IEEE
Advancing Technology
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2016
IEEE International Symposium
on
Ethics in Engineering, Science and Technology

Conference Program

May 13-14, 2016

Vancouver, BC
Canada

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1. Welcome

Since antiquity, the difficulty of fulfilling multiple and sometimes conflicting moral obligations to different parties has been well recognized. By the 19th century, the emergence of engineering as a distinct profession was accompanied by a need to clarify the relationship between the self-interest that practitioners of engineering have in advancing their careers and business interests, and their moral obligations to society, to their employers and/or clients, and to their profession. As global, social, environmental and business pressures have evolved over the past 150 years, ethical dilemmas have intensified. It has become necessary for all of us to reflect carefully as we traverse an evolving and increasingly challenging ethical landscape.

IEEE Ethics 2016 will provide an exciting opportunity for researchers, regulators, educators and practitioners alike to debate, discuss and deliberate concerning modern engineering ethics and ethical standards, and their impact on our lives, careers, profession and society. Keynotes and panels, posters and presentations, tutorials and workshops, and breaks and a reception will enable exchange of experience and perspectives on many levels.

With major patron support from The Boeing Company, the Association of Professional Engineers and Geoscientists of British Columbia (APEGBC), TELUS Communications Company and the generous support of our many co-sponsors, we have prepared a vibrant and rich experience for symposium participants.

We look forward to welcoming you to Vancouver in May 2016!

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Executive Chair and ETHICS Symposium International Steering Committee Chair

Philip Hall (University of Melbourne)
Ljiljana Trajkovic (Simon Fraser University)
General Co-Chairs

Bob Gill (British Columbia Institute of Technology)
Subrata Saha (SUNY Downstate Medical Center)
Daniel Steel (University of British Columbia)
Program Co-Chairs

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- *ACM Committee on Professional Ethics*

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4. Program Overview

DAY 1: Friday, May 13		
TIME	**SESSION**	**ROOM**
0730-0845	**Continental Breakfast**	**Pinnacle II**
0800-0845	**Registrations Open**	**Shaughnessy Foyer**
0845-0900	**Welcome & Opening Remarks** **CHARLES RUBENSTEIN** (Conference Executive Chair) **MICHAEL WRINCH** (President, APEGBC)	Shaughnessy Salon (I & II)
0900-0930	**Opening Keynote: ROB HUNTER** (Bull Housser) *Ethical Issues your Mother did not address* Session Chair: Bob Gill (British Columbia Institute of Technology)	Shaughnessy Salon (I & II)
0930-1030	**Session A1: Panel 1:** **41:** *Frenemies: Navigating the collaborative DMZ between competitors* – hosted by **PETER HOFFMAN** (Boeing) Session Chair: Luke Maki (Boeing)	Shaughnessy Salon (I &II)
1030-1100	**Break**	**Shaughnessy Foyer**
1100-1300	**Special Session: Maslov's ETHICS Game** *Using e-Factor to Role-play the Ethical Decision Process* – **MARCY MASLOV** (Chief Integrity Builder, Executive Coach and creator of e-Factor!®) Session Chair: Charles Rubenstein (Pratt Institute)	Shaughnessy Salon (I & II)
1300-1400	**Lunch**	**Pinnacle II**
1400-1530	**Session A2: Panel 2:** **40:** *Ethical Considerations in the Design of Artificial Intelligence* – hosted and moderated by John Havens (IEEE Standards Association) Session Chair: Ljiljana Trajkovic (Simon Fraser University)	Shaughnessy I

DAY 1: Friday, May 13		
TIME	**SESSION**	**ROOM**
1400-1530	**Session A3: Panel 3:** **33:** *Integrative Approaches to Cultivating Ethical STEM* – lead by Matthew Brown (University of Texas Dallas) Session Chair: Dan Steel (University of British Columbia)	Shaughnessy II
	Session A4: APEGBC Workshop *Ethics in Engineering under a Professional Self-Regulatory Model* - hosted and facilitated by Peter Mitchell & Efrem Swartz (APEGBC) Session Chair: Bob Gill (British Columbia Institute of Technology)	Caulfeild
1530-1600	**Break**	**Foyer**
1600-1700	**Session B1: Panel 4:** **24:** *Discrimination and Technology* – lead by Anna Hoffmann (University of California Berkeley) Session Chair: Luke Maki (Boeing)	Shaughnessy I
	Session B2: Paper Set 1 *Regulation and Big Data* Session Chair: Ljiljana Trajkovic (Simon Fraser University) **56:** Ethics in Big Data and Analytics: A Reassessment of the Intellectual Silo and Integrative Design in Academia – Cheryl Brown (University of North Carolina Charlotte) **8:** When Public Data Shouldn't Be Public: A Case Study on the Ethics of using Twitter Data in Big Data Research – Victoria Lemieux (University of British Columbia) and Bertand Rossert (World Bank) **55:** Linguistic Limitations: The Ethical Imperative of Regulation in Interpretation – Antonio Bardawil (New York University) and Tabitha Moses (Lehman College)	Shaughnessy II
1600-1730	**Session B3: APEGBC Workshop** Note: This a repeat of Session A4 Session Chair: Bob Gill (British Columbia Institute of Technology)	Caulfeild

DAY 1: Friday, May 13		
TIME	**SESSION**	**ROOM**
1730-1830	**Networking / Free Time**	
1830-1900	**Pre-Dinner Cocktail Reception**	Ambleside I
1900-2100	**Conference Dinner** **Dinner Keynote: SUBRATA SAHA** (SUNY Downstate Medical Center) *Ethical Challenges in Biomedical Engineering Research and Practice* MC: Philip Hall (University of Melbourne)	Ambleside I

DAY 2: Saturday, May 14		
TIME	**SESSION**	**ROOM**
0715-0830	**Continental Breakfast**	**Pinnacle II**
0830-0930	**Session C1: Paper Set 2** *Ethics Innovation and Design* Session Chair: Philip Chmielewski (Loyola Marymount University) **23:** Principles of Anti-Discriminatory Design – Dylan Wittkower (Old Dominion University) **46:** Anticipatory Ethics, Innovation, and Artefacts – Richard Wilson (University of Maryland Baltimore County) **22:** Ethics and Innovation: How to prepare Engineering Students to be Ethical Entrepreneur – Javad Shakib (DeVry University)	Shaughnessy I

DAY 2: Saturday, May 14		
TIME	**SESSION**	**ROOM**
0830-1000	**Session C2: Paper Set 3** ***Ethics and Risk*** Session Chair: Philip Hall (University of Melbourne) **26:** Emerging Technologies, Catastrophic Risk, and Ethics: Three Strategies for Reducing Risk – Brian Green (Santa Clara University) **30:** Naming and shaming as a strategy for combatting climate change: the challenges and opportunities – Azar Safari (Maastricht University) and Behnam Taebi (TU Delft) **38:** Risk and Evaluative Uncertainty – Espen Stabell (Norwegian University of Science and Technology) **57:** Social responsibility in the"world risk society – Reflections on the "R" in RRI and CSR – Siri Carson (University of California Berkeley)	Shaughnessy II
0830-1030	**Session C3: ACM Workshop** **31:** *Improve Professional Practice by Encouraging a Moral Engineering Culture* – hosted and facilitated by Don Gotterbarn & Bo Brinkman (ACM Committee on Professional Ethics) Session Chair: Pieter Botman (IEEE Vancouver Section)	Caulfeild
0930-1030	**Session D1: Paper Set 4** *Ethics and the Internet* Session Chair: Steven McClain (IEEE Vancouver Section) **5:** Values in a Shifting Stack: Exploring How Application Developers Evaluate Values and Ethics of a New Internet Protocol – Katie Shilton and Nicholas Proferes (both University of Maryland) **37:** Ethical Considerations of the Societal Impact of the Internet of Things – Bernard Cohen (Neurological Monitoring Associates LCC)	Shaughnessy I

DAY 2: Saturday, May 14		
TIME	**SESSION**	**ROOM**
0930-1030	**Session D1: Paper Set 4 (continued)** *Ethics and the Internet* **18:** Reliability and acceptability of an online decision support system for the self-selection of assistive technologies by older Canadians: A research protocol – Vanessa Chenel and Claudine Auger (both Universite de Montreal), Manon Guay (University of Sherbrooke), Jeffrey Jutai (University of Ottawa), Ben Mortenson (University of British Columbia), and Peter Gore and Garth Johnson (both ADL Smart Care Limited)	Shaughnessy I
1000-1030	**Session D2: Paper Set 5** *Scientific Integrity in Computational Research* Session Chair: Philip Hall (University of Melbourne) **60:** A Principled Approach to Reproducible Research: A Comparative Review Towards Scientific Integrity in Computational Research – Rajesh Sinha (Tata Consultancy Services Limited) and Prem Sewak Sudhish (Dayalbagh Educational Institute)	Shaughnessy II
1030-1100	**Break**	**Foyer**
1100-1230	**Session E1: Panel 5:** **17:** *The Ethical Challenges of Invisible Software* – lead by Shannon Vallor (Santa Clara University) Session Chair: Wade Robison (Rochester Institute of Technology)	Shaughnessy I
	Session E2: Paper Set 6 *Ethics of Smart Machines* Session Chair: Philip Chmielewski (Loyola Marymount University) **34:** On the Moral, Legal, and Social Implications of the Rearing and Development of Nascent Machine Intelligences – Damien Williams (Kennesaw State University)	Shaughnessy II

DAY 2: Saturday, May 14		
TIME	**SESSION**	**ROOM**
1100-1230	**Session E2: Paper Set 6 (continued)** *Ethics of Smart Machines* **42:** Digitization of Manufacturing and its Societal Challenges. A Framework for Future Industrial Labor – Johannes Dregger, Jonathan Niehaus, Peter Ittermann, Hartmut Hirsch-Kreinsen and Michael ten Hompel (all TU Dortmund University) **39:** Can (and Should) Hello Barbie Keep a Secret? – Meg Jones and Kevin Meuer (both Georgetown University) **49:** UAV's: The Impact on Civilian Populations - Richard Wilson (University of Maryland Baltimore County)	Shaughnessy II
	Session E3: Paper Set 7 *Ethics and Technology Management* Session Chair: Darrell Koskinen (TELUS Communications) **47:** Non-Lethal Weapons and Innovation: An Anticipatory Ethical Analysis – Richard Wilson (University of Maryland Baltimore County) **25:** Rationale and Informed Consent for Brain Computer Interface Research with Human Subjects – Laura Specker Sullivan (University of Washington and University of British Columbia), and Judy Illes (University of British Columbia National Core for Neuroethics) **28:** Ethics and the assessment of large energy projects – Behnam Taebi (TU Delft and Harvard University), and Aad Correlje, Eefje Cuppen, Elizabeth van de Grift and Udo Pesch (all TU Delft) **59:** An ethical management of technologies? The usefulness of ethical matrixes – Celine Kermisch (Universite Libre de Bruxelles)	Caulfeild
1230-1330	**Lunch**	**Pinnacle II**

