-2006. (PI: Souvaine, Tufts University)
31. Multi-Threaded Instruction: Forming Multi-disciplinary Research Groups to Improve Undergraduate Education – National Science Foundation – NSF Grant ECC-0212046 (\$372,972) – CoPI – 2002-2005. (PI: Rogers, Tufts University)

**MEDIA COVERAGE**

1. Dayton startups land \$100K+ for prototype development. Dayton Tech Guide, April 29, 2019. ([https://daytontechguide.com/dayton-startups-lands-100k-for-prototype-development/?mc\\_cid=e64d2a1170&mc\\_eid=ad339f7011](https://daytontechguide.com/dayton-startups-lands-100k-for-prototype-development/?mc_cid=e64d2a1170&mc_eid=ad339f7011))
2. Optical Device Offers Less Painful Colonoscopy. Hospimedica.com, May 9, 2011 ([http://www.hospimedica.com/surgical\\_techniques/articles/294734898/optical\\_device\\_offers\\_less\\_painful\\_colonoscopy.html](http://www.hospimedica.com/surgical_techniques/articles/294734898/optical_device_offers_less_painful_colonoscopy.html))
3. A Less Painful Colonoscopy. Sciencedaily.com, April 28, 2011 ([http://www.sciencedaily.com/releases/2011/04/110427091953.htm?utm\\_source=feedburner&utm\\_medium=feed&utm\\_campaign=Feed%3A+sciencedaily+%28ScienceDaily%3A+Latest+Science+News%29&utm\\_content=My+Yahoo](http://www.sciencedaily.com/releases/2011/04/110427091953.htm?utm_source=feedburner&utm_medium=feed&utm_campaign=Feed%3A+sciencedaily+%28ScienceDaily%3A+Latest+Science+News%29&utm_content=My+Yahoo))
4. The Grabbiest Lab in Boston. Discovery.com, June 6, 2008 (<http://news.discovery.com/tech/videos/tech-the-grabbiest-lab-in-boston.htm>)

**PUBLICATIONS & SCHOLARLY ACTIVITIES**

**Patents (4)**

1. PCT/US17/55346 (US 62/404,370), Sensorized guidewire and catheter. Inventor Cao. Filed Oct 2017.
2. US 8,219,180 B2, System and method employing fiber optic shape tracking. Inventors Cao, Lilge, Milgram, Wong. Issued July 10, 2012.
3. US 8,725,234 B2, Systems, devices, and methods employing fiber optic shape tracking. Inventors Cao, Lilge, Milgram, Wong. Issued May 13, 2014.
4. US 2010/0120006 A1, Dynamic minimally invasive training and testing environments. Inventors Bell, Cao, Johanas, Leisk, Saide, Schwaizberg. Published May 13, 2010.

**Refereed Journals (Total 49 published)**

**Theme 1: Surgical Simulation Technology & Skills Training**

1. Lopez, C.A., Cao, C.G.L., Kruger, U., Misra, A.C., Milef, N., Schwaizberg, S., Jones, D.B., De, S., Olasky, J. (submitted June 25, 2018). Evaluation of the electro-surgery skill trainer (VEST) direct and capacitive coupling effects module. *Surgical Endoscopy*.
2. Dombek, M., Courant, R., Lungarini, A., Santos, N., Schwaizberg, S., Cao, C.G.L., Jones, D., De, Suvranu, Olasky, J. (2018). FUSE certification enhances performance on a virtual computer based simulator for dispersive electrode placement. *Surgical Endoscopy*, 32(8), 3640-3645. DOI: 10.1007/s00464-018-6095-2
3. Linsk, A., Monden, K., Sankaranarayanan, G., Ahn, W., Jones, D., De, S., Schwaizberg, S., Cao, C.G.L. (2018). Validation of the VBLaST pattern cutting task: a learning curve study. *Surgical Endoscopy*, 32(4), 1990-2002. DOI: 10.1007/s00464-017-5895-0
4. Maddah, M. & Cao, C.G.L. (2017). Application of the alpha method to visualize and analyze surgical motion. *Surgical Science*, 8(11) 2017.
5. Dorozhkin, D., Olasky, J., Jones, D.B., Schwaizberg, S.D., Jones, S.B., Cao, C.G.L., Molina, M., Henriques, S., Wang, J., Flinn, J., De, S., and the SAGES FUSE Committee (2017). OR fire virtual

- training simulator: design and face validity. *Surgical Endoscopy*, 31(9), 3527-3533.
6. Chellali, A., Mentis, H., Miller, A., Ahn, W., Arikatla, V., Sankaranarayanan, G., De, S., Schwaizberg, S., Cao, C.G.L. (2016). Achieving interface and environmental fidelity in the virtual basic laparoscopic surgical trainer. *International Journal of Human-Computer Studies*, 96, 22-37.
  7. Dorozhkin, D., Nemani, A., Roberts, K., Ahn, W., Halic, T., Dargar, S., Wang, J., Cao, C.G.L., Sankaranarayanan, G., De, S. (2016). Face and content validation of a Virtual Transluminal Endoscopic Surgery Trainer (VTEST). *Surgical Endoscopy*. DOI: 10.1007/s00464-016-4917-7
  8. Demirel, D., Butler, K.L., Halic, T., Sankaranarayanan, G., Spindler, D., Cao, C.G.L., Petrusa, E., Molina, M., Jones, D., De, S. DeMoya, M. (2015). A hierarchical task analysis of cricothyroidotomy procedure for a virtual airway skills trainer (VAST) simulator. *American Journal of Surgery*, 212(3), 475-484.
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59. Hall, T.J., Rudolph, J. W. & Cao, C.G.L. (2006). Fixation and attention allocation in anaesthesiology crisis management: an abstraction hierarchy perspective. *Proceedings of the 50<sup>th</sup> Annual Meeting of the Human Factors and Ergonomics Society*, 1064-1067.
60. Cao, C.G.L., Ozdas, A., Slagle, J. (2006). Utilisation of computerised order entry protocols in the ICU for glucose management. *Proceedings IEA 2006 Congress*, Maastricht, the Netherlands, July 10-14, 2006.
61. O'Connor, A., Cao, C.G.L. & Schwaitzberg, S. (2006). Knowledge of results in surgical skills training. *Current Surgery*. **BEST PAPER PRIZE – 3<sup>RD</sup> PLACE**
62. Rivera, C. & Cao, C.G.L. (2005). Toward improved communication in laparoscopic surgery: Accounting for multiple frames of reference and visuomotor transformations. *Proceedings of the 49<sup>th</sup> Annual Meeting of the Human Factors and Ergonomics Society*, 999-1003.
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64. Gaulin, M. & Cao, C.G.L. (2005). Surgical learning aid: Reducing uncertainty for the novice during simulated minimally invasive surgery. *Proceedings of the 49<sup>th</sup> Annual Meeting of the Human Factors and Ergonomics Society*, 1089-1093.