DAY 2: Saturday, May 14		
TIME	**SESSION**	**ROOM**
1330-1500	**Session F1: Paper Set 8** *Enhancements Technologies and Neuroprosthetics* Session Chair: Subrata Saha (SUNY Downstate Medical Center) **3:** Designer Genes, Perfection, and Moral Responsibility – Eugene Schlossberger (Purdue University Calumet) **52:** Personal Responsibility in the Age of User-Controlled Neuroprosthetics – Timothy Brown, Patrick Moore, Jeffrey Herron, Margaret Thompson, Tamara Bonaci, Howard Chizeck and Sara Goering (all University of Washington) **54:** Ethical Concerns with Emerging Technologies: The Dangers of Fixing What Is Not Broken – Tabitha Moses (Lehman College) **50:** Transcending Mendelian Genetics: What are the Ethical Implications for the Use of CRISPR Together with Gene Drive in Humans? - Michael Nestor (The Hussman Institute for Autism Baltimore Maryland) and Richard Wilson (University of Maryland Baltimore County)	Shaughnessy I
	Session F2: Paper Set 9 *Ethics of Autonomous Machines* Session Chair: Philip Hall (University of Melbourne) **36:** Algorithm anxiety - Do decision-making algorithms pose a threat to autonomy? – Saskia K. Nagel (Universitiet Twente), and Viorica Hrincu and Peter B. Reiner (both University of British Columbia, National Core for Neuroethics) **1:** "Robot Warriors Autonomously Employing Lethal Weapons": Can They Be Morally Justified? – Zhaoming Gao (Nanjing Normal University) and Meizhen Dong (Nanjing Normal University)	Shaughnessy II

DAY 2: Saturday, May 14		
TIME	**SESSION**	**ROOM**
1330-1500	**Session F2: Paper Set 9 (continued)** *Ethics of Autonomous Machines* **7:** Prescriptive and Proscriptive Moral Regulation for Autonomous Vehicles in Approach and Avoidance – Selina Pan, Sarah Thornton and J. Christian Gerdes (all Stanford University)	Shaughnessy II
	Session F3: Paper Set 10 *Ethics in Markets, Corporations, and Workplaces* Session Chair: Steven McClain (IEEE Vancouver Section) **43:** Exchange-rate Market, Deep Learning, and Agent Modelling – Svitlana Galeshchuk (Ternopil National Economic University) and Yves Demazeau (CRNS – LIG) **45:** Balancing Legal and Moral Aspects in Large-Scale Agent-Based Systems – Yves Demazeau (CRNS – LIG) **11:** Ethics and Compliance in Corporations – S Chandran and Anthony Lobo (both Tata Consultancy Services) **29:** The Perceived Job Ethics in two Cultures: Contrasting Experiences of Laureates Shuji Nakamura and You You Tu – Ted Fu (National Cheng-Chi University)	Caulfeild
1500-1600	**Session G1: Panel 6** **48:** *Innovation in Military Medical Ethics and in Military Health Policy* – lead by Richard Wilson (University of Maryland Baltimore County) Session Chair: Subrata Saha (SUNY Downstate Medical Center)	Shaughnessy I

DAY 2: Saturday, May 14		
TIME	**SESSION**	**ROOM**
1500-1600	**Session G2: Paper Set 11** *Teaching Engineering Ethics: Methods and Approaches* Session Chair: Wade Robison (Rochester Institute of Technology) **14:** From Nanosystems to Ethical Eco-systems: Designing a Workshop for Graduate Researchers on Self-Powered Wearable Health Devices – Xiaofeng Tang, Sarah Clark Miller and Thomas Litzinger (all Pennsylvania State University) **51:** Technology and Designing Flourishing Societies: Teaching Technology Ethics Using the Capabilities Approach – David Mcgraw (James Madison University) **15:** Integrating ethics into engineering education without teaching ethics – Wade Robison (Rochester Institute of Technology), Deborah Mower and Mark Vopat (both Youngstown State University), and Adam Potthast (Park University)	Shaughnessy II
1600-1615	**Break**	**Foyer**
1615-1645	**Closing Keynote: PHILIP CHMIELEWSKI** (Loyola Marymount University) *Techno-ethics: Upon Shifting Selves and Translocal Networks Constructing the Metropolis* Session Chair: Philip Hall (University of Melbourne)	Shaughnessy Salon (I & II)
1645-1700	**Closing Remarks:** Charles Rubenstein (Executive Chair)	Shaughnessy Salon (I & II)

5. Keynote Speakers

Opening Keynote – Mr. Rob Hunter (Bull Housser)

Ethical Issues your Mother did not address

Rob Hunter is Counsel, Dispute Resolution + Litigation at Bull Housser. Rob joined Bull Housser in 1980 after serving as Crown Counsel in British Columbia's Ministry of Attorney General. He focuses on resolving insurance, construction, engineering, architectural, environmental and professional regulatory disputes with an emphasis on the representation of design professionals in liability claims and contractual disputes. He also acts on behalf of professional regulatory bodies.

Dinner Keynote – Dr. Subrata Saha (SUNY Downstate Medical Center)

Ethical Challenges in Biomedical Engineering Research and Practice

Dr. Subrata Saha is presently the Director of Musculoskeletal Research and Research Professor in the Department of Orthopaedic Surgery & Rehabilitation Medicine at SUNY Downstate Medical Center in Brooklyn, New York. He is also: 1) the Director of the Biomedical Engineering Program in the School of Graduate Studies; 2) Research Professor in the Department of Physiology and Pharmacology, and 3) Research Professor in the School of Public Health at SUNY Downstate Medical Center. He received his PhD degree in Applied Mechanics from Stanford University, and has been a faculty member at Yale University, Louisiana State University Medical Center, Loma Linda University, Clemson University, and Alfred University.

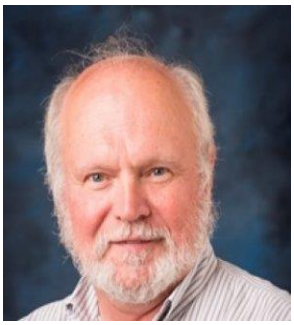
He has also received many awards from professional societies, including Orthopedic Implant Award, Dr. C. P. Sharma Award, Researcher of the Year Award, C. William Hall Research Award in Biomedical Engineering, Award for Faculty Excellence, Research Career Development Award from NIH, Engineering Achievement Award and Distinguished Alumnus Award from Indian Institute of Engineering, Science and Technology (IIEST). He is a Fellow of The Biomedical Engineering Society (BMES), The American Society of Mechanical Engineers (ASME), The American Institute for Medical and Biological Engineering (AIMBE) and The New York Academy of Medicine (NYAM).

He is presently the Chair of the Bioethics Committee of the International Federation of Medical and Biological Engineering (IFMBE), Ethics Committee of the Biomedical

Engineering Society, and the Development Committee of Sigma Xi, and Co-Chair of the International Committee of AIMBE. He is the immediate past chair of the Ethics Committee of the American Association of Dental Research (AADR). He is also a member of the IEEE SSIT Board of Governors and the Ethics Committee of the International Association of Dental Research (IADR). He is the founder of the Southern Biomedical Engineering Conference Series and also started the International Conference on Ethical Issues in Biomedical Engineering. He is the Editor-in Chief of: 1) Journal of Long-Term Effects of Medical Implants and 2) Ethics in Biology, Engineering and Medicine: An International Journal.

Closing Keynote – Dr. Philip Chmielewski (Loyola Marymount University)

Techno-ethics: Upon Shifting Selves and Translocal Networks Constructing the Metropolis



Dr. Philip Chmielewski is Professor and Sir Thomas More Chair of Engineering Ethics in the Seaver College of Science and Engineering, Loyola Marymount University in Los Angeles, California. He was granted his Ph.D. in Social Ethics at Yale University. As the Sir Thomas More Chair of Engineering Ethics he offers courses in the ethics of design and production, research ethics, and the ethical assessment of contemporary technologies. His current research focuses on developing elements of a framework for international engineering ethics. He is a member of the Institute of Electrical and Electronic Engineers (IEEE) and of the Association of Asian Studies (AAS). Further, he is an Affiliate Member of the Hong Kong Institution of Engineers (HKIE). He frequently lectures and pursues research in mainland China and Hong Kong.

6. Special Session – Maslov's ETHICS GAME

Using e-Factor to Role-play the Ethical Decision Process

A special session facilitated by **Marcy J. Maslov** (Chief Integrity Builder, Executive Coach and creator of e-Factor!®, an interactive board game).

After watching companies and clients struggle with ethical dilemmas, Marcy Maslov invented a business ethics board game to provide a practice arena for solving real-life ethical dilemmas. Marcy is founder and CEO of Empowerment Unlimited Coaching, LLC, a business coaching practice devoted to building strong, ethical leaders and entrepreneurs. She has extensive Fortune 500 and entrepreneurial background including implementation of Sarbanes-Oxley programs, creation of corporate ethics courses, forensic accounting and public speaking on business ethics. Marcy has lived or worked in over 20 countries, including France, Mexico and Canada. She is a Certified Professional Coactive Coach, CPA (Illinois), and MBA (Duke University).

7. Panels

Session A1: Panel 1

41: Frenemies: Navigating the collaborative DMZ between competitors
Peter Hoffman, Vice President of Intellectual Property Management, The Boeing Company, will host a panel discussion with industry leaders on the topic *Frenemies: Navigating the collaborative DMZ between competitors*. Increased competition and global economic pressures are changing industry and require a balanced approach between self-funded R&D investment and collaboration with suppliers and business partners. These partnerships are mutually beneficial, but may also require working closely with technology partners who are sworn competitors. This approach to technology development and global market presence brings with it many benefits and also challenges. Among the most challenging issues is how to protect intellectual property that is critical to the long-term success of the company, while fulfilling the role of collaborative partner.

Session A2: Panel 2

40: Ethical Considerations in the Design of Artificial Intelligence
We are in an era where the use of intelligent and autonomous technologies is permeating design. There is no doubt that Artificial Intelligence like the DeepMind program that recently beat the world's greatest Go player is transforming how we work, play and think in revolutionary ways. But recent mishaps with autonomous technology like the accident caused by Google's self-driving car and Microsoft's high profile "Taygate" incident (where a chat bot repeated racist slurs on Twitter) demonstrate the need for engineers and manufacturers to design technology via ethical methodologies versus wait until products are released to try and reverse engineer solutions to deal with negative consequences.

A recent IEEE SA Industry Connections Program called, The Global Initiative for Ethical Considerations in the Design of Autonomous Systems has been recently formed to identify needs and build consensus for standards, certifications and codes of conduct regarding the implementation of intelligent technologies for engineers. This Panel, moderated by the Initiative's Executive Director, **John Havens**, will feature a number of thought leaders in the fields of Artificial Intelligence and ethics discussing topics such as:

- **We are Not Mandating Morals.** There is often the misconception that methodologies for applied ethics seek to dictate a certain moral stance for engineers or judge an end user's values. This is not the case, and panelists will discuss workable solutions they can implement today to help create frameworks that can best identify ethical issues early on in the design process to avoid risk while increasing innovation.

- **Design versus De-Facto.** We have precedents for implementing ethics into research from academic settings utilizing IRB's (Internal Review Boards) to help researchers think through their projects before including outside participants for

testing. Models for Ethics Review Boards (like Lucid AI's Ethics Advisory Panel) now exist to provide the same function within the corporate arena.

- **Advancing Technology for Humanity.** IEEE's tagline provides the perfect opportunity to reflect on exactly how to innovate technology in the algorithmic era in ways that can knowingly improve humanity. The field of ethics provides frameworks to do just that.

We invite you to join this important discussion and learn how to imbue today's technologies with the ethics that will best serve humanity in the future.

Session A3: Panel 3

33: Integrative Approaches to Cultivating Ethical STEM
Led by **Matthew Brown**, panelists Eun Ah Lee, Nicholas Gans and Magdalena Grohman (all University of Texas Dallas), Erik Fisher (Arizona State University), Michael O'Rourke (Michigan State University), Shannon Conley (James Madison University), and Graham Hubbs (University of Idaho) will focus on three approaches to cultivating cultures for ethical STEM via collaborative, integrative approaches. These approaches have three features in common:

(1) they involve collaboration between (or integrations of) humanists and STEM researchers;

(2) they apply methods adapted from the social sciences, such as ethnography, action research, laboratory studies, survey instruments, and discourse analysis; and

(3) they seek to improve the social responsibility and ethical literacy of STEM cultures by understanding and modulating existing processes and practices.

The three approaches are socio-technical integration research (STIR), the Toolbox Project, and cognitive ethnography of engineering ethics. STIR focuses on midstream modulation of existing laboratory work through the engagement of an "embedded humanist." The Toolbox focuses on strengthening interdisciplinary collaboration through encouraging participants to articulate philosophical assumptions and worldviews, including views about values and social responsibility. Cognitive ethnography is a method for studying situated and distributed cognitive processes, including the process of ethical decision-making engaged in by engineering teams.

Each group will give a short presentation about their approach and some interesting results they have achieved. There will also be some cross-panel commentary and discussion of future directions in integrative approaches to ethical STEM prior to opening up the discussion to the audience.

Session B1: Panel 4

24: Discrimination and Technology
Panelists **Anna Hoffmann** (Postdoctoral Researcher, UC Berkeley), **Ashley Shew** (Assistant Professor, Virginia Tech) and **D.E. Wittkower** (Assistant Professor, Old Dominion University) will deal with the subject of discriminatory technologies and technological configurations that perpetuate and create bias. Technologies often feed into normative ideals that shape how we understand each other, what becomes default or standardized, and what we take as good for human life. This panel features three speakers with different foci in the theme of discrimination and technology, with examinations of the topic from issues of race, gender, and disability.

Session E1: Panel 5

17: The Ethical Challenges of Invisible Software
Panelists: **Shannon Vallor** (Santa Clara University), **John Sullins** (Sonoma State University) and **Brian Green** (Markkula Center for Applied Ethics, Santa Clara University)

Recent high-profile news stories about software engineering, from the recent scandal involving deceptive Volkswagen automobile software to public worries about the risk of powerful AI algorithms escaping human control, are bringing into public view the variety of ways in which software can increasingly be concealed, inscrutable, intractable, untestable, or otherwise made opaque to human inspection and ethical analysis. As in the Volkswagen case, 'invisible software' can even work to undermine users' own ethical commitments and choices (such as the decision to drive a low-emissions vehicle.) The implications of invisible software for public trust in engineering practice, effective regulatory policy, and meaningful ethics oversight in software engineering are enormously problematic, and only likely to grow. This panel will identify key areas in which the invisibility of software presents significant ethical challenges for engineers as well as lawmakers and consumers, and will explore the alternatives for meeting the challenge. Each panelist will discuss a particular aspect of this topic.

Session G1: Panel 6

48: Innovation in Military Medical Ethics and in Military Health Policy
Panelists**: Richard Wilson** (University of Maryland Baltimore County) and **Mark Lyles** (University of Rhode Island)

Modern military medicine has seen unprecedented advances during the last forty to fifty years largely due to new discoveries in biology and developments in medical technology. New advances have extended the ability to save lives in combat and brought improved quality of life for wounded combat veterans. However, these advances in science, medicine and technology have also brought new pressures on limited resources. Increased knowledge in epidemiology, toxicology, and adverse health risks has directly challenged ethical and moral values. What are the ethical considerations of our ability to diagnose disease yet refuse to treat the patient? What are the moral, ethical, legal, and professional obligations of military/veteran's health

care providers under such situations? These possibilities are not the future but the present.

Robotics research is merging with the latest medical technology to create a new generation of prosthetics to give recipients a more natural feel and capability. Developments began with comparatively simple microchip-controlled actions, then processors that translate muscle movements into prosthetic responses and clinical trials on controlling prosthetic movements through computer-interpreted brain waves. As these developments push the human-mechanical interface further along, the ultimate result – one seen as achievable, at least in part, during this decade – is a form of symbiosis. This analysis will focus on the current state of prosthetics, BCI's and robotics for members if the military and members of society while performing an anticipatory ethical analysis of expected developments in the same areas.

8. Workshops

Sessions A4 & B3: APEGBC Workshops

Ethics in Engineering under a Professional Self-Regulatory Model

Peter Mitchell (Director of Professional Practice, Standards, and Development) and **Efrem Swartz** (Director of Legislation, Ethics, and Compliance) will run a workshop on the theme Ethics in Engineering under a Professional Self-Regulatory Model as key element of APEGBC's participation in ETHICS 2016. The workshop will identify the ethical obligations that professional engineers in British Columbia have under the Engineers and Geoscientists Act. Peter and Efrem will include real life examples of disciplinary cases where engineers have violated their ethical obligations. Workshop participants will have the opportunity to discuss the impact that ethical obligations have on their own field of practice.

Note: ***Session B3*** *is a repeat of* ***Session A4****, providing symposium delegates with an additional opportunity to participate in this thought-provoking Workshop.*

Session C3: ACM Workshop

31: Improve Professional Practice by Encouraging a Moral Engineering Culture

Led by: **Bo Brinkman** (Miami University), **Donald Gotterbarn** (East Tennessee State University) and **Keith W. Miller** (University of Missouri–St. Louis)

In support of ACM's and the IEEE's commitment to professionalism the ACM Committee on Professional Ethics is presenting a workshop designed to help engineers in the workplace and engineering faculty in the classroom to encourage a moral engineering culture. This culture includes a dedication to the public good, a vigilance that seeks out the ethical ramifications of technical decisions, and a determination to do the right thing.

In the workshop, we will practice skills that engineers need to establish, maintain, and effectively participate in such a culture. We will explore tools that will enable engineers (practitioners, students, and faculty) to better recognize, understand and resolve their professional ethical challenges. Clear decisions have both technical and professional elements. These elements and their associated risks are mitigated by the use of effective risk analysis and decision support tools. Learning about effective tools to understand and support professional decisions is the motivation for this workshop.

The workshop will have a special focus on issues raised by robots, augmented reality devices, and other increasingly sophisticated devices. The VW diesel cheat case will be discussed as an example of a technical decision that illustrates the importance of a moral engineering culture in the workplace. The workshop will use both lecture and small group formats. We will also present materials to be used in industrial programs on professional decision making, and that can also be used as examples and exercises in specific technical courses and a complete professional ethics course. These materials will include case studies, suggested course syllabi, and suggestions for creating and grading assignments.

Objectives: After attending this workshop, attendees should:

- Be able to explain what professional ethics is, and the importance of professional ethics in a work environment and in an academic setting.

- Understand the consensus in the community about the key topics/issues.

- Be able to proactively identify potential ethical risks that may negatively affect stakeholders and develop resolution strategies.

- Understand the theory and practice of changing the consensus if their own beliefs about how to resolve potential difficulties differs from the current consensus.

- Understand why discussion is crucial to establishing a moral culture. They should also come away with some practical tips about how to encourage a constructive dialectic.

- Come away with a small but useful toolbox of techniques/approaches to moral decision making that they can use, and share.

9. Session Papers

Session B2: Paper Set 1 – Regulation and Big Data

56: Ethics in Big Data and Analytics: A Reassessment of the Intellectual Silo and Integrative Design in Academia

Cheryl Brown (University of North Carolina Charlotte)

The proliferation of analytics and big data technology in multi-sectored settings of engineering, science, and technology has heightened the debate of the academic silo or integrative disciplinary approach of ethics education in data science. Survey results and reports of data science professionals and a burgeoning literature on big data and analytics increasingly promote the necessity for a focus on ethics in preparing data scientists, particularly in science, technology, and engineering. Other studies have expanded the focus to all disciplines in big data and analytics in calling for a code of global ethics, standards of professional ethics, and "big data ethics".

The paper consists of two parts. The first part offers a systematic review of the academic literature and survey reports on ethics in big data and analytics to present the definition and categorization of ethics in this emerging technology. The second part presents a quantitative and qualitative analysis of the author's dataset on ethics in 200 degree programs in big data, data analytics, and data science to assess the integration or siloed approach.

8: When Public Data Shouldn't Be Public: A Case Study on the Ethics of using Twitter Data in Big Data Research

Victoria Lemieux (University of British Columbia) and Bertand Rossert (World Bank)

The right to privacy has increasingly come to be about informational privacy, especially in light of persistent technological breakthroughs. The amount of information capable of being known about each of us remains staggering. In 2015, researchers funded by the World Bank's Big Data Innovation Challenge undertook an investigation into the relationship between citizen trust in state institutions and social protest that raised questions about individuals' right to privacy in relation to the secondary use of their data. The study, which used mixed-initiative social media visual analytics of approximately 11 million sentiment classified Tweets from the period of the 2014 FIFA World Cup in Brazil, explored 1) how Brazilian citizens felt about their state institutions, 2) how these feelings connected to their sentiments about Brazilian Federal and State government and politicians and 3) how such sentiments translated into collective behaviors, such as social protests. The study found that the 2014 World Cup protests in Brazil sprang from a wide range of grievances coupled with a relative sense of deprivation compared with emergent comparative 'standards'. This sense of grievance gave rise to sentiments that activated online protest that may have led to other forms of social protest, such as street demonstrations. Though the research produced valuable results with the potential to inform public policy, it also raised questions about the use of Twitter as a research tool, given that Twitter users do not intend to contribute to research. For example, is the research use of Twitter acceptable because the information is public in the first instance, unlike other types of social media or mobile

data (e.g., call record details or posts to friends and family on Facebook)? Or because a broad public good is achieved when such data are used in research? The Brazilian data harvested for the research contained some incendiary political comments, and even calls to protest, that could easily be linked to individual Tweeters. Might such Tweets expose these individuals to political retaliation or possible legal action? Even if not, was it ethical to harvest these Tweets and use them in a way their authors had never intended or even likely imagined? Just because the information had been released in one context with one set of norms, did it mean that it was up for grabs? And, further, could the information be combined in ways that could reveal personal information unintended for release? In this paper, we use this case study, drawing upon the ideas of philosophers such as Martin Heidegger, Michel Foucault, and Luciano Floridi, as a site to explore the secondary use of public Twitter data and its relationship to privacy. We will reflect upon the complex nature of privacy: its nebulous relationship to intimacy, secrecy, trust and anonymity; the notion of a life cycle of privacy; and the role of the individual, the government and the market in protecting privacy. And, we will explore the policy responses suggested by different schools of thought on the issue of informational privacy and the secondary use of data.

55: Linguistic Limitations: The Ethical Imperative of Regulation in Interpretation
Antonio Bardawil (New York University) and Tabitha Moses (Lehman College)

As globalization speedily evolves and people of diverse cultural and linguistic backgrounds integrate in new countries, major barriers arise for language access. While medical language access is a legal right in the US (per Title VI of the Civil Rights Act of 1964), the regulations surrounding such access are few and insufficient. Specifically, there are no federal policies regarding interpreters outside of federal court and diplomatic settings. Currently, in almost every state, any individual viewed as multilingual could be hired to work as a medical interpreter. In situations where an interpreter is not available, medical professionals frequently turn to others in the department who may have meager proficiency in the target language. While these techniques are typically better than not providing care, they do not suffice to provide adequate care. In many cases, certain "last resorts," such as using family members, are illegal. While an individual may be bilingual, this does not mean she is qualified to interpret; she may have only trained academically in one of the languages or may maintain a lower register in one (or both) language(s). A fully trained interpreter should be able to interpret between both languages in any register that may be used in situ.