65. Webster, J. & Cao, C.G.L. (2004). Divided attention in using robotic surgical systems. *Proceedings of the 48<sup>th</sup> Annual Meeting of the Human Factors and Ergonomics Society*. 1751-1754.
66. Perreault, J. & Cao, C.G.L. (2004). Effects of friction on haptic perception in simulated endoscopic environments. *Proceedings of the 48<sup>th</sup> Annual Meeting of the Human Factors and Ergonomics Society*. 1704-1707.
67. Waxberg, S., Goodell, K., Avgerinos, D., Schwaitzberg, S., Cao, C.G.L. (2004). Evaluation of physical versus virtual surgical simulators. *Proceedings of the 48<sup>th</sup> Annual Meeting of the Human Factors and Ergonomics Society*. 1675-1679.
68. Alvarado, C. & Cao, C.G.L. (2004). Panel: Human factors in healthcare in 2020. *Proceedings of the 48<sup>th</sup> Annual Meeting of the Human Factors and Ergonomics Society*. 1764-1767.
69. Cao, C.G.L. & Taylor, H. (2004). Effects of new technology on the operating room team. *Proceedings of the 7<sup>th</sup> International Conference on Work with Computing Systems*, special session on IT in Healthcare. 309-312.
70. Horn, M., Cao, C.G.L., Baise, L., Kilmer, M., Hassoun, S., Souvaine, D. (2004). Model for mentoring and retaining engineering students from underrepresented groups. *Proceedings of the ASEE New England Section 2004 Annual Conference*.
71. Cao, C.G.L., Webster, J., Perreault, J., Schwaitzberg, S., Rogers, G. (2003). Visually perceived force feedback in simulated robotic surgery. *Proceedings of the 47<sup>th</sup> Annual Meeting of the Human Factors and Ergonomics Society*. 1466-1470.
72. Cao, C.G.L., Waxberg, S., Smith, E. (2003). Role of landmark for spatial mapping in non-rigid environments. *Proceedings of the 47<sup>th</sup> Annual Meeting of the Human Factors and Ergonomics Society*. 1545-1548.
73. Cao, C.G.L. (2003). How do endoscopists maintain spatial awareness in colonoscopy? *Proceedings of the International Ergonomics Association XV<sup>th</sup> Triennial Congress*.
74. Lomax, A.J., Payandeh, S., Dill, J., MacKenzie, C.L., Cao, C.G.L. (2002). Design of a virtual laparoscopic training environment based on time and motion analyses of surgeons' manipulative performance. *Proceedings of the Annual Meeting of the Society for Medical Innovation and Technology*. National Hospital, Oslo, Norway, September 5, 2002.
75. Payandeh, S., Lomax, A.J., Dill, J., MacKenzie, C.L., Cao, C.G.L. (2002). On defining metrics for assessing laparoscopic surgical skills in a virtual training environment. In J.D. Westwood, H.M. Hoffman, R.A. Robb, D. Stredney (Eds.), *Medicine Meets Virtual Reality: 10, Digital Upgrades: Applying Moore's Law to Health*. IOS Press, Washington, DC. 334-340.
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77. Cao, C.G.L. & Milgram, P. (2000). Case studies of disorientation in minimally invasive surgery. *Proceedings of the 44<sup>th</sup> Annual Meeting of the Human Factors and Ergonomics Society and XIV<sup>th</sup> Triennial Congress of the International Ergonomics Association*. Vol 4, 169-172.
78. Cao, C.G.L. (2000). Augmented reality displays for endoscopic orientation and navigation. Doctoral Consortium. *Proceedings of the CHI 2000 Conference on Human Factors in Computing Systems*. 91-92.
79. Cao, C.G.L., MacKenzie, C.L., Ibbotson, J.A., Turner, L.J., Blair, N.P., & Nagy, A.G. (1999). Hierarchical decomposition of laparoscopic procedures. In J.D. Westwood, H.M. Hoffman, R.A. Robb, D. Stredney (Eds.), *Medicine Meets Virtual Reality: 7. The Convergence of Physical and Informational Technologies: Options for a New Era in Healthcare*. IOS Press, Washington, DC. 83-89.
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*Proceedings of Enhancing Patient Safety and Reducing Errors in Health Care*. Chicago: National Patient Safety Foundation. 226-229.

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#### **Abstracts & Posters (Total 67)**

1. Cao, C. Topolski, C. (2019). Physician and patient trust in robotic surgery. Presented at the *2019 International Symposium on Human Factors and Ergonomics in Health Care*, Chicago, IL, March 24-27, 2019.
2. Topolski, C., Mensah, A., Cao, C.G.L. (2018). Trust in robot-assisted surgery. Presented at the *BMES 2018 Annual Meeting*, Atlanta, GA, October 17-20, 2018.
3. Hamdan, M. & Cao, C.G.L. (2018) Investigating the after-effects of stochastic resonance for use in laparoscopic surgery. Presented at the *IEEE Haptics Symposium 2018*, San Francisco, CA, March 25-28.
4. He, S., Goonetilleke, R., Cao, C.G.L. (2018). Hardness perception of viscoelasticity in a probing task. Presented at the *IEEE Haptics Symposium 2018*, San Francisco, CA, March 25-28.
5. Lopez, C., Misra, A., Milef, N., Santos, N., Lamien, A., Cao, C.G.L., Schwaizberg, S., Jones, D., De, S., Olasky, J. (2018). Design of the electrosurgery skill trainer (VEST) direct and capacitive coupling effects module. Presented at the *2018 SAGES Annual Meeting*, Seattle, WA, April 2018.
6. Santos, N., Lamien, A., Findley, A., Galloway, M., Hellan, M., McCarthy, M., Simon, T., Linsk, A., Derevianko, A., Olasky, J., Fitzpatrick, E., Nguyen, B., Schwaizberg, S., Jones, D., De, S., Cao, C.G.L. (2018). Measuring transfer of skill from the virtual transluminal endoscopic surgery trainer (VTEST) to EASIE-R model. Presented at the *2018 SAGES Annual Meeting*, Seattle, WA, April 2018.
7. Santos, N., Carter, J., He, F., Linsk, A., Lungarini, A., Nemani, A., Sankaranarayanan, G., Jones, D., De, S., Schwaizberg, S., Cao, C.G.L. (2017). A learning curve study using the virtual transluminal endoscopic surgery trainer (VTEST). Presented at the *2017 SAGES Annual Meeting*, Houston, TX, March 2017.
8. Dorozhkin, D., De, S., Jones, D., Schwaizberg, S., Jones, S., Olasky, J., Molina, M., Henriques, S., Wang, J., Flinn, J., Cao, C.G.L. (2016). OR fire virtual training simulator: design and face validity. Presented at the *2016 SAGES Annual Meeting*, Boston, MA, March 16-19, 2016.
9. Wang, J., Hellan, M., Lin, K., Watson, K., Galloway, M., Cao, C.G.L. (2016). Need help with port-placement in robot-assisted surgery: a survey study. Presented at the *2016 SAGES Annual Meeting*, Boston, MA, March 16-19, 2016.
10. Wang, J., Ahn, W., Dorozhkin, D., Jones, D., De, S., Cao, C.G.L. (2016). Virtual transluminal endoscopic surgical trainer (VTEST): an evaluation study. Presented at the *2016 SAGES Annual Meeting*, Boston, MA, March 16-19, 2016.
11. Linsk, A.M., Diller, E., Monden, K., Sankaranarayanan, G., Ahn, W., Awtrey, C., De, S., Jones, D., Schwaizberg, S., Epstein, S., Rideout, J., Cao, C.G.L. (2016). Comparison of learning curves on the FLS and the Virtual Basic Laparoscopic Skill Trainer (VBLaST): pattern cutting and ligating loop tasks. Presented at the *2016 SAGES Annual Meeting*, Boston, MA, March 16-19, 2016.
12. Diller, E., Cao, C.G.L. (2015). The use of stochastic resonance in a two-dimensional Fitts' task. *BMES 2015 Annual Meeting*, Tampa, Florida, October 7-10, 2015.
13. Babbitt, K., Hoskins, R., Wang, J., Diller, E., Spindler, D., Cao, C.G.L. (2015). Vibrotactile feedback and stochastic resonance improves simulated laparoscopic palpation. 2015 Medical Student Program, *American College of Surgeons, Division of Education*. Chicago, IL, October 4-6, 2015.
14. Hoskins, R.D., Babbitt, K., Wang, J., Diller, E., Cao, C.G.L. (2015). Use of stochastic resonance methods for improving laparoscopic surgery performance. *2015 SAGES Annual Meeting*, Nashville, TN, April 15-18, 2015.
15. Flinn, J., Berguer, R., Cao, C.G.L. (2015). Display optimisation of indocyanine green cholangiography (ICG) imaging. *2015 SAGES Annual Meeting*, Nashville, TN, April 15-18, 2015.
16. Maddah, M., Wang, J., Galloway, M., Lin, K., Watson, K., Cao, C.G.L. (2015). Kinect accuracy in abdominal surface reconstruction for robotic surgery. *BMES 2015 Annual Meeting*, Tampa, Florida, October 7-10, 2015.
17. Wang, J., Lin, K., Watson, K., Cao, C.G.L. (2015). 3D modelling of patient-specific abdomen for