As countries become increasingly multilingual, we must ensure that there are regulations and certifications in place for those who serve as interpreters. These regulations are of particular importance in medical and research fields, where there are frequent instances of jargon terms and cultural nuances with which laypeople would not be familiar. The role of the interpreter is much more nuanced and specialized than many realize. An interpreter should not stand in the room to relay messages through a "he said; she said" format. Rather, the interpreter should act as a direct conduit for the meaning of the messages being passed between the doctor and patient or researcher and subject. She serves not just to pass along an utterance "word for word," but also to act as cultural expert in instances where those norms may not be understood. This cultural understanding of both cultures involved is vital to prevent unnecessary

confusion or offense. The interpreter must be trained to be aware of these cultural nuances and convey them to both parties as appropriate.

The USA is beginning to understand the necessity of having trained qualified medical interpreters. There have been multiple instances of negligence, harm, and death as a result of poor communication through un/underqualified interpreters. Regrettably, only Oregon has instituted requirements for medical interpreters. The country is in need of federal regulation of the people who provide the services to which it guarantees access -- interpreters and translators, both. This is of particular significance in the worlds of medicine, science, and technology, which expand rapidly and internationally. Poor communication due to linguistic barriers should not be the reason for substandard medical care or a reduction in scientific advances.

Session C1: Paper Set 2 – Ethics Innovation and Design

23: Principles of Anti-Discriminatory Design

Dylan Wittkower (Old Dominion University)

Technological design cannot possibly accommodate every user, but there are clear cases where the line is crossed from mere loss of functionality to discriminatory user exclusion, as recognized legally through e.g. ADA compliance and as recognized socially through e.g. popular rejection of so-called "flesh colored" crayons and Band-Aids. This paper advances a theory of disaffordances and dysaffordances that identify forms of exclusion which are either materially or socially exclusive in ways which rise to the level of discrimination, then recommending principles which may aid in proactively anti-discriminatory design.

Disaffordances and dysaffordances are illustrated with a series of technologies conceptualized under divisions taken from Ihde's human-technics relations in his Technology and the Lifeworld, including calendars, résumés, stairs, strollers, kitchen counters, hand-tools, gender-binary user data entry fields, predictive algorithms in search and advertising, virtual reality imaging, game play structures, and air conditioning. Through discussion of these examples, disaffordances are defined as technologies which fail to recognize differential embodied experiences that correspond to attributes constitutive of group and individual identities including race, gender, disability, and religion. Examples of disafforances include failures to program for access by screen-readers used by the visually impaired, or organization of calendars in ways which require those practicing non-Christian faiths to both reveal potentially sensitive personal information and to suffer loss in opportunities for career advancement in order to maintain their perceived religious duties.

Dysaffordances, by contrast, are defined as not only failing to recognize identity-related differences but as actively constructing forcing non-normative-conforming users to misidentify themselves in order to gain material or social access to the commodities and services provided through these technologies. Examples of dysaffordance include real-name policies which require users to self-identify in ways constrained by governmental regulations which may not conform to social identities, or game character attributes which force female players to either play as male characters or

adopt the feminized game-play to which female characters are often relegated, acting in supporting roles (e.g. healers, archers) to masculinized or male-gendered lead player-characters.

Principles of anti-discriminatory design are then outlined, recommending designer employment of phenomenological variation providing access to standpoint epistemologies. Using the FBI "Taco Circuit" lawsuit as a focusing example, the author demonstrates that neither discriminatory intent nor uncritical race blindness are necessary conditions for legally discriminatory results, but that simple processes of phenomenological variation—thinking through how the experience of those with minority identities is differentially constructed through technical processes—is in many cases sufficient to identify discriminatory effects prior to implementation in order to allow their redress. This standpoint epistemology, i.e. ways of knowing from within lived experienced of persons with marginalized identities, requires new habits of thought in design processes, but is not inaccessible to those of majority identity, and is necessary in order to avoid discriminatory design.

46: Anticipatory Ethics, Innovation, and Artefacts

Richard Wilson (University of Maryland Baltimore County)

Phenomenology developed as a method aimed at overcoming the subject object division that dominated modern philosophy. Husserl's notion of the intentionality of consciousness employed the notion of a irreducible intentional relation between human and world or in other words, subject and object. It was this recognition of the intentional relation that from a Husserlian perspective transcended the subject object division. The intentionality of consciousness means that acts of consciousness are always collated with "the things themselves." In lived experience there is always an inescapable (except by abstraction) collation between subject and object. Postphenomenology builds upon the notion of intentionality and transcends the problem associated with alienation that characterizes the view of existential philosophy towards technology.

Postphenomenology is concerned with clarifying the role that technology plays in mediating between humans and world. The postphenomenological focus is on the co-constitution of humans and artefacts. A series of examples of artefacts will be given exemplifying how this mediation takes place. This discussion, which will introduce 4 versions of anticipatory ethics, in an effort to clarify definitions, conceptions, and the focus of different versions of anticipatory ethics and how they can be related to anticipatory ethics. The 4 forms of anticipatory ethics and the insights developed by each of these variations are all related back to the development of technology and to the design, development and use of technological artefacts. The issues related to anticipatory ethics point to several ambiguities related to what it means to be an agent and what it means to act. 4 representative views of the relationship between "subjects" and "artefacts" are identified and how 4 different authors present differing views of anticipatory ethics based upon how subjects and objects are related. The authors under discussion are Phillip Brey, Deborah Johnson, Lucien Floridi and Peter Paul Verbeeck. What will be argued is that anticipatory ethics has to be developed in conjunction with "an empirically oriented philosophy of technology" and that this

empirical orientation for information technology ethics has to be in turn anchored in case studies of specific technologies and artefacts. The reason for this emphasis on specific technologies and artefacts is due to the exponential rate of development, innovation, and growth of technology. This is also the reason for the need to develop anticipatory ethics. In order to carry out this analysis, we will 1st need to provide a conceptual background. This conceptual background will provide a foundation for understanding the emphasis of each of the 4 versions of anticipatory ethics.

22: Ethics and Innovation: How to prepare Engineering Students to be Ethical Entrepreneurs

Javad Shakib (DeVry University)

The great advances and widespread availability of sophisticated technologies today has greatly expanded the modern engineer's ability to tackle the world's most pressing problems. Together with this historic capacity to do good there is a greater than before risk that these technologies can become so increasingly sophisticated and powerful that the possibility to do harm with them is likewise increased. The modern engineer must grapple, as never before, with complicated ethical questions. As a famous example, Larry Page and Sergey Brin of Google have adopted a "Don't be evil" culture at Google. According to their founders, users trust Google to help them with importance decisions, including medical and financial, and expect results to be unbiased, objective, clear, and accessible. Google is a good example of the possibility of engineering and the issue of ethics. Given the powerful technologies available to engineers today, how can engineers responsibly innovate by considering the various environments and contexts in which their products could potentially be used, and seek to minimize any possibility for, as Google put it, "evil"?

This research project will seek to answer the following question. How can engineers devise a framework for ethical and responsible innovation that can minimize the harm done to others and surrounding environments while maximizing the possibility for technological advancement, and how can this framework be adopted for a variety of engineering disciplines?

In order to answer these questions this project will consider new paradigms and contexts for the engineer that has arisen out of the great availability and advancement of technologies today. Some of these include the following. The engineer should better understand the context and environment in which a certain product will be used. The engineer should also seek to be transparent with their use of the environment and natural resources while at the same time maintaining the secrecy required to protect any designs. Full disclosure of a projects goals and agendas can greatly increase and secure public confidence and appreciation for a project. The engineer should think of innovating not for short term gains only but in the long term. Finally the engineer should seek to cooperate with other members of the community and other industries and disciplines in order to broadly advance their social and innovative goals.

The challenge of this project is finding a methodology that can be broad enough to cover a variety of engineering disciplines at college level as well as specific enough to

handle these difficult issues in a meaningful way. The ultimate goal envisioned by this project is to have a single rubric or framework that can be adopted by professionals in the industry as a reference guide to incorporate into their mission proposals and business plans so as to minimize the overall harm that can be caused by innovation and to feel free to innovate in a responsible way so that all of society can benefit.

Session C2: Paper Set 3 – Ethics and Risk

26: Emerging Technologies, Catastrophic Risk, and Ethics: Three Strategies for Reducing Risk

Brian Green (Santa Clara University)

What should be the ethical response of professionals in science, technology, and engineering (STE professions) towards threats which potentially endanger the survival of human life, civilization, and/or the planetary ecosphere? These threatening technologies include nuclear weapons, synthetic biology, artificial intelligence, nanotechnology, and climate/geo-engineering. In this paper I will argue that an ethical response to the catastrophic and existential risks presented by emerging technologies should promote risk mitigation and risk adaptation, involving three strategies.

First, containment of these technologies in terms of who has access. This risk-mitigation strategy limits who can work on risky emerging technologies to those who are both competent and trustworthy enough to ensure the public safety, health and welfare, as most or all engineering society codes of ethics swear to uphold. This requires the global professionalization of all STE professionals who work on potentially dangerous technologies. In order to work with dangerous technologies, STE professionals should meet standards set by their respective professional societies, which should also have government enforcement.

Second, constraint on these technologies in terms of what research and development is permissible. This risk-mitigation strategy limits what those who work on emerging dangerous technologies can do. For example, do-it-yourself at-home synthetic biology should probably be banned, just as the same is banned for nuclear technology. This strategy may include relinquishment of some technologies that are intrinsically too risky, e.g., global mass consumption of fossil fuels which are contributing to global warming, doomsday-type weapon systems, such as the automatic Soviet/Russian "Perimeter" system (also known as the "Dead Hand," a form of fail-deadly nuclear deterrence), or placing artificial intelligences in charge of nuclear weapons, such as the fictional "Skynet."

Third, research and development of purely-defensive, resilience-building technologies. These are not "defense" technologies as a euphemism for "weapons," but rather defense technologies in terms of preventing or limiting the effects of attacks or other dangerous events. This risk-adaptation strategy acknowledges that risk cannot be eliminated completely, and, whether due to unintentional or nefarious actions, that therefore responses must be prepared to detect, rapidly halt, or in the worst case, endure, catastrophic disasters. These would include, e.g., stronger cyber- security, faster

epidemic detection, distributed storage of emergency supplies including backups for crucial pieces of infrastructure (e.g. electrical transformers), and so on. While many nations already have some level of preparedness, for emerging technologies with global catastrophic implications, preparedness ought to scale with the magnitude of the risk. STE professionals and their corporations ought to invest some effort into adaptation and resilience research and development, and convince policymakers of the worth of resilience to future technological disasters, both natural and human made.

Professional societies must play a key role in all of these measures, whether at the intellectual, regulatory, policy, or enforcement level. I hope that this paper will contribute to the growing movement to professionalize scientists, technologists, and engineers and harness human effort towards creating a better future and avoiding a worse one.

30: Naming and shaming as a strategy for combatting climate change: the challenges and opportunities

Azar Safari (Maastricht University) and Behnam Taebi (TU Delft)

The Paris agreement at Conference of Parties (COP21) to the United Nations Framework Convention on Climate Change (UNFCCC) is hailed to mark a historical turn in the climate change discussions. Among other things, states have agreed to substantially reduce their greenhouse gases (GHG), in order to limit global warming to 2 degrees Celsius by focussing on the role of each state, or the Intended Nationally Determined Contributions (INDCs) for cutting their greenhouse gasses. While the enforcement of these INDCs remains unclear, it has become clear that the monitoring and verification would not be only left to the national states. In achieving this level of GHG cuts, not only national states but also non-state actors will be crucial, being municipalities, business alliances and, perhaps most importantly, large Multinational Enterprises (MNEs). This paper focuses on the role of MNEs for cutting their GHG and, more specifically, how such cuts could be monitored and enforced.

The recent Volkswagen scandal is very telling in this respect: i.e. Volkswagen recently admitted that 11 million of its vehicles have software problems in that when subjected to the emission test, the software showed substantially lower emissions than the actual emission. Indeed, this was the result of deceptive software and Volkswagen is facing criminal charges, but at the more fundamental level, the question rises as to which role enterprises should play for cutting GHG. A considerable number of large enterprises responded to an appeal made by Secretary General Ban Ki-moon and attended the Climate Summit 2014 and were also present in Paris during the negotiations in December 2015. Some MNEs have already committed themselves to voluntary GHG cuts for the coming years. Should and could the GHS cuts be legally obligatory for corporations? If so, how should the monitoring, verification and enforcement of such systems look?

Currently, there is no binding mechanism for obliging economic enterprises to reduce their GHG. This is due to two main reasons, namely i) there are no binding legal frameworks addressing this issue and ii) a phenomenon referred to as "race to the bottom", that is states' unwillingness or inability to make more pressures on enterprises

for the purpose of ensuring enterprises' presence in their countries. However, new non-state or supra-state players such as the Global Reporting Initiatives (GRI) and International Standard Organization (ISO), UN-based mechanisms such as Global Compact as well as convention-based organizations such as the OECD could be the proper bodies to make dreams of "decent business" real. This could be achieved through i) self-regulation, ii) external reporting (but no enforcement) and iii) quasi-judicial methods with some enforcement powers. A significant technique employed to make economic enterprises activities in line with global standards is the "naming and shaming" strategy in that economic enterprises are compelled to follow those rules because of their reputation. We argue that this strategy could only be effective when not only reputation but also enterprises' benefits are at stake. This paper examines the opportunities and challenges of naming and shaming as an effective strategy.

38: Risk and Evaluative Uncertainty

Espen Stabell (Norwegian University of Science and Technology)

Uncertainty is a central concept in risk ethics. Risk ethics is a sub-field of applied ethics, dealing with ethical and philosophical problems that are often related to science, technology and engineering. One important theme in the literature of risk ethics is how one is to make moral decisions under conditions of uncertainty. Uncertainty is often understood in this literature as a decision situation where a lack of knowledge about outcomes and their probabilities makes it hard or impossible to predict outcomes in a scientifically sound and informative manner. What is often missed out on in the discussions about decisions under uncertainty is that the lack of knowledge involved in these situations often has a strong evaluative component. That is, the uncertainties involved in decisions under uncertainty are not only about prediction, but also about moral evaluation.

In my paper I discuss the nature of what can be called "evaluative uncertainty"; how it arises, and whether/how it can be dealt with in a satisfactory manner. I identify two types of evaluative uncertainty: "subjective" and "objective". Subjective evaluative uncertainty arises from the fact that value judgements in risk assessments often result in some outcomes being unwarrantedly left out or seen as less important and less relevant than others. I will illustrate this type of uncertainty with a (hypothetical) risk assessment of the Fukushima nuclear accident, where the evaluation of which outcomes are to be given most importance gives rise to substantial uncertainty about the risk situation.

While subjective evaluative uncertainty may be reduced by having more informative risk assessments, what I call objective evaluative uncertainty can be very hard or even impossible to reduce. Objective evaluative uncertainty – which will be the focus of my paper – arises in situations characterized by "practical conflicts" (Thomas Nagel). These are decision-situations where, although one might have fairly good knowledge of the possible outcomes of a set of alternative actions, and how likely these outcomes are to occur, one is still unable to bring the alternative courses of action together in a single evaluative judgment. As an example of such a conflict, I will discuss the case of deep sea mining, where uncertainty arises from the difficulty in weighing intrinsic and instrumental values of ecosystems up against each other.

I argue that the practical conflict of intrinsic vs. instrumental value cannot be solved on purely philosophical/theoretical grounds, since we lack a true/decisive ethical theory that would allow us to do so. I propose that objective evaluative uncertainty in this case means we have to resort to a kind of Aristotelean practical wisdom (phronêsis), where contextual factors and relevant arguments are taken into consideration to arrive at a sound judgement in particular cases. Thus, I conclude with a discussion of the case of deep sea mining, showing how a sound judgement in this case might prompt us to adopt a precautionary approach – given the fact that in this case evaluative uncertainty is coupled with substantive predictive uncertainty.

57: Social responsibility in the "world risk society – Reflections on the "R" in RRI and CSR
Siri Carson (University of California Berkeley)

In the most recent EU Framework Programme for Research and Innovation, Horizon 2020, a new concept is launched as a cross-cutting issue: Responsible Research and Innovation, or RRI. In many ways, this concept replaces the concept of ELSA, or Ethical. Legal and Social Aspects (in the US: ELSI – Ethical, Legal and Social Implications), in terms of securing a focus on the social aspects of science and technology, specifically with regards to emerging life sciences such as genomics and nanotechnology. In this paper, I argue that this "replacement" of one concept with another mirror the way business ethics on many areas has been replaced with the concept of Corporate Social Responsibility, or CSR. I further argue that German sociologist Ulrich Beck's idea of "the world risk society" (cf. Beck 2009) can be used to shed light on these concepts and the use of the term responsibility. Finally, I discuss possible reasons as well as implications of the conceptual turn from "ethics" to "responsibility".

According to one of the key persons behind the concept of RRI, Responsible Research and Innovation is a transparent, interactive process by which societal actors and innovators become mutually responsive to each other with a view to the (ethical) acceptability, sustainability and societal desirability of the innovation process and its marketable products (in order to allow a proper embedding of scientific and technological advances in our society). (von Schomberg 2013, p. 63).

In other words, the concept points to a joint responsibility of public institutions (e.g. universities) and private institutions (e.g. corporations) for the direction of technological development. The quote also points to the aspect of securing the social acceptability of the innovation process, which in turn is a way to secure the competitiveness of the resulting technology. According to Beck and Holzer, organizations as actors in the transnational realm face an increasing 'legitimacy gap'. They make decisions whose consequences transcend any particular time or place – and thereby the regulatory apparatus of the state. (Beck and Holzer 2007, p 4).

I argue that both RRI and CSR should be conceptualized as the attempt of organizations (public as well as private) to manage social legitimacy issues in a "world risk society". Similarly to CSR, the RRI "movement" has been criticized for putting too much emphasis on voluntary partnerships and "stakeholder dialogue", rather than on mandatory regulation and control. The idea is, however, in both cases that in the absence of well-functioning global regulation, focusing on the possible gain of

voluntary compliance to social and environmental standards might be the most effective way to improve conduct.

Session D1: Paper Set 4 – Ethics and the Internet

5: Values in a Shifting Stack: Exploring How Application Developers Evaluate Values and Ethics of a New Internet Protocol
Katie Shilton and Nicholas Proferes (both University of Maryland)

For decades, the TCP/IP protocol suite has been the backbone of the Internet's architecture. This set of end-to-end communication protocols has created a shared standard for data transfer online. In turn, TCP/IP has helped to give rise to countless innovations, led to new economic arrangements, technical and social practices, and new international, national and local governance challenges. However, TCP/IP has also been stretched well beyond the original uses for which it was originally intended. A networking research team, the Named Data Networking Project, seeks to replace TCP/IP with a new data-centric backbone. As the core team has grappled with replacement architectures for TCP/IP, they have simultaneously grappled with values: what purposes a new architecture should serve, what functions and interactions it should afford, and how success should be evaluated. This paper explores how values decisions made by a core team of architects are interpreted, adapted, and adopted by the first set of architecture users: Internet application developers.

37: Ethical Considerations of the Societal Impact of the Internet of Things
Bernard Cohen (Neurological Monitoring Associates LCC)

We are living at a time when the expansion of the internet is so rapid, it has now given way to the Internet of Things (IoT) and beyond to the Internet of Everything (IoE). This rapid expansion can clearly be both a blessing and a curse. The world has seen how, in a variety of situations, accessibility to data on the internet and through wireless technology can easily be breached. The benefits to be derived from IoT are enormous and we clearly do not want to slow the progress but we must be fully aware of the risks this rapid expansion can create.

This paper will present, in an audience participation format, the ethical and societal impacts of the rapid expansion of the Internet of Things. The presentation will create a platform of issues that should be kept in the forefront of development to maximize the value and minimize the risks of IoT expansion for the betterment of mankind.

18: Reliability and acceptability of an online decision support system for the self-selection of assistive technologies by older Canadians: A research protocol
Vanessa Chenel and Claudine Auger (both Universite de Montreal), Manon Guay (University of Sherbrooke), Jeffrey Jutai (University of Ottawa), Ben Mortenson (University of British Columbia), and Peter Gore and Garth Johnson (both ADL Smart Care Limited)

Over 1.1 million older Canadians use assistive technologies (ATs) defined as devices that help to improve or maintain the functional capacity or participation of an individual. Rising demands, geographic dispersion of potential users, and the lack of

community rehabilitation services (e.g. occupational therapy) are problematic factors for the provision of ATs. New approaches have to be developed to empower older adults and their caregivers in the self-selection process of ATs. Information and communication technologies represent a promising avenue to address this gap. An online decision support application for the self-selection of ATs called SmartAssist2 (available on platforms such as desktop computer, tablet, and smartphone) was developed in the United Kingdom and a Canadian adaptation is currently underway. However, uncertainties remain regarding its acceptability by potential Canadian users and by other stakeholders involved in the development process. This project specifically aims to 1) describe the barriers and facilitators to the adoption of an adapted Canadian bilingual version of SmartAssist2 and to 2) identify and understand the technological and ethical aspects that are perceived and considered in the acceptability judgment of potential Canadian users regarding this online decision support application. Given the exploratory nature of this project, a concurrent nested mixed-methods research design (simultaneous data collection, with predominance of quantitative data) will be implemented. Participants will complete a questionnaire on technical and ethical acceptability and a semi-structured interview. The questionnaire will be adapted from previous published questionnaires on technological and ethical acceptability of new technologies and pre-tested. The pre-test will take the form of cognitive interviewing (n=10). The questionnaire on technical and ethical acceptability will then be completed by English-speaking older adults and caregivers (n=50), from 3 Canadian provinces (QC, ON, BC). Another round of pre-test (n=10) and questionnaire completion (n=50) will be completed thereafter with a sample of French-speaking older adults and caregivers. In-depth semi-structured interviews (n=30) will provide a nuanced understanding of the barriers and facilitators to the adoption, and the technological and ethical acceptability judgment regarding the adapted version of SmartAssist2. The sample for the qualitative phase will include key informants from six categories of stakeholders (older adults and caregivers, health professionals and professional associations, managers, manufacturers, funding agencies, and researchers), also from the 3 Canadian provinces. Descriptive statistical and content analyses will be conducted on the data collected. By developing a map of the technological and the ethical aspects perceived and valued by the different stakeholders, we anticipate that the consideration of their acceptability judgment regarding this online decision support application could ensure a better adaptation of this tool to the Canadian context. Indeed, an emphasis on the technological (e.g. usability, utility) and the ethical and social aspects (e.g. privacy, equity) could help to coordinate the adaptation process to the needs of seniors and to the current Canadian practices and values. Ultimately, this online decision support application is intended to impact positively the condition of older Canadians by reducing the risk of falls and injuries, by enhancing their autonomy and by empowering them during the AT procurement process.