- port placement planning in robot-assisted surgery. *2015 SAGES Annual Meeting*, Nashville, TN, April 15-18, 2015.
18. Butler K, Petrusa E, Spindler D, Halic T, Ryanson A, Sankaranarayanan G, De S, deMoya M, Cao, C.G.L. (2015). Development of a Virtual Airway Skill Trainer (VAST): An Initial Task Analysis of the Open Cricothyroidotomy. *2015 ASE Annual Meeting*, Seattle, WA, April 23-25, 2015.
  19. Jones S.B., Spindler D., Sankaranarayanan G., Halic T., Jones D.B., De S., Cao C. (2015). Development of a Virtual Airway Skill Trainer (VAST): An Initial Task Analysis. *2015 SEA Annual Meeting*, Seattle, WA, April 24 - 26, 2105.
  20. Coles, T., Cao, C.G.L., Dumas, C. (2014). Medimq: a medical image diagnostic learning and assessment tool. Presented at the *2014 SAGES Annual Meeting*, Salt Lake City, UT, April 2-5, 2014.
  21. Dumas, C., Cao, C.G.L., Coles, T. (2014). ETrack: an affordable ergonomic assessment tool for surgical settings. Presented at the *2014 SAGES Annual Meeting*, Salt Lake City, UT, April 2-5, 2014.
  22. Miller, A., Saxe, J., Cao, C.G.L. (2014). ICG infrared imaging: a novel alternative to intraoperative cholangiography. Presented at the *2014 SAGES Annual Meeting*, Salt Lake City, UT, April 2-5, 2014.
  23. Dumas, C., Coles, T., de Visser, H., Cao, C.G.L., Grimpén, F. (2014). Haptic feedback tuning in colonoscopy simulation. Presented at *Eurohaptics 2014*, Versailles, France, June 24-26, 2014.
  24. Sankaranarayanan, G., Baichun, L., Chellali, A., Mentis, H., Jones, S. Jones, D.B., Schwaizberg, S., De, S., Cao, C.G.L. (2014). A new virtual reality immersive surgical trainer with distractions for situated and cognitive training. Presented at the *2014 Surgical Education Week of the Annual Meeting of the Associate for Surgical Education*, Chicago, IL, April 8-12, 2014.
  25. Baichun, L., Sankaranarayanan, G., Jones, S. Jones, D.B., Schwaizberg, S., De, S., Cao, C.G.L. (2014). Preliminary validation of a novel VR2C (VR within VR) simulator for surgical education. Presented at the *2014 Surgical Education Week of the Annual Meeting of the Associate for Surgical Education*, Chicago, IL, April 8-12, 2014.
  26. Chellali, A., Ahn, W., Sankaranarayanan, Flinn, J., G., Schwaizberg, S., Jones, D., Cao, C.G.L. (2014). Preliminary evaluation of the pattern cutting and the ligating loop virtual laparoscopic trainers. Presented at the *2014 SAGES Annual Meeting*, Salt Lake City, UT, April 2-5, 2014.
  27. Abtahi, K., Flinn, J., Yaklic, J., Cao, C.G.L., Galloway, M. (2014). Smart phones and intraoperative assessment of obstetric and gynecologic residents: The future is here! *The 2014 CREOG and APGO Annual Meeting*, Atlanta, GA. Feb. 26-Mar. 1, 2014.
  28. Flinn, J., Wood, D., Cao, C.G.L. (2013). Technology-based procedure for automatic and objective error measurement in FLS pattern cutting task. Presented at *The Annual Meeting of the Society of Gastrointestinal and Endoscopic Surgeons (SAGES)*, Baltimore, MD, April 17-20, 2013.
  29. Sankaranarayanan, G., Zhang, L., De, S., Jones, D. B., Schwaizberg, S., Cao, C.G.L. (2013). The learning plateau and the learning rate for the VBLaST-PT compared to the FLS simulator. Presented at the *2013 Association For Surgical Education (ASE) Annual Meeting*, Orlando, FL.
  30. Olasky, J., Eskander, M., Ahn, W., Sankaranarayanan, G., De, S., Chellali, A., Cao, G. L., Feldman, L.S., Schwaizberg, S., Jones, D. B. (2013). The Impact of Simulator Based Electrosurgical Training on Resident Education. Presented at *The Annual Meeting of the Society of Gastrointestinal and Endoscopic Surgeons (SAGES)*, Baltimore, MD, April 17-20, 2013.
  31. Chellali, A., Sankaranarayanan, G., Zhang, L., Cao, C.G.L., De, S., Jones, D.B., Schneider, B. (2013). Effects of sleep hours and fatigue on performance in laparoscopic surgery simulators. Presented at *The Annual Meeting of the Society of Gastrointestinal and Endoscopic Surgeons (SAGES)*, Baltimore, MD, April 17-20, 2013.
  32. Cao, C.G.L., Matthews, G., Malek, D., Neville, K., Ryan, J., Schneider, M. (2013). Panel: Human factors in robotics safety: From individual to organisation. *2013 Safety Across High Consequence Industries (SAHI) Conference*, St. Louis, March 12-13, 2013.
  33. Cao, C.G.L., Wong, P.Y., Eisenstein, J. (2011). Development of a shape tracker for colonoscopy navigation. *The Annual Meeting of the Society of Gastrointestinal and Endoscopic Surgeons (SAGES), Emergent Technology*. San Antonio, TX, March 30-April 2, 2011.
  34. Bell, A., Schwaizberg, SD, Cao, C.G.L. (2009). Using vibration to provide force information during surgery. Presented at the 2009 Meeting of the *Society of American Gastrointestinal and Endoscopic Surgeons*, April 22-25, 2009, Phoenix, Arizona. **BEST POSTER AWARD**

35. Lin, H., Sankaranarayanan, G., Jones, D.B., Sreekanth, A.V., Mulcare, M., Zhang, L., Derevianko, A., Lim, R., Fobert, D., Cao, C.G.L., Schwaitzberg, S.D., De, S. (2009). Steps toward virtual reality FLS: Virtual Basic Laparoscopic Skill Trainer (VBLAST) preliminary face and construct validity study. Presented at the 2009 Meeting of the *Society of American Gastrointestinal and Endoscopic Surgeons*, April 22-25, 2009, Phoenix, Arizona.
36. Gavalis, R.M., Xing, H., Wong, P.Y., Lilge, L., Cao, C.G.L. (2008). Design of a navigational aid for colonoscopy. Presented at the 3<sup>rd</sup> *Frontiers in Biomedical Devices Conference, Proceedings of BioMed2008*, Irvine, CA, June 18-20, 2008. *Journal of Medical Devices*, 2(2), 027523. <http://link.aip.org/link/?MED/2/027523> **BEST POSTER AWARD -- 2<sup>ND</sup> PLACE**
37. Gavalis, R., Xing, H., Wong, P.Y., Lilge, L., Cao, C.G.L. (2008). Design of a real-time guidance system for colonoscopy. Presented at *the 2008 Design of Medical Devices Conference*, Minneapolis, Minnesota, April 15-17, 2008.
38. Zhou, M., Tse, S., Derevianko, A., Jones, D.B., Schwaitzberg, S.D., Cao, C.G.L. (2008). Learning Curve in Laparoscopic Suturing With Haptic Feedback. Presented at *the 2008 meeting of the Society of American Gastrointestinal and Endoscopic Surgeons*, Philadelphia, PA, April 9-12, 2008.
39. Bell, A., Saide, M., Johanas, J., Leisk, G., Schwaitzberg, S.D., Cao, C.G.L. (2008). Using a Dynamic Training Environment to Assess Laparoscopic Skill. Presented at *the 2008 Meeting of the Society of American Gastrointestinal and Endoscopic Surgeons*, Philadelphia, PA, April 9-12, 2008.
40. Bell, A., Mandelupe, E., Schwaitzberg, S.D., Cao, C.G.L. (2008). Speed-Accuracy Tradeoff in VR Simulator with Haptic Feedback. Presented at *the 2008 meeting of the Society of American Gastrointestinal and Endoscopic Surgeons*, Philadelphia, PA, April 9-12, 2008.
41. Barrios, L., Tsuda, S., Derevianko, A., Barnett, S., Moorman, D., Cao, C.G.L., Jones, D.B. (2008). Framing family conversation after early diagnosis of iatrogenic injury and incidental findings. Presented at the *2008 meeting of the Society of American Gastrointestinal and Endoscopic Surgeons*, Philadelphia, PA, April 9-12, 2008.
42. Dezube, R., Dale, C., Weinger, M., Muldoon, R., Ayers, G. D., Zhong, S., Cao, C.G.L. (2008). Procedural learning in simulated colonoscopy. Presented at *the 2008 International Meeting on Simulation in Healthcare*, San Diego, CA, January 13-16, 2008.
43. Barrios, L., Tsuda, S., Derevianko, A., Barnett, S., Moorman, D., Cao, C.G.L., Karavas, A.N., Jones, D.B. (2007). Framing family conversation after early diagnosis of iatrogenic injury and incidental findings. Presented at *the 54<sup>th</sup> Annual Meeting of the Massachusetts Chapter of the American College of Surgeons*, Boston, MA, December 8, 2007.
44. Dezube, R., Dale, C., Weinger, M., Muldoon, R., Ayers, G. D., Zhong, S., Cao, C.G.L. (2007). Procedural learning in simulated colonoscopy. Presented at *the NASPGHAN Annual meeting*, Salt Lake City, UT, October 25 -27, 2007.
45. Cao, C.G.L., Zhou, M.G., Jones, D.B., Schwaitzberg, S.D. (2007). Can surgeons think and operate with haptics at the same time? Presented at the *Society of Surgery of the Alimentary Tract 48<sup>th</sup> Annual Meeting*, Washington, DC, May 19-23, 2007. **POSTER OF DISCTINCTION AWARD**
46. O'Connor, A., Cao, C.G.L. & Schwaitzberg, S. (2007). Impact of knowledge of results in surgical skills training. *Surgical Endoscopy*, 21 (supplement 1), S312.
47. Bell, A., Johanas, J., Cao, C.G.L. & Schwaitzberg, S. (2007). Dynamite skill assessment system: initial evaluation. *Surgical Endoscopy*, 21 (supplement 1), S344. **POSTER OF DISTINCTION AWARD**
48. Vuong, L., Schwaitzberg, S., Cao, C.G.L. (2006). What can motion derivatives tell us about skill performance. *Surgical Endoscopy*, 20 (Supplement 1), S254-282.
49. Nguyen, T., Schwaitzberg, S., Cao, C.G.L. (2006). Effect of friction and vision on simulated laparoscopic surgery performance. *Surgical Endoscopy*, 20 (Supplement 1), S254-282.
50. Rivera, C. & Cao, C.G.L. (2005). The effect of tool angle on force perception in a simulated laparoscopic environment. Presented at the *New England Surgical Society Annual Meeting*, Boston, MA, May 27, 2005.
51. Avgerinos, D., Rivera, C., Schwaitzberg, S., Cao, C.G.L. (2004). Visual and force feedback in laparoscopic robotic manipulation. Presented at the *New England Surgical Society*. Montreal, Canada, September 30, 2004.

52. Goodell, K., Avgerinos, D., Cao, C.G.L., Schwaitzberg, S. (2004). The effects of distraction on performance of laparoscopic surgical tasks. Presented at the *New England Surgical Society*. Montreal, Canada, September 30, 2004.
53. Cao, C.G.L. & Schwaitzberg, S. (2004). An alternative to haptics in robotic surgery. *Surgical Endoscopy*, 18 (5), 725-878.
54. Cao, C.G.L., Waxberg, S., Park, B., Schwaitzberg, S. (2004). Comparison of real versus virtual surgical training models. *Surgical Endoscopy*, 18 (5), 725-878.
55. Cao, C.G.L. (2004). Hand-eye co-ordination in simulated laparoscopic surgery. *Journal of Sport & Exercise Psychology*, 26: S47.
56. Cao, C.G.L., Schwaitzberg, S., Rogers, G. (2003). Visuomotor constraints in laparoscopic surgery: a human factors engineering perspective. *Surgical Endoscopy*, 17 (Supplement), S218-314.
57. MacKenzie, C.L., Ibbotson, J.A., Cao, C.G.L., Lomax, A.J. (2000). Hierarchical decomposition of goal-directed activity: a valuable research and investigative tool for minimally invasive surgery. Poster presented at the *7th World Congress of Endoscopic Surgery*. Singapore, May 28-June 5, 2000, 409.
58. Cao, C.G.L. & Milgram, P. (2000). Augmented reality displays for endoscopic orientation and navigation. Abstracts of the *31st International Symposium on Robotics/ 9th Annual Institute for Robotics and Intelligent Systems/PREARN Conference*. Montreal, Quebec, May 14-17, 2000.
59. Milgram, P. & Cao, C.G.L. (1999). Mixed reality in the OR. Abstracts of the *9th Annual Institute for Robotics and Intelligent Systems/PREARN Conference*, Toronto, Canada, June 7-9, 1999.
60. MacKenzie, C.L., Cao, C.G.L., Nagy, A.G., Turner, L.J., & Lomax, A.J. (1997). Quantifying surgeons' performance. *The International College of Surgeons XXXV North American Federation Congress: Enabling Technologies of the Minimal Access Revolution*. Vancouver, BC, July 24-26, 1997.
61. Cao, C.G.L. & MacKenzie, C.L. (1997). Direct, 2-D vs. 3-D endoscopic viewing & surgical task performance. A Symposium on Evolving Technologies: Surgeons' Performance of Surgical Tasks. *J. Sport and Exercise Psychology*, 19, *NASPSA/ACSM Meeting*. Denver, Colorado, May 28-June 1, 1997.
62. MacKenzie, C.L., Cao, C.G.L., Turner, L.J., Blair, N.P., & Nagy, A.G. (1997). Endoscopic viewing technologies on surgeons' performance. *The 50th Annual Spring Meeting of the BC Surgical Society*. Victoria, BC, April 30-May 3, 1997.
63. Cao, C.G.L., MacKenzie, C.L., & Payandeh, S. (1995). Task analysis of laparoscopic surgery: Determination of requirements for endoscopic tool design. *Abstracts 5th Annual IRIS/PREARN Conference*, Vancouver, Canada, June 1995.
64. Cao, C.G.L., MacKenzie, C.L., & Payandeh, S. (1996). Precision and safety constraints in laparoscopic surgery. *J. of Sport and Exercise Psychology*, Volume 18 Supplement, 19.
65. Cao, C.G.L., MacKenzie, C.L., & Payandeh, S. (1995). Remote manipulation in endoscopic surgery: A task analysis approach. *Abstract SCAPPS Annual Conference*. Vancouver, B.C., October 1995, 62.
66. Cao, C.G.L., & MacKenzie, C.L. (1995). Effect of fatigue on grip force in a precision grip. *J. Sport and Exercise Psychology*, Volume 17 Supplement, 36.
67. Cao, C.G.L. & Hair, M.L. (1989). Measurement of charge on sterically stabilised polyacrylic acid polystyrene particles. *Pacific Chemical Congress*. Honolulu, Hawaii, December 16-22, 1989.

#### **Technical Reports (Total 11)**

1. Luu, D. & Cao, C.G.L. (2010). Design and development of a robotic arm prototype for needle insertion. Report EREL-010TR, July 2010.
2. Khawatmi, N., Cao, C.G.L. (2004). Digital vs. analogue displays for force application. Report EREL-007TR, August 2004.
3. Perreault, J. & Cao, C.G.L. (2004). Force measurements in MIS. Report EREL-006TR, August 2004.
4. Perreault, J., Rivera, C., Cao, C.G.L. (2004). Fibre optics and fluorophores. Report EREL-005TR, December, 2003.
5. Cao, C.G.L., Waxberg, S. (2003). Role of landmark in spatial orientation in colonoscopy. Report EREL-004TR, June 2003.
6. Webster, J., Cao, C.G.L. (2003). Effect of visual augmentation on laparoscopic and robotic surgery skills. Report EREL-003TR, April 2003.

7. Webster, J., Cao, C.G.L. (2003). Comparison of hierarchical decomposition of robotic and laparoscopic cholecystectomies. Report EREL-002TR, April 2003.
8. Cades, D., Cao, C.G.L. (2003). Effects of spatial maps in colonoscopy. Report EREL-001TR, December, 2002.
9. Cao, C.G.L. (1990). Ergonomic analysis of glass-washing station in a chemistry laboratory.
10. Cao, C.G.L. (1989). Mono-dispersed coloured silica particles for toner applications. Report for Xerox Research Centre of Canada, Mississauga, ON, December, 1989.
11. Cao, C.G.L. (1988). Electrophoretic properties of synthesised colloidal polystyrene. Report for Xerox Research Centre of Canada, Mississauga, ON, December, 1988.