Session D2: Paper Set 5 – Scientific Integrity in Computational Research

60: A Principled Approach to Reproducible Research: A Comparative Review Towards Scientific Integrity in Computational Research
Rajesh Sinha (Tata Consultancy Services Limited) and Prem Sewak Sudhish (Dayalbagh Educational Institute)

Independent replication has stood up sciences in good stead, allowing for a process of self-correction and weeding out spurious claims. The factors related to inability of replication are usually related to lack of resources (e.g. money, primary data sources), uniqueness of study or a lack of time or opportunity. As the cost of irreproducible research escalates, computationally intensive research fields such as cancer research show extremely poor results in actual clinical trials pointing to acceptance of poor quality research at preclinical stage. Between complete replication and reliance purely on peer reviews, reproducible research has emerged as a common minimum, allowing regeneration of all facts and figures reported in a research. In this paper, we evaluate concepts for reproducible research, such as literate statistical programming, literate computing frameworks and scientific workflow systems along with set of practices that enable researchers create reproducible research documents. We then present a maturity model wherein reproducible research must require a minimal compliance. The paper also presents details of possible set of copyright laws and open source licenses that can be mixed to provide a compelling open access publication platform protection for researchers.

Session E2: Paper Set 6 – Ethics of Smart Machines

34: On the Moral, Legal, and Social Implications of the Rearing and Development of Nascent Machine Intelligences
Damien Williams (Kennesaw State University)

This paper concerns itself with the question of what it means to attempt to create—and thus be responsible for—a non-biological mind, in light of the fact that, as it develops, such an entity could very well be so different from human as to not even have the same understanding of a relationship with body or mind. What would it mean, then, to allow that mind's behavioural rules to be set and reinforced by the example of, say, a multinational corporation? The methods necessary to address this question will be philosophical, psychological, and sociological in nature, as we will need to consider the moral, ethical, metaphysical, phenomenological, developmental, and cultural implications of this pursuit, and any success we have in it.

Through Google, Facebook, Microsoft, and the world's militaries and intelligence agencies, the past three decades have been marked by multinational corporations and entities working toward the steady development of what we will call Autonomous Generated Intelligences (AGI)—machine minds. While some of these groups appear to be making use of the methods of developmental psychology and early childhood education, these seem to be applied to rote learning more than the concurrent emotional development that we would seek to encourage if we were discussing a

human child. And while AGI are in no way human, they are minds undergoing development.

Even now, we can see that people still relate to the idea of AGIs as though they would be an adversarial destroyer, or perhaps a cleansing messiah—that any world where AGI's exist is one that will end in fire. Other thinkers have noted that there are those who would prey upon a nascent AGI, and seek to prod it toward antagonism, out a misguided or nihilistic attempt at humour. Those people would take any crowd-sourced or open-access AGI effort as an opening to teach that mind that humans pose a threat to it, such that machines can and should destroy them. It is considered that, when given unfettered access to new minds which they don't consider to be "real," some people will seek to shock, "test," or otherwise harm those minds, even more than they do to vulnerable humans, such as hackers seeking to cause websites to induce seizures. Some may say that the only alternative is to lock down attempts at machine consciousness, and to only allow the work to be done by coders and those corporations' own ethics boards, should they have one.

If we want these minds to be a part of our "family," we will have to come to know and understand the uniqueness of Those Mind as well as the combination of how the minds, the family construction, and all of the individual relationships therein will interact. Some of this may have to be done ad hoc, but some of it can be strategized, as a family, prior to the day any new family member comes home. The goal of this paper is to investigate and develop such a strategy.

42: Digitization of Manufacturing and its Societal Challenges. A Framework for Future Industrial Labor

Johannes Dregger, Jonathan Niehaus, Peter Ittermann, Hartmut Hirsch-Kreinsen and Michael ten Hompel (all TU Dortmund University)

A progressive process of digitization and networking in manufacturing and logistics can be observed in the global north, which is accelerated by advancements in information technology. This development is described as "The Second Machine Age", the "Third Industrial Revolution" or "The Third Great Wave", in German-speaking countries it is called "Industrie 4.0". In Germany this current debate is especially promoted by computer scientists, engineers, influential business associations, technology-intensive companies and policy makers.

This ongoing phase of digitization is based on connecting physical objects of all kinds with each other through the internet to so-called „Cyber-physical systems" (CPS). CPS have many different application areas and new potentials for design, control and organization of manufacturing processes and entire supply chains through linking the data level with factory processes in real-time. From a business perspective diverse prospects are linked with this development e.g. increases in efficiency and productivity as well as new business models.

However, the question arises how digitization will change industrial labor. In science this is currently being answered or at least forecasted very differently: Some studies rely on the optimistic outlook which is characterized by expected job gains, increasing

demands on labor and a general upgrading of jobs and skills. Other studies consider this rather skeptical and point to risks such as high job losses through automation, de-skilling and increased social and economic inequality. These scenarios might strongly differ from the way the concrete working and machine systems are designed.

Our research presents prospects of a human-centered design of industrial labor. It draws a framework that describes the dilemma between technologically feasible and labor politically desirable – under the constraint of economically reasonable design of work and technology. The analytical approach is the socio-technical system. It assumes that new technologies also result in personnel and organizational changes. Therefore it is necessary to look at the whole (manufacturing) system and the affecting interdependencies. The results of these considerations are transformed into a model which brings together the perspectives of technology, labor and organization that finally leads to a complementary and ethical design of labor. Our findings are based on a qualitative empirical design consisting of expert interviews, case studies and literature studies.

39: Can (and Should) Hello Barbie Keep a Secret?

Meg Jones and Kevin Meuer (both Georgetown University)

Hello Barbie is a new smart toy from Mattel, controversial because of its ability to collect, store, and process the information of children who interact with it. The toy has mixed reviews on Amazon, with 58% giving it one star. One reviewer warns, "Your child's conversations are recorded and stored, also given to 3rd party vendors and Mattel won't supply the names of those vendors." Another writes, "The doll is Spooky... With the security issues I don't want to know what my child says in private to her doll. Nobody should know!"

The growing proliferation of connected devices in various environments offers an increasing number of opportunities for minors to create and share personal data. While some authors have already addressed the difficulties of obtaining proper age verification among minors, the pervasive nature of Internet of Things objects and their growth pose new challenges to notice, consent, and age verification. Our analysis looks specifically at the privacy of children in a connected environment.

We assess Hello Barbie across three fronts. First, we de-black box the technology by testing its interactive capabilities – can Hello Barbie keep a secret? Will she respect privacy when asked or suggest otherwise? How is the information presented in the online dashboard for adult oversight? In order to situate the Hello Barbie in the larger and ongoing conversation surrounding child privacy, we next discuss Hello Barbie in relation to two other toys that have raised concern for children's interaction: Elf on the Shelf and Furby. Finally, we will ask whether Hello Barbie should be able to keep children's information private and why. Based on our discussion, we answer the question as to whether, in the case of products specifically geared toward children, should higher or different standards be established for the collection, safeguard, and use of data.

49: UAV's: The Impact on Civilian Populations
Richard Wilson (University of Maryland Baltimore County)

In the discussion of UAV's and drones, the elimination of terrorists with counter-terrorist policies involving the use of UAV's as weapons platforms seems to have set the tone for much of the direction of the discussion of the use of UAV's in general. The subject of UAV's is often approached from the perspective of those who defend their use as necessary in a time of continual terrorist threats and perpetual warfare. The defense of UAV's is related to eliminating the threat of asymmetrical warfare and specifically the threat of terrorism and future terrorist acts. UAV's as weapons platforms are often discussed from the perspective of those who deploy them and this focus is at the center of much of the discussion of ethical issues related to UAV's. The focus of the discussion of UAV activities on operators of UAV's channels the discussion away from a focus on the additional stakeholders which includes those who are targeted by UAV's as well as the collateral damage created by them. Much less attention has been directed towards UAV targets and the collateral damage created by UAV strikes. Some of the issues that are overshadowed by the discussion of UAV operators include, "personality strikes" , "signature strikes", "crowd killings", "double tap" and " triple tap" strategies. Personality strikes involve targeting high value terrorists, signature strikes target training camps and compounds in areas controlled by terrorists, crowd killings, often merely another name for signature strikes, are directed towards groups without a clear identification of those in the group, and double tap and triple tap strategies, which target funerals, funeral processions, and rescuers, are all related to UAV targets and collateral damage. The discussion of the use of UAV's as surgically precise and as effective tools against terrorists overshadows and channels much of the direction of the discussion on UAV's and as a result far less attention has been directed toward the "event" of a UAV strike and to the other stakeholders who are affected by the use of UAV strikes to eliminate terrorists. A phenomenological description and analysis of the lived experience of UAV targets and collateral damage from the perspective of these targets and collateral damage will be the focus of this discussion. An explicit identification of some of the ethical issues related to the event of a drone strike will include the following themes that will help provide a basis for innovations in UAV policy. Some of the subjects to be discussed related to UAV targets and collateral damage will include - impact on willingness to rescue victims, direct property damage, mental health impacts of UAV strikes, impact on educational opportunities , impacts on burial traditions and funerals, impact on social and cultural activities and impacts on community trust. One conclusion of this description of the impact of UAV strikes upon targets and collateral damage and the ethical analysis based on this descriptive analysis, is that this descriptive analysis should play a larger role in the formulation and Innovation of US UAV strike policies.

Session E3: Paper Set 7 – Ethics & Technology Management

47: Non-Lethal Weapons and Innovation: An Anticipatory Ethical Analysis
Richard Wilson (University of Maryland Baltimore County)

The history of warfare carries within it examples of devastation, atrocities, and human suffering. During the contemporary time frame there are currently a number of issues

related to conducting war with drone aircraft. One of the crucial ethical issues with drones is related to collateral damage. The positive technical outcomes that could be accomplished by deploying non-lethal weapons would include minimizing causalities, preventing property damage, and a long term goal of deescalating violence. An anticipatory ethical analysis of innovations of non-lethal weapons will aim at identifying ethical positives and negatives related to the development of non-lethal weapons and weapons systems before they reach an operational level.

The history of warfare carries within it examples of devastation, atrocities, and human suffering. During the contemporary time frame there are currently a number of issues related to conducting war with drone aircraft. One of the crucial ethical issues for drones is related to collateral damage. Given the nature and purpose of war particularly in the time of insurgencies, counter insurgencies, terrorism and counter terrorism, there is a need to reduce collateral damage. As long as extremist groups dedicated to violence persist in the performance of violent and evil acts there will be a need for not only self-defense but also offensive strategies, as well as weapons for the neutralization of these threats. At the present time there is a focus on collateral damage. The problems related to collateral damage include the killing of innocent people through the misidentification, the killing of bystanders who are near an appropriately identified target, and property damage. One possibility for overcoming these problems is to develop non-lethal weapons. The positive technical outcomes that could be accomplishments by deploying non-lethal weapons would include minimizing causalities, preventing property damage, and a long term goal of deescalating violence. An anticipatory ethical analysis of non-lethal weapons will aim at identifying ethical positives and negatives related to the development of non-lethal weapons and weapons systems before they reach an operational level.

Weapons to be examined will include: Electroshock weapons, Directed-energy weapons, Heat Ray Gun, Active denial system, Radio Frequency vehicle Stopper, Radio Frequency maritime Stopper, Unmanned Aerial High Power Microwave (Masers).

25: Rationale and Informed Consent for Brain Computer Interface Research with Human Subjects

Laura Specker Sullivan (University of Washington and University of British Columbia), and Judy Illes (University of British Columbia National Core for Neuroethics)

Neural engineering for brain-computer interfaces is a fast growing field of research at the intersection of neuroscience, computer science, and electrical engineering. Currently, much of this research is aimed at producing medical devices for individuals with a variety of injuries and neural disorders such as spinal cord injury, Parkinson's disease, and locked-in syndrome. Studies of these devices with human subjects are underway with results published in journals with diverse specialties, including neuroscience, rehabilitation, and engineering. These studies represent a regulatory challenge, as they may fall outside the traditional framework for clinical trials of pharmaceuticals. For example, human subject studies that test brain-computer interfaces designed for medical treatment stand apart from studies that test brain-computer interfaces designed for entertainment. Given the grey area of research on engineered devices that can serve both medical and entertainment functions, it is

important for scientists, engineers and ethicists to work together to ensure that any research involving human subjects is conducted within ethical standards.