**Invited Presentations (Total 74)**

1. Keynote at the Journées de la Réalité Virtuelle (JRV2018), 13<sup>th</sup> Annual Meeting of the Association Française de Réalité Virtuelle (AFRV), Paris, France, October 29-31, 2018.
2. Human Factors in Product Design. Programme des journées jeunes chercheuses et chercheurs. JRV2018, 13<sup>th</sup> Annual Meeting of the Association Française de Réalité Virtuelle (AFRV), Paris, France, October 29-31, 2018.
3. Marquette University and the Wisconsin Medical College, December 14, 2017.
4. Robotic Surgery. Nanjing University Institute of Robotics, Nanjing, China, April 6, 2017.
5. Building a Career in Engineering and Medicine: Challenges for Women in STEM. American Center, US Consulate in Ho Chi Minh City, Vietnam, March 24, 2017.
6. International University, Vietnam National University in Ho Chi Minh City, Vietnam, March 6, 2017.
7. IRCCyN, Nantes, France. June 2, 2016.
8. Barn Gang, Dayton Engineers' Club, Dayton Ohio, September 22, 2015.
9. Université d'Evry Val d'Essonne, Evry, France, July 9, 2015.
10. Houston Methodist Hospital, Surgery Grand Rounds, January 28, 2015.
11. University of Toronto, MIE Seminar Series, November 28, 2014.
12. University of Toronto, HFIG Seminar, November 27, 2014.
13. Kettering College, Health Sciences Seminar, October 3, 2014.
14. Innovations in Medical and Surgical Education, presenter, Wright State University Boonshoft School of Medicine, September 19, 2014.
15. Wright State University, Alumni College, presenter, August 2, 2014.
16. Wright State University Direct Admit Day, Keynote speaker, Dayton, OH, March 15, 2014.
17. Wright State University E-Week and Celebration of Women in Engineering, Keynote speaker, Dayton, OH, February 21, 2014.
18. Innovation, Design, & Emerging Alliances in Surgery (IDEAS) Workshop, Beth Israel Deaconess Medical Center, Boston, MA, November 23, 2013.
19. The Australian e-Health Research Centre, CSIRO (Commonwealth Scientific and Industrial Research Organisation), Brisbane, Australia, August 2, 2013.
20. HFES, University of Queensland Chapter, July 27, 2012.
21. The Australian e-Health Research Centre, CSIRO (Commonwealth Scientific and Industrial Research Organisation), Brisbane, Australia, July 25, 2012.
22. Research Colloquium, Department of Psychology, College of Math and Science, Wright State University, Dayton, OH, USA, April 27, 2012.
23. Aptima, Inc. Dayton, OH, USA, March 22, 2012.
24. Ph.D. Seminar. College of Engineering and Computer Science, Wright State University, Dayton, OH, USA, March 2, 2012.
25. Human Factors in Undergrad and Graduate Education. Office of Admissions, Tufts University, Medford, MA, USA, September 9, 2011.
26. Human Factors Research in Endoscopic Surgery. Faculty of Medicine and Dentistry seminar, University of Alberta, Edmonton, Calgary, Canada, May 2, 2011.
27. Human Factors Research in Endoscopic Surgery. Department of Biomedical Engineering, Systems and Human Factors Engineering Seminar, Wright State University, Dayton, OH, April 8, 2011.
28. Human Factors Research and Development of Enabling Technology for Endoscopic Surgery. Presidential Seminar, Wright State University, Dayton, OH, October 21, 2010.
29. Research methods in human factors. Guest lecture in ASP Master's Programme, l'Ecole Centrale de Nantes, Nantes, France, December 10, 2009.

30. Human factors issues in minimally invasive surgery. Institut National Des Sciences Appliquees de Lyon, Lyon, France, December 7, 2009.
31. Human factors in robotic surgery. Guest lecture in European Masters on Advanced Robotics (EMARO) Programme, l'Institut de Recherche en Communications et Cybernétique de Nantes, Nantes, France, November 26, 2009.
32. Design for data visualisation and navigation. Guest lecture in graduate HCI course at l'Ecole des Mines de Nantes, Nantes, France, October 13, 2009.
33. Technology Development for Minimally Invasive Surgery. NSF WIRES (Women's International Research Engineering Summit), Barcelona, Spain, June 2-4, 2009.
34. Visuomotor Coordination in Endoscopic Surgery. *Design of Medical Devices Conference 2009*, Minneapolis, MN, April 14-16, 2009.
35. Human Factors Research in Robotic Surgery. *L'Institut de Recherche en Communications et en Cybernétique de Nantes, and l'École des Mines de Nantes*, Nantes, France, March 19, 2009.
36. Human Factors Research in Minimally Invasive Surgery. *L'Institut des Systèmes Intelligents et de Robotique, Université Pierre et Marie Curie*, Paris, France, March 13, 2009.
37. Fibre Optic Shape Tracking to Improve Inflammatory Bowel Disease Diagnosis. *Broad Medical Foundation Principal Investigator Annual Meeting*, Los Angeles, CA, February 13, 2009.
38. Human Factors Research in Minimally Invasive Surgery. *Center for Ergonomics, Transportation Research Institute, University of Michigan*, Ann Arbor, MI, May 5, 2008.
39. Improving Endoscopic Surgery Through Human Factors Engineering. *Tufts University Alumni Visit*. April 4, 2008.
40. Human Factors in Minimally Invasive Surgery. *ASME Boston Section Meeting*. Tufts University, March 25, 2008.
41. Research in Minimally Invasive Surgery. *Biomedical Engineering Seminar Series*. Tufts University, March 24, 2008.
42. Research Considerations in Simulation Training. *Establishing a Simulation and Skills Training Center: Comprehensive Educational Module*. Harvard Medical School CME Course. Boston, MA, March 14-16, 2008.
43. Human Factors Principles in Design. *Guest Lecture in ME 102 Inventive Design*, Mechanical Engineering, Tufts University, March 6, 2008.
44. Haptics in Minimally Invasive Surgery. Engineering Research Center for Computer-Integrated Surgical Systems and Technologies Seminar Series. Johns Hopkins University, Baltimore, ME, February 27, 2008.
45. HF Research in Minimally Invasive Surgery. *Ergonomics and Safety Research Group Seminar*. Harvard School of Public Health, Boston, MA, December 7, 2007.
46. Implementation: Bring New Technologies to Clinical Use. *Tufts University Research Days on Translational Research: Applying Discovery*. Tufts University, Boston, MA, November 29, 2007.
47. Surgical Ergonomics and Patient Care. *Mayo Clinic Conference on Human Factors in Health Care: Practical Applications to Improve Patient Safety*. Mayo Clinic CME Course. St. Paul, MN, October 17-19, 2007.
48. Human Factors Research using Surgical Simulation. Experimental-OP und Ergonomie, Universitätsklinikum Tubingen, Tubingen, Germany, July 5, 2007.
49. Human Factors and Surgical Education. Simulator Hands-On Course: Establishing a Skills Program. *Society of American Gastrointestinal and Endoscopic Surgeons Annual Meeting*, Las Vegas, April 18-22, 2007.
50. Enabling Technology for Endoscopic Surgery. *Alumni Campus Visit*. Tufts University, March 30, 2007.
51. Adapting to Technology in Endoscopic Surgery. *Tufts University School of Medicine and School of Engineering Alumni Event*, Palo Alto, Computer History Museum, February 6, 2007.
52. Surgical Simulation Training. *Tufts University School of Medicine and School of Engineering Alumni Event*, Palo Alto, Computer History Museum, February 6, 2007.
53. Visualisation in Endoscopic Environments. *Biomedical Informatics Seminar Series*. Vanderbilt University, November 9, 2005.
54. Human Factors Research in Endoscopic Surgery. *Patient Safety Seminar Series*. Vanderbilt University Medical Centre, October 25, 2005.
55. Input/ Output Devices. *Guest lecture in Computer Science Course CS 352: Human-Computer Interaction*. Vanderbilt University, October 11, 2005.

56. HF in Information Display Design. *Guest lecture in Mechanical Engineering*. Tufts University, March 31, 2005.
57. Addressing Human Factors Issues in Endoscopic Surgery. *Tufts University Biomedical Engineering Seminar Series*. Tufts University, October 22, 2004.
58. Integration of Enabling Technology into the OR, and Beyond. *Science Federation Forum on Human Factors and Patient Safety*. The National Academy of Sciences, Washington, DC, October 15, 2004.
59. Human Factors Engineering in Robotics Academy Project. *Tufts University Robotics Academy*. Tufts University, October 13, 2004.
60. Addressing Human Factors Issues in Endoscopic Surgery. *School of Engineering Seminar Series*. University of Miami, August 27 2004.
61. Human Factors Research in Surgery: Adapting to Technology. *Grand Rounds*, Department of Anaesthesiology, Jackson Memorial Hospital, University of Miami, May 20, 2004.
62. Human Factors Research in Endoscopic Surgery. *Dean's Safety Colloquium*, University of Miami, May 2004.
63. MR (Mixed-Reality) in the OR. *Guest lecture in Biomedical Engineering*. Tufts University, February 18, 2004.
64. Human Factors Research in Surgery. *Tufts University Dental School Colloquium*. September 9, 2003.
65. Human Factors Engineering: Coupling People and Technology. *Tufts University PCET Workshop*, July 16, 2003.
66. Tufts University Usability Laboratory. *All University Teaching and Research Conference*, Tufts University, Grafton Campus. April 25, 2003.
67. Navigation and Orientation in Endoscopic Environments. *MVL/HST/HFES Special Seminar*, Department of Aeronautics and Aerospace, MIT. December 5, 2002.
68. What Does a Human Factors Engineer Do? *Tufts University CSEMS Program Academic Speakers Series*. November 20, 2002.
69. Navigation and Orientation in Non-Rigid Environments. *Tufts University Department of Psychology Colloquium*. March 14, 2002.
70. Human Factors in Endoscopy. *Brock Rogers Surgical*, Norwood, MA, February 15, 2002.
71. Human Factors in the Operating Room. Tufts University, *Mechanical Engineering Seminar Series*. Medford, MA, November 28, 2001.
72. Orientation and navigation in endoscopy. *Colloquium on Human Factors in the Operating Room, the 43<sup>rd</sup> Annual Meeting of the Human Factors and Ergonomics Society*. Houston, Texas, September 27- October 2, 1999.
73. Spatial visualisation in minimal access environments. *Human Factors Interest Group Seminar Series*, University of Toronto, March 24, 2000.
74. Orientation and navigation in minimally invasive surgery. *Knowledge Media and Design Institute Seminar Series*, University of Toronto, December 2, 1999.

#### **Development of Educational Media & Textbook Chapter**

1. MacKenzie, C.L. & Cao, C.G.L. *Manipulation and remote manipulation in humans: Implications for sensorimotor organisation in the human brain*. Videotape (10 minutes) developed for International Symposium on Sensorimotor Representation in the Nervous System. In honour of Dr. Marcus Devanandan, Christian Medical College, Vellore, India, January 1997.
2. MacKenzie, C.L., Cao, C.G.L. & Ibbotson, J.L. *Remote manipulation in laparoscopic surgery and the Virtual Hand Laboratory*. Videotape (30 minutes) developed for Invited Dinner Address at the Industry Symposium on 3D Animation and 3D Interaction, Intel Corporation, Hillsboro, Oregon, December 1996.
3. Cao, C.G.L. & O'Leary, J. (2003). Prosthesis project. In *Science Explorer: Human Biology and Health Series D*. Prentice Hall, Needham, MA.

#### **TEACHING ACTIVITIES**

##### **Wright State University, 2012-present**

BME/IHE 7370 Medical Devices (course originator)

IHE/ISE 6300/4300 Fundamentals of Human Factors Engineering (also distance offering)

IHE 7300 Research Methods in Human Factors Engineering

**Tufts University, 2001-2011**

ENP 061 Introduction to Human Factors and Ergonomics

ENP 162 Human-Machine Systems Design

ENP 163 Analytical Methods in Human Factors Engineering (course originator)

ENP 120 Human Systems Design (Capstone course)

ME 152 Biomechanics (course originator)

ENP 210 Human Factors in Medical Systems (course originator)

**MENTORING ACTIVITIES**

Co-Chair, Advisory Council for the WSU STEMS Mentoring Circles, 2014-2016

Faculty Advisor, Engineers Without Borders, WSU Student Chapter, 2014-2016

Faculty Advisor, Wright State University Postdoc Association, 2012-present

**Supervisor of Post-doctoral Associates and Researchers (27 total):**

1. Jamaya Carter, BS (2016). STREAMS Scholar. Wright State University.
2. Thomas Simon, BS (2016). Visiting Scholar. Wright State University.
3. Fangshu He, BS (2016). Visiting Scholar. Wright State University.
4. Nicole Santos, BS (2016-2017). Research Coordinator. Cambridge Health Alliance Hospital.
5. Alyssa Lungarini, MS (2015). Research Coordinator. Cambridge Health Alliance Hospital.
6. Ali Linsk, MD (2014-2016). Research Fellow. Cambridge Health Alliance Hospital.
7. Jinling Wang, PhD (2013-2016). Post-doc Associate, Wright State University.
8. Jeff Flinn, MS (2012-2015). Research assistant, Wright State University.
9. Akole Mensah (2014-present). Biomedical Engineering undergrad student research assistant. Wright State University.
10. Katherine Babbitt, BS (2014-2016). Medical student research assistant. Wright State University.
11. Miller, Stephanie, BS (2014). Analysis of students' eye gaze during surgical skills training. NIH STREAMS Fellow. Wright State University.
12. Riyad Tayim, MS (2013-2014). Medical student research assistant. Wright State University.
13. Janine Dewar, MS (2014-2015). Research assistant, Cambridge Health Alliance Hospital.
14. Kelly Manser, BA (2013-2014). Research assistant, Cambridge Health Alliance Hospital.
15. Mary Runkle (2013-2014). Medical student research assistant. Wright State University.
16. Winnie Chen (2013-2014). Research Associate, Cambridge Health Alliance Hospital.
17. David Wood (2013-2014). Undergrad research assistant, Wright State University.
18. Natalie Pyatka, B.S. (2012-2015). Medical student research assistant, Wright State University.
19. Amie Miller, M.D. (2012-2014). Surgical Research Fellow, Wright State University.
20. Alexandra Geada (2013). Research Associate, Cambridge Health Alliance Hospital.
21. Helena Mentis, Ph.D. (2012-2013). Post-doc Associate, Cambridge Health Alliance Hospital.
22. Manuel Simoes, Ph.D. (2012-2013). Post-doc Associate, Wright State University.
23. Tzu-Ting Sun, B.S. (2012). Research assistant, Wright State University.
24. Jacob Brewer, B.S. (2012-2013). NIH GRAD-PREP Fellow, Wright State University.
25. Amine Chellali, Ph.D. (2011-2013). Post-doc Associate, Tufts University/Cambridge Health Alliance Hospital.
26. Likun Zhang, M.S. (2010-2011). Research Associate, Tufts University.
27. Hua Xing, Ph.D. (2007). Post-doc Associate, Tufts University.

**Supervisor of Graduate Students (37 total):**

***Ph.D. Students (No Ph.D. program in HFE at Tufts University):***

1. Maddah, M. (2018). 3D Visualization & interactive image manipulation for surgical planning in robot-assisted surgery. Ph.D. in Engineering (COTUTELLE), Wright State University & Ecole des Mines de Nantes, France. September 2018.
2. Zhou, Mi (2010). Haptics in laparoscopic remote manipulation. Ph.D. in Mechanical Engineering, Tufts University, May 2010.

***M.S. Thesis Students:***

3. Crosby, W. (in progress). MS thesis in Biomedical Engineering, Wright State University.
4. Topolski, C. (in progress). MS thesis in Human Factors Engineering, Wright State University.
5. Goswami, T. (in progress). MS thesis in Biomedical Engineering, Wright State University. Expected August 2019.
6. Rinehart, B. (2016). Design and evaluation of a fiber optic shape tracker for use as a navigational aid in endovascular guidewires and catheters. MS thesis in Biomedical Engineering, Wright State University. May 2016.
7. Hoskins, R. (2015). Use of vibrotactile feedback and stochastic resonance for improving laparoscopic surgery performance. MS thesis in Human Factors Engineering, Wright State University. May 2015.
8. Banez, J. (2012). Port-placement optimisation in robotic surgery. MS thesis in Human Factors Engineering, Tufts University, August 2012.
9. Cunningham, S. (2012). Team communication in robotic surgery. MS thesis in Human Factors Engineering, Tufts University, May 2012.
10. Roth, E. (2010). European Masters on Advanced Robotics (EMARO), Institut de Recherche en Communications et Cybernétique de Nantes, Nantes, France, August 2011.
11. Wong, C. (2010). Psychophysics test apparatus for haptics. European Masters on Advanced Robotics (EMARO), Institut de Recherche en Communications et Cybernétique de Nantes, Nantes, France, August 2010.
12. Takac, B. (2010). Haptic communication. European Masters on Advanced Robotics (EMARO), Institut de Recherche en Communications et Cybernétique de Nantes, Nantes, France, August 2010.
13. Zhang, Likun (2010). Visuomotor congruency in laparoscopic surgery. M.S. thesis in Human Factors, Tufts University, May 2010.
14. Eisenstein, Jessica (2010). Development and preliminary evaluation of a fibre optic bend sensor using CMOS imaging technique. M.S. thesis in Mechanical Engineering. Tufts University, May 2010.
15. Gavalis, Robb (2009). Multi-axis optical-fiber bend sensor for colonoscopy guidance. MS thesis in Mechanical Engineering, Tufts University, May 2009.
16. Bell, Audrey (2008). Evaluation of rotational frequency modulation for force feedback delivery in laparoscopic tissue differentiation tasks. M.S. thesis in Mechanical Engineering, Tufts University, November 2008.
17. Nodine, E. (2008). Detection of drowsy drivers through driver performance indicators. M.S. thesis in Human Factors, Tufts University, August 2008.
18. Dill, Meredith (2007). Treatment of optical fibres for curvature measurements. M.S. thesis in Human Factors, Tufts University.
19. Slutsky, Fran (2007). Confusion in auditory alarms in everyday products. M.S. thesis in Human Factors, Tufts University.
20. Schoonmaker, Ryan (2006). Vibrotactile stimulation and force feedback in laparoscopic surgery. M.S. thesis in Mechanical Engineering, Tufts University, May 2006.
21. Shimotsu, Ryan (2006). Enhancing depth perception with coloured shadows. M.S. thesis in Biomedical Engineering, Tufts University, May 2006.
22. Goble, Jess (2005). Design of logging tool for behaviour modification. M.S. thesis in Human Factors, Tufts University, December 2005.
23. Huang, Brian (2005). Enhancing the layout of graphically presented browsing history with implicit spatial and temporal knowledge. M.S. thesis in Human Factors, Tufts University, February 2005.
24. Fletcher, Martha (2004). Assessment of cognitive loading attributed to encapsulation by headgear. M.S. thesis in Human Factors, Tufts University, August 2004.
25. Perreault, Jesse (2004). Effects of friction on haptic perception in simulated endoscopic environments. M.S. thesis in Human Factors, Tufts University, August 2004.
26. Webster, Jessica (2004). Introducing a robotic surgical system in the operation room: effects on communication flow and attentional resources. M.S. thesis in Human Factors, Tufts University, August 2004.
27. Scherpa, Josef (2003). The effects of texture and 3D graphic representations on human performance using touchscreen interfaces. M.S. thesis in Human Factors, Tufts University, August 2003.