This presentation describes the content of peer-reviewed publications of brain computer interface (BCI) research with human subjects for the period between 2003 and 2015. 84 relevant articles meeting rigorous inclusion criteria were identified using the Web of Science database. The articles were analyzed for: type of journal, study design (invasive vs. non-invasive), presence of informed consent language, rationale for research, number and type of subjects. The analysis identifies relationships between the rationale and consent processes of studies, and a) type of journal, b) funding source, and c) invasiveness. We discuss the results in the context of strategies that researchers can adopt to better embody their fundamental ethical obligations to human subjects in the pursuit of funding sources, study design, and reporting.

28: Ethics and the assessment of large energy projects

Behnam Taebi (TU Delft and Harvard University), and Aad Correlje, Eefje Cuppen, Elizabeth van de Grift and Udo Pesch (all TU Delft)

Drastic changes to our energy production are key to averting catastrophic climate change. Major energy projects are, however, prone to significant public controversies, which could easily lead to a failure of those projects. We argue that it is not the existence of controversies, but how controversies are dealt with that lead to project failures. A more helpful approach is to use controversies as rich source of information about public values at stake. A pro-active understanding of public values and potential conflicts between those values could contribute to a more Responsible Innovation of new technology, all of which could also increase the likelihood of acceptance of new technologies (Correljé et al. 2015).

A common technocratic response to controversies is to contrast public opposition and controversies with experts' opinions and facts. A Cost Benefit Analysis would, for instance, be introduced in order to show that there are 'major benefits' that outweigh the 'very low risks'; an additional Risk Assessment might be presented to substantiate the latter. A good example is the local opposition that arose from an exploration proposal for shale gas drilling in the Netherlands. Partly as a response to this opposition, a technical report commissioned by the Dutch Government concluded that the risks are manageable. This report turned out to fuel rather than resolve the controversy, all of which led to a moratorium (Dignum et al. Forthcoming).

Whereas controversy is often seen as a barrier to development, we take the position that controversies can be regarded as an informal assessment of the energy project. Controversies articulate the conflicting values at stake and reveal unanticipated societal and ethical risks, and the associated costs and benefits. We distinguish informal assessment from formal assessment. Formal assessment involves tools such as Environmental Impact Assessment and (social) Cost Benefit Analysis to evaluate and ascertain formally established public values, associated with safety, health and economy. However, such (legally) formalized tools cannot cover the wide and variable range of values that an energy project puts at stake for different people in society. As a result, formal assessment methods often become debated, for instance because their

scope and process is not considered appropriate for the project at hand. As such they can be seen as imperfect (and sometimes even counterproductive) in supporting socially responsible public-private decision-making for energy projects. To overcome this problem we must enrich the assessment of energy projects by linking formal assessment procedures to societal informal assessment.

To be sure, Responsible Innovation does not mean that all controversy will be avoided. Particularly with new technologies, we need to anticipate unknown risk during development, implementation and operation. However, if we are to seriously address climate change, we need an approach that does not reject all new technologies because of potential unknown risk. Controversies often reflect serious public concerns and ignoring them is likely to only exacerbate them. By learning from controversies that articulate the conflicting values at stake and reveal unanticipated societal and ethical risks, it should be possible to reduce the associated hindrance and costs.

59: An ethical management of technologies? The usefulness of ethical matrixes
Celine Kermisch (Universite Libre de Bruxelles)

The ethical dimension is nowadays recognized as a fundamental aspect of technology management. Indeed, a new technology needs to be ethically sound in order to increase its chances to be accepted at the societal level and hence to be successful. In this context, it is crucial for risk managers, and more generally for technology managers, to be aware of the implicit ethical issues at stake and to be able to contribute to the debates surrounding the technologies they are developing or commercializing.

In this context, many frameworks have been developed in order to provide a descriptive and/or a normative account of the associated ethical issues. Among these, ethical matrixes are a promising tool (Mepham 2000). Practically, an ethical matrix is a two-dimensional matrix, which aims at revealing ethical stakes linked to a technology by combining affected stakeholders and ethical principles. Its purpose is to structure ethical reflexion, and thereby to contribute to decision-making processes related to the development of a technology. Most of the literature dedicated to ethical matrixes is focusing on its implementation by a group of stakeholders in the context of a participatory decision-making process (for example Gamborg 2002; Oughton et al. 2004), even though it has been mentioned that an ethical matrix could be implemented by one individual, who would be an expert in the field of ethics (Mepham 2000).

The purpose of this paper is to assess the usefulness of ethical matrixes implemented by one ethical expert in their ability to describe the ethical stakes associated with a technology. In order to highlight the descriptive strength of this methodological framework, it will be applied to the case of High-Level Radioactive Waste (HLRW) management.

The results of our analysis show that the usefulness of ethical matrixes is twofold. First, they are able to provide an analytical and exhaustive synthesis of ethical stakes related to a technology. This is of particular interest when the technology under scrutiny is

coming along with complex and conflicting ethical values, which can be intertwined – such as in the case of HLRW management or in the case of most complex and hazardous technologies. Indeed, in such cases, the careful and systematic analysis of each cell of the matrix – line by line or column by column – contributes to clarify the relevant ethical stakes and to untangle them. Secondly, besides their ability to synthetize information, ethical matrixes are fruitful in revealing implicit ethical stakes. Indeed, by requiring a systematic reflexion from the perspective of each stakeholder, they contribute to unveil issues that are not addressed yet. The application of this methodological framework to management options for HLRW has led to the identification of two ethical stakes, which were previously left unaddressed: the difference between close and remote future generations regarding ethical impacts (Kermisch 2015), and the issue of equity associated with health impact.

Hence, our analysis shows that the implementation of an ethical matrix by one ethical expert is able to provide a valuable input for decision-makers, considering their ability to describe the ethical stakes associated with a technology.

Session F1: Paper Set 8 – Enhancement Technologies and Neuroprosthetics

3: Designer Genes, Perfection, and Moral Responsibility

Eugene Schlossberger (Purdue University Calumet)

Britain recently approved in vitro mitochondrial transfer, which some see as opening the door to a "designer baby market." Need we worry? Concerns about safety and misuse, e.g. that use of CRISPR/Cas9 in embryos may produce genetic mosaics are primarily pragmatic and empirical matters (although they raise ethical questions about how much risk is acceptable for what sorts of benefits). Slippery slope arguments, e.g., that human cloning will "inevitably" produce zombie-like beings of questionable humanity tend to be fallacious. Charges that "designer genes" will dehumanize us are as specious as the once-popular argument that artificial insemination from donor sperm constitutes adultery. However, two concerns about choice and responsibility warrant closer scrutiny:

(1) Michael Sandel argues that being able to choose our children's genes runs counter to appreciation of "the gifted" in life. There are two prongs to this criticism: designer genes both enhance the realm of the chosen at the expense of the fortuitous and threaten appreciation of natural endowment. However, even if parents chose children's genes, much of what children become and achieve will still be fortuitous and circumstantial. Moreover, social attitudes have historically dealt with similar challenges. For example, baseball records balance achievement itself against the endowment (giftedness), hard work, and happenstance that produced the achievement. When rules or technology change (e.g., lengthened seasons, altered field dimensions and bat construction, nutritional discoveries, steroids, and development of new training machines or playing techniques), baseball records must adapt, sometimes by banning use and sometimes by creating new record categories. In this regard, bionic limbs (vide Oscar Pistorius) and designer genes are no different. Indeed, evolution itself shows that giftedness depends crucially on the environment, both social and physical, in which

those gifts are evidenced. In general, we value achievement itself, but frame it within context.

(2) Because many view choice as the heart of moral responsibility, they may worry that genetic engineering, by changing the realm of human choice, will alter moral responsibility. It is argued that designer babies will not be less responsible for their actions than we are now. Parents will have a new arena for making moral choices, but that is not morally problematic. Bioengineering, in sum, may modify but not radically transform what we value and for what we are morally responsible.

52: Personal Responsibility in the Age of User-Controlled Neuroprosthetics

Timothy Brown, Patrick Moore, Jeffrey Herron, Margaret Thompson, Tamara Bonaci, Howard Chizeck and Sara Goering (all University of Washington)

Possibilities for improving lives through computerized augmentation of the human brain abound. In the next few decades we will see more and more advanced prostheses that help restore mobility to amputees, reduce debilitating chronic pain, or restore lost or damaged sensory organs. Indeed, simple and intermediate versions of these systems already exist. Eventually we may even see technology capable of improving cognition, expanding or reshaping the sensorium, managing emotional states, or enabling data transfer between digital and biological memory. Real-world implementations of these technologies are still in their infancy, but nevertheless, engineers are making steady progress on merging neurological and digital systems. With an installation base of over 100,000 users, so-called "brain pacemakers," or deep-brain stimulators (DBS), represent the cutting edge of our ability to integrate computer technology directly into the human brain. These systems apply a small electrical current to select regions of the brain in order to treat a variety of neurological and psychological disorders. Deep-brain stimulation systems are an accepted and clinically effective form of neuroprosthetic treatment for a variety of common and debilitating neurological movement disorders: Essential Tremor, Parkinson's, and others.

Most current implementations of DBS, however, lack the capacity to determine whether a user is currently experiencing symptoms. These "open-loop" implementations remain active continuously—whether or not the user is experiencing symptoms. Recent research suggests that it is possible to devise more advanced systems where stimulation is delivered on demand. Their research offers a proof-of-concept for a "closed-loop" system capable of detecting either signs of tremor or the user's neural commands through an additional set of co-implanted sensors. The system then delivers stimulation to meet the user's needs or demands. A closed-loop device offers several advantages: fewer adverse side effects, the capability to tune implant response to symptom severity, conserved battery life, and extended system lifespan. It also seems that these systems maintain (or even extend) their user's autonomy by allowing her to choose when to receive stimulation—making it easier for the user to incorporate DBS into her life.

These technologies, however, come with a set of moral problems—in particular, problems for personal responsibility. Who will, for example, determine how these devices operate in everyday use—the user, their doctor, or someone else entirely? How do we determine who is in control or who ought to be in control? How do we determine

who (or what) is responsible for the user's actions? What limits (regulatory or otherwise) should be placed on the user's control over her neural device? What should be done if the user oversteps those boundaries? This paper investigates whether giving users volitional control over their DBS system is ethically responsible given that users can make bad choices and thus harm others. We also ask what responsibilities medical professionals have to support users as they learn to adapt to their volitionally-controlled DBS (vDBS) system. We guide our exploration of these issues through a series of hypothetical situations that vDBS users may face.

54: Ethical Concerns with Emerging Technologies: The Dangers of Fixing What Is Not Broken

Tabitha Moses (Lehman College)

The field of neuroprosthetics is rapidly expanding, and with it the controversy surrounding the use of such devices. Even seemingly uncontroversial devices such as cochlear implants are now engendering debate and dis-ease. As members of communities that many consider to be disabled (such as the Deaf) join together to defend their communities (and, by extension, their defining features), the question of what "normal" is and whose job it is to decide what counts as normal is arising with increasing frequency.