28. Fabian, Steve (2002). Evaluation of Three Model Predictions of Alertness. M.S. thesis in Human Factors, Tufts University, May 2002.
29. Rivera, Cristina (ABD). Task analysis of NOTES (natural orifice transluminal endoscopic surgery). M.S. thesis in Human Factors, Tufts University.
30. Hall, Jason (ABD). Analysis of fixations in team decision making in the OR. M.S. thesis in Human Factors, Tufts University.
31. O'Connor, Ashling (ABD). Knowledge of results in surgical skills acquisition. M.S. thesis in Human Factors, Tufts University.
32. Waxberg, Sara (ABD). Modelling training and success of surgical residents at Tufts-New England Medical Centre. M.S. thesis in Human Factors, Tufts University.
33. Friedberg, Leah (ABD). Postural stress in surgeons. M.S. thesis in Human Factors, Tufts University.

**M.S. (Non-Thesis) Students (6 total):**

32. Mensah, A. (2018). Master's in Biomedical Engineering, Wright State University.
33. Pinon, N. (2017). ME Industrial & Human Factors Engineering, Wright State University.
34. Hamdan, M. (2017). ME in Biomedical Engineering, Wright State University.
35. Diller, E. (2016). ME in Biomedical Engineering, Wright State University.
36. Spindler, D. (2015). ME in Industrial & Human Factors Engineering. Wright State University.
37. Lou, Y. (2014). ME in Industrial & Human Factors Engineering, Wright State University.

**Supervisor of Undergrad Theses (6 total):**

1. Topolski, Chloe (2019). Trust in Robotic Surgery. BS honours in Biomedical Engineering, Wright State University.
2. Greenwald, Daniel (2008). Haptics in MIS during levering actions. B.A. honours in Psychology, Tufts University, May 2008.
3. Hamada, Kristi (2004). *Human factors and children: Designing an interface for an interactive kinetic sculpture*. B.S. honours thesis in Human Factors, Tufts University, May 2004.
4. Waxberg, Sara (2004). *The effects of video game experience on laparoscopic skill acquisition*. B.S. honours thesis in Human Factors, Tufts University, May 2004.
5. Basford, Eric (2003). *The application and interface of the tube-crawling robot: A human factors approach*. B.S. honours thesis in Human Factors, Tufts University, May 2003.
6. Cades, David (2003). *Target detection in robotic colonoscopy*. B.A. honours thesis in Human Factors, Tufts University, May 2003.

**Committee Member of Undergraduate Theses (10 total):**

1. Wong, Daniel (2009). Modal specific context varies discourse self-relevance and narrative simulations. B.A. in Psychology, Tufts University, May 2009.
2. Pergakis, Melissa (2007). Spatial reference frames in spatial memory. B.A. in Psychology, Tufts University, May 2007.
3. Zigelbaum, Jamie (2006). B.S. in Human-Computer Interaction. Tufts University, May 2006.
4. Parent, Daniel P. (2003). *The forensic crashworthiness analysis of the Placentia, CA rail collision*. B.S. honours thesis in Mechanical Engineering, Tufts University, May 2003.
5. DeLuca, Diana (2003). *Robotics and education: teaching with technology*. B.A. honours thesis in Child Development and Education, Tufts University, May 2003.
6. Hacker, Laura (2003). *Robotics in education: ROBOLAB and robotic technology as tools for learning science and engineering*. B.A. honours thesis in Child Development and Education, Tufts University, May 2003.
7. Nodine, Emily (2003). *Kinematic design and analysis of a laparoscopic surgical assist device*. B.S. in Mechanical Engineering, WPI, December 2003.
8. Cohen, Jonathan (2004). B.A. honours thesis in Psychology, Tufts University, May 2004.
9. Sutphen, Adeline (2004). *A multidisciplinary team approach to the design and development of an autonomous mobile robot team*. B.S. honours thesis in Mechanical Engineering, Tufts University, May 2004.
10. Tang, Sandra (2004). *RoboHunt: A study of instructional strategies and the gender differences that arise in a robotics workshop*. B.A. honours thesis in Child Development and Education, Tufts University, May 2004.

**Committee Member of Graduate Theses (17 total):**

1. Davies, Christopher (in progress). MS in Biomedical Engineering, Wright State University.
2. Hamandi, Farah (in progress). PhD in Engineering, Wright State University.
3. Epps, Justin (in progress). PhD in Neuroscience, Wright State University.
4. Langri, Dharminder Singh (in progress). *Monitoring functional response in brain using high density diffuse optical imaging*. MS in Biomedical Engineering, Wright State University.
5. Clouse, Cassandra (in progress). *Immersive rehearsal in a simulated environment (IRISE)*. Ph.D. in Engineering, Wright State University.
6. Salih, Anmar (2019). Characterization of in-vivo damage in implantable cardiac devices and the lead residual properties. MS in Biomedical Engineering, Wright State University.
7. Whatley, Stephen (2019). Computational simulation of a femoral nail. MS in Biomedical Engineering, Wright State University.
8. Montgomery, Andrew (2018). *Novel auto-calibrating neural motor decoder for robust prosthetic control*. MS in Biomedical Engineering, Wright State University.
9. Gundapaneni, Dinesh (2017). *Computational simulations of biomechanical kinematics in WSU Total Ankle Replacement Systems*. Ph.D. in Engineering, Wright State University.
10. Wang, Shuai (2017). *Models and methodology for optimal financial aid allocation for a state university*. Ph.D. in Engineering, Wright State University.
11. Zhao, C. (2015). *AE-SIFT: An autoencoder-based image descriptor for image matching and retrieval*. PhD in Computer Science and Engineering, Wright State University, December 2015.
12. Brunye, Tad (2004). *Multimedia presentations as effective tools for learning procedural assembly sequences*. M.A. in Psychology, Tufts University, May 2004.
13. Spataro, Joseph E. (2004). *Evaluation of surgical blade cutting forces*. M.S. in Mechanical Engineering, Tufts University, August 2004.
14. Gemmill, Benjamin (2005). *Design and construction of a physically controlled, online, persistent 3D world*. M.S. in Mechanical Engineering, Tufts University, August 2005.
15. Mason, Paul (2005). *The development of Robotable: A hands-on tabletop environment to support engineering education*. M.Sc. in Human Factors, Tufts University, August 2005.
16. Bilge, Reyhan (2005). *Learning nested environments from maps: Is spatial updating simultaneous?* M.A. in Psychology, Tufts University, March 2005.
17. Afram, Andrew (2005). *Evaluation of semantic fisheye zooming for navigating concept maps*. M.S. in Human Factors, Tufts University, April 2005.

**Supervisor of Special Projects (45 total):**

1. Hoang et al. (2019). Intracranial pressure waveform generator for traumatic brain injury simulation. Senior Design Project, Biomedical Engineering, Wright State University.
2. Guay et al. (2017). Design of eyeblink conditioning apparatus. Senior Design Project, Biomedical Engineering, Wright State University.
3. Pinion, N. (2016). Effect of haptics on trust in human-machine interaction. Human Factors Engineering Undergraduate Research, Wright State University.
4. Mohler et al. (2015). Design and testing of sensorised endovascular guidewires. Senior Design Project, Biomedical Engineering, Wright State University.
5. Campbell et al. (2014). Force measurement in flexible endoscopy. Senior Design Project, Biomedical Engineering, Wright State University.
6. Millar et al. (2014). ICG imaging. Senior Design Project, Biomedical Engineering, Wright State University.
7. Allen, J., Diller, E., Merrell, T., Reinhart, B. (2013). Instrumented glove for force measurements in medical device manipulation. Senior Design Project, Biomedical Engineering, Wright State University.
8. Luu, D. (2013). Haptic sensation replication in contralateral limbs. Australian e-Health Research Centre, The Commonwealth Scientific and Industrial Research Organisation (CSIRO).
9. Jarusiewicz, S., Iman (2012-2013). Water filtration system for third world countries. Senior Design Project, Biomedical Engineering, Wright State University.
10. Davis, E., Grosdemouge, C., Linsalata, R., Morowsky, K., Noble, J., San, C., Seng, A., Ventalon, L. (2012). International Project on Telemedicine Design and Control. Joint international project between Tufts University and Ecole des Mines de Nantes (Projet en Contexte Internationale).

11. Banez, J., Cunningham, S., Kwinn, C., Napal, V., Pham-Le, C., Six, A., Taylor-Brown, P. (2011). An innovative and collaborative approach to learning telesurgery concepts. Joint international project between Tufts University and Ecole des Mines de Nantes (Projet en Contexte Internationale).
12. Grosdemouge, C. (2010). Measuring human haptic perception thresholds. Summer Intern, Institut de Recherche en Communications et Cybernétique de Nantes (UMR CNRS 6597), Nantes, France.
13. Luu, D. (2010). Design and development of robotic arm prototype for needle insertion. Summer Intern, Ecole des Mines de Nantes, France.
14. Eyzat, L. & Ngabe, G. (2009). Fibre optics guidance automation. French International Visiting Scholars.
15. Chan, L. (2009). Endoscopic shape tracking. NSF-REU Fellow.
16. Miller, A. (2009). Dynamic laparoscopic skills simulator. NSF-REU Fellow.
17. Potts, J. (2008). Evaluation of elbow external fixators. NIH BREEM Fellow.
18. Bader, D. (2008). Design of cylindrical fixture for optical fibre bending. NIH BREEM Fellow.
19. Greenwald, D. (2008). Haptic perception in minimally invasive surgical tasks: An investigation of tumour detection. BA Honours Thesis in Psychology, Tufts University.
20. Taylor, D., Lui, J., Chen, J., Knowles, M., LeBlanc, S. (2008). Design of 3D virtual haptic system for surgical training. COMP 190 senior project in Computer Science, Tufts University.
21. Johnston, L. & Lokhande, K. (2007). Information display in the OR. NSF-CUSP Fellows.
22. Zamarripa, N. (2007). Design of micro fixture for fibre preparation. NSF-REU Fellow.
23. Mandelupe, E. (2007). Design of next generation haptic devices for MIS. NIH BREEM/NSF-REU Fellow.
24. Maxwell, Kyle (2007). Deformable surfaces in VR environments for MIS training. NSF-REU Fellow.
25. Dennis, D. (2006). Generating haptic events using the Phantom. NSF-CUSP Fellow.
26. Eaton, C. (2006). Investigation of haptics in a virtual endoscopic environment. NSF-CUSP Fellow.
27. Bell, A. (2006). Effect of magnified haptics on control of force application in MIS. NSF-REU Fellow.
28. Johanas, J. (2006). Effect of haptics on depth perception in MIS. NSF-REU Fellow.
29. Meng, J. & Wu, D. (2005). ARMISTS: Augmented reality in MIS training system. Special Project, CS352 Human-Computer Interaction, Computer Science, Vanderbilt University.
30. Bell, A., Johanas, J., Saide, M. (2005). Dynamic surgery simulator. Senior Design Project, Mechanical Engineering, Tufts University.
31. Abbott, Rebecca (2005). Automation of FLS scoring for mesh-cutting task. B.Sc. in Mechanical Engineering, Tufts University.
32. Nguen, Tuan (2005). Haptic perception in laparoscopic surgery for residents. First year medical student. Tufts Medical School.
33. Laurel Vuong (2005). Performance metrics in surgical skills learning. First year medical student. Tufts Medical School.
34. Kalafarski, Edward (2005). Design of dynamic task in surgical simulation. B.Sc. in Computer Science, Tufts University.
35. Butler, Kristen (2005). Robotics Academy: Genetic Line Sorting Optimisation. Senior Project. B.Sc. in Human Factors Engineering, Tufts University.
36. Gaulin, Mathieu (2005). Design of Learning Aids for Novice Surgeons in MIS. Special Project. B.Sc. in Psychology, Tufts University.
37. Khawati, Nadia (2004). Analogue vs. Digital Force Displays. NSF-REU Fellow.
38. Emily Finn, Chris Papazian, Ed Schwehm, Tion Thomas, Bryan Warner. Flexible Virtual Environment. COMP 190 Senior Design Project, Computer Science, Tufts University.
39. Kogan, Anna (2004). Visuomotor coordination in endoscopic surgery. B.Sc. in Mechanical Engineering, Tufts University.
40. Waxberg, Sara & Park, Brian (2003). Surgical training using real and virtual models. NSF-REU fellows.
41. Nodine, Emily (2003). Design of endoscopic camera holder. Senior Design Project, Mechanical Engineering, WPI.
42. Iny, Mandy & Waxberg, Sara (2003). Task analysis of robotic surgery. B.Sc. in Human Factors Engineering, Tufts University.

43. Ono, Mamiko & Chan, Melissa (2003). Navigational aid display. B.Sc. in Human Factors Engineering, Tufts University.
44. Fisher, Jennifer & Marshall, Kate (2002). Verbal protocol analysis. B.Sc. in Human Factors Engineering, Tufts University.
45. Dombach, M., Schrauth, A.J., Parent, D., Adrian, J., Wilson, A. (2003). Design of robotic colonoscope. Robotics Academy, Mechanical Engineering, and Electrical Engineering and Computer Science, Tufts University.

**External Examiner of Habilitation and PhD Dissertations (4 total):**

1. Giannopulu, Irimi (2011). Contribution a la comprehension des representations multimodales chez l'homme sain et chez les patients avec atteinte neuropsychologique: une perspective "life span". L'Habilitation a Diriger des Recherches (HDR), Universite Pierre & Marie Curie – Paris 6, January 2011.
2. Chellali, Amine (2009). Etude des interactions homme-homme pour l'elaboration du referential commun dans les environnements virtuels collaboratifs. Ph.D. in Informatique et applications (automatique et informatique appliques), Universite de Nantes, UFR Sciences et Techniques, December 2009.
3. Poor, Michael (2008). The effects of varying levels of reality based interaction styles on a subjects ability to perform a 3D construction task. Ph.D. in Computer Science, Tufts University, 2008.
4. Christou, Georgios (2007). A knowledge-based framework for the description and evaluation of reality-based interaction. Ph.D. in Computer Science, Tufts University, 2007.

**Honors Achieved by Students**

1. SPIE Optics and Photonics Education Scholarship, July 2015.
2. Outstanding Graduate Student Award, WSU College of Engineering and Computer Science, May 2015.
3. First Prize Research Division, DAGMEC Research Symposium, Dayton, OH, 2013.
4. Graduate Student Research Award, Tufts University Graduate School of Arts & Sciences, 2011.
5. Best Presentation Award, New England Chapter Human Factors and Ergonomics Society, 2011.
6. Health Care Technical Group Best Student Paper Prize, Human Factors and Ergonomics Society (HFES) Annual Conference, 2009.
7. Outstanding Graduate Researcher, Department of Mechanical Engineering, Tufts University, 2009.
8. Best Poster Award, Society of American Gastrointestinal Endoscopic Surgeons (SAGES), 2009.
9. Best Poster Award, 2<sup>nd</sup> Place, Biomedical Devices Division, ASME, 2008.
10. Poster with Distinction Award, Society of American Gastrointestinal Endoscopic Surgeons (SAGES), 2007.
11. Health Care Technical Group Best Student Paper Prize, Human Factors and Ergonomics Society (HFES) Annual Conference, 2006.
12. Third Place Best Paper Prize, Surgical Resident Research Day at T-New England Medical Centre, 2006.
13. Poster with Distinction Award, Society of American Gastrointestinal Endoscopic Surgeons (SAGES), 2006.
14. Best Presentation Award, New England Chapter of Human Factors and Ergonomics Society, 2005.
15. Best Presentation Award, New England Chapter of Human Factors and Ergonomics Society, 2005.
16. Best Teaching Assistant Award, Department of Mechanical Engineering, Tufts University, 2005.
17. Graduate Student Research Award, Tufts University Graduate School of Arts & Sciences, January 2003.
18. Graduate Student Research Award, Tufts University Graduate School of Arts & Sciences, January 2003.
19. Best Research Assistant Award, Department of Mechanical Engineering, Tufts University, 2002.