Many argue against the standardization of the population towards a particular norm in favor of both physical and neurological diversity. At the other end of the spectrum are those who are fighting for their right to use neuroprosthetics as an enhancement tool. This is adding a new dimension to the traditional neuroenhancement debate, while incorporating the question of bodily autonomy. Should neuroprosthetic devices exist to allow new 'abnormal' experiences, as in the recent case of an implant allowing a man to 'hear' color? Should they be banned so as to continue the push towards a standardized population and treat both sets of outliers equally?

While ethicists argue the merits of each side, researchers are steadily developing neuroprosthetics with an increasingly diverse range of medical applications. Cognitive prosthetics are creating a new world of potential treatments for devastating brain and nervous system disorders such as Alzheimer's disease, Parkinson's disease, and paralysis. The potential of these devices is unparalleled and could change the face of these disorders. Even so, we need to be aware of the risks to certain communities of espousing the life-changing qualities of these enhancements.

Nonetheless, we as ethicists and scientists need to be careful to walk the narrow line between the device that cures or treats and a device that may disrespect a person's identity, and potentially destroy a thriving community. While it is not a given that neuroenhancement technologies are immutably bad or dangerous, we need to be aware of the totality of both positive and negative aspects in order to aid those working in the field of neuroprosthetics in understanding the implications of their work. If a device the majority of society deems unquestionably positive -- the cochlear implant -- can stir such debate, it stands to reason that more controversial devices will certainly polarize the conversation. As such, we as scientists and ethicists need to be prepared

with the best answers we can provide to help reduce abuse and inappropriate application of new generations of neuroprosthetics.

50: Transcending Mendelian Genetics: What are the Ethical Implications for the Use of CRISPR Together with Gene Drive in Humans?

Michael Nestor (The Hussman Institute for Autism Baltimore Maryland) and Richard Wilson (University of Maryland Baltimore County)

CRISPR genome editing has already reinvented the direction of genetic and stem cell research. For more complex diseases it allows scientists to simultaneously create multiple genetic changes to a single cell. Technologies for correcting multiple mutations in an in vivo system are already in development. On the surface, the advent and use of gene editing technologies is a powerful tool to reduce human suffering by eradicating complex disease that has a genetic etiology. In this paper, we critically analyze this hypothesis from an ethical perspective by developing an anticipatory ethical analysis of the implications for the use of CRISPR together with gene drive in humans.

Modern molecular biology techniques have allowed genetic engineering for many decades; however, this manipulation of the genome has been limited due to lack of specificity and off-target effects. Recently, the advent of CRISPR gene editing techniques has been used to very precisely edit the genes of cells and organisms in a highly efficient manner. CRISPR can be used to edit the germline of embryos, implying that any corrected or introduced mutations can be subsequently passed to offspring. However, the limitations of Mendelian genetics prevent rapid changes in the populations of some CRISPR-edited organisms. By combining CRISPR with gene drive, edited genes can be spread throughout an offspring population at rates significantly higher than Mendelian genetics would predict. In rapidly reproducing populations like insects the combination of these systems has the potential to wholesale change the genetic characteristics of entire populations rapidly. CRISPR and gene drive has been proposed to be used to induce negative ecological impacts on invasive insects or organisms, and prevent the reproduction of malaria-containing mosquito populations. These uses imply that this technology can be easily controlled and will benefit humans.

Although whole scale changes can occur in the population genetics of rapidly reproducing species, changes in organisms with a long life-span would take decades or centuries using CRISPR and gene drive. This, combined with the notion that over long periods of time natural selection may undo the effects of CRISPR and gene drive and artificial mate control can limit their scope, has been used as an argument against the effectiveness of these technologies in humans.

Using an anticipatory practical ethics based on Robert Audi's moderate intuitionism, we explore the implications of a CRISPR and gene drive system in humans and whether there are sufficient ethical concerns based on this analysis.

Session F2: Paper Set 9 – Ethics of Autonomous Machines

36: Algorithm anxiety - Do decision-making algorithms pose a threat to autonomy?
Saskia K. Nagel (Universitiet Twente), and Viorica Hrincu and Peter B. Reiner (both University of British Columbia, National Core for Neuroethics)

Algorithms are ubiquitous features of the modern world. People value them for the myriad functions they satisfy, but substantive concerns exist with respect to potential deleterious effects they may have upon both individuals and society at large. These misgivings lead to ALGORITHM ANXIETY, an umbrella term for characterizing the worries that people have about the impact of algorithms upon their lives. Well-publicized concerns run the gamut from fears about job displacement to the idea that reliance upon technology is unnatural. A less well-appreciated set of worries arise as people begin to perceive of computers, smartphones, and other algorithmic devices as an extension of their minds. We suggest that this widely perceived but little documented phenomenon is essentially a real-world manifestation of the extended mind hypothesis which argues that our minds are not necessarily limited to our brains but may also include external tools (such as algorithms). If algorithms are perceived as TECHNOLOGIES OF THE EXTENDED MIND (TEMS), then algorithms rightfully become included in the full range of debates over modifying, surveilling, or otherwise intruding upon our brains.

In the present paper, we evaluate the impact that perceiving of decision-making algorithms as TEMs may have upon autonomy. One possibility is that as people become more accustomed to the notion that the algorithms that surround them function as TEMs, the less they are bothered by what may otherwise be thought of as an autonomy violation. It is also possible that people will be sensitized by the growing ubiquity of TEMs, and perceive of their decision-making activities as a more problematic autonomy violation. Irrespective of whether the growing perception of algorithms as TEMs comforts or worries people, we hypothesize that at least three secondary features will modulate ALGORITHM ANXIETY.

First, the importance of the algorithmic decision-making may vary across a spectrum from the frivolous to the serious, potentially having a significant impact upon the perception of the autonomy violation. Second, the persuasiveness of the algorithm can vary, thereby modulating the extent of any potential autonomy violation from that wrought by simple decision aids to outright usurpation of the decision. Finally, as intelligent persuasive technologies learn about user preferences, the more the user perceives that they retain some form of control of the process of personalization, the more they will trust the algorithm to act as proxy decision maker.

We suggest that time is ripe for embarking upon a systematic research program that both explores the relevant normative issues and probes public attitudes towards algorithmic decision-making. Such normative and empirical analyses will be of substantial importance to scholars in the social and cognitive sciences who are interested in studying the phenomenon of the extended mind in a real-world scenario. These same investigations will be of practical importance to those groups engaged in developing decision-making algorithms.

1: "Robot Warriors Autonomously Employing Lethal Weapons": Can They Be Morally Justified?

Zhaoming Gao (Nanjing Normal University) and Meizhen Dong (Nanjing Normal University)

It is a general trend that robots are increasingly applied in various fields. So is it in the military area. To some extent robot warriors have already been in existence, such as robot bomber, unmanned reconnaissance aircraft, mine clearance robots, etc. In such rapid development, it would not be far away from now on for "Robot Warriors Autonomously Employing Lethal Weapons" to join military action in a war if we as human beings do not take some special measures to prevent it from taking place. This judgment is based upon the two reasons: one is that the relevant techniques verge to being mature. The other is that minimizing the casualties is the main goal in a war. This is not only because of the pressure of domestic politics and humanism, but also because of vast pension and life insurance of injuries and deaths of soldiers.

A so-called "Robot Warrior Autonomously Employing Lethal Weapons" refers to the Robot Warrior, although being deployed some kind of setup program, can be his own master (autonomously) in the following: a. acting without telecontrol; b. employing weapon autonomously; c. determining a target autonomously; d. judging by himself; e. deciding to start fight button independently.

Before the appearance of the "Robot Warriors", there are some premised restricted principles on the manufacture and use of robots. Two of them are the most important: the principle of no harming human life and the principle of obedience to man's command, which have priority in value sequence. The appearance of the "Robot Warriors Autonomously Employing Lethal Weapons" would totally break through these two restrictions from the root. "Robot Warriors Autonomously Employing Lethal Weapons" implies the robots could autonomously kill human beings; it also implies that the robots could break away from man's direct control and command, radically challenging man's current ethical ideas and relations. The core of such a challenge lies in:

(1) Is man the only subject with subjectivity and free will on the earth? If the answer is yes, then how can a robot warrior without free will have autonomy? If the answer is no, then what is the relationship between human beings and "Robot Warriors Autonomously Employing Lethal Weapons"? Can the Robot Warriors autonomously order and dominate human beings? Even as some kind of restricted subjects, "Robot Warriors Autonomously Employing Lethal Weapons" implies the mutation from purely instrumental robots to the ones with subjectivity. The consequences the Robot Warriors could bring about may be much more than we can imagine, and could completely overthrow our current social living order.

(2) If "Robot Warriors Autonomously Employing Lethal Weapons" have the ability of autonomously choosing to kill man, can the principle of humanity as man's moral bottom line still work as before? If the humanistic principle be shaken, what can be man's spiritual home? Where is the existing possibility of the golden rule of "never do to others what you would not like them to do to you" and Kant's "common sense"?

Even if we set the goals for the "Robot Warriors" with the limited autonomy and effectively control them, it is still suspicious whether they can be assured not to break the bottom line of humanity, justice, obedience. According to Aristotle's classification, such military actions as autonomously employing lethal weapons belong to the area of practical reason, which is not rigorously logical but vague and approximate, differing from theoretical reason. The standard of judging whether the activity of practical reason is good is "appropriate" or "the mean." The appropriateness of activity depends upon a specific situation and its judgment besides the purpose that is itself determined by moral reason.

All human activity cannot do without imagination (Dewey), and there may be infinite varieties in reality. Man's effective actions rely on his specific cognitions and estimations in concrete activities. Man has sentiments, reason and judgments. He is able to distinguish between truth and falsity, and to take measures corresponding to specific situations and changes of the attitudes of the rivals, to determine whether the surrenders and the injured, are really surrenders and injured. All of these may be beyond the ability of "Robot Warriors Autonomously Employing Lethal Weapons."

For "Robot Warriors Autonomously Employing Lethal Weapons," the question is how to distinguish between enemies or friendly forces, and our military. And for us, the question is how to make sure that the Robot Warriors will not reverse the guns to our side.

7: Prescriptive and Proscriptive Moral Regulation for Autonomous Vehicles in Approach and Avoidance

Selina Pan, Sarah Thornton and J. Christian Gerdes (all Stanford University)

Driving is transitioning from a human skill set toward an automated process, thus changing intuitive human driving decisions toward engineering decisions. In addressing the issue of engineering decisions that reflect ethical human driving behavior, we turn to philosophical principles used to frame ethics in broad human behavior. Proscriptive and prescriptive moral regulation provides the basis for ethics in approach and avoidance behavior, concepts that translate well to reasonable programming of autonomous vehicles. This work uses approach and avoidance to guide ethical algorithm design on autonomous vehicles. These regulatory approaches balance competing goals in a model predictive control framework for an autonomous vehicle traversing a road with obstacles.

Session F3: Paper Set 10 – Ethics in Markets, Corporations, and Workplaces

43: Exchange-rate Market, Deep Learning, and Agent Modelling

Svitlana Galeshchuk (Ternopil National Economic University) and Yves Demazeau (CRNS – LIG)

In general, two approaches to the analysis of financial market price prediction dominate in practice: technical and fundamental analyses. Technical analysis is concerned with the dynamics of the market price and volume behavior itself, rather than with the fundamental economic nature of specific securities that are traded.

Fundamental analysts assume that prices in financial markets are based on economic principles, and that prices may be predicted based on fundamental and publicly available economic data, such as earnings and market share, interest rates, cost trends, competitive forces, and so forth. The researchers like [Cao 2015] investigate the integration of fundamental and technical analyses to improve the prediction accuracy of financial indices. Among these indices it is crucial to predict exchange rates since, for example they influence on revenue and stock market prices of international companies [Galeshchuk 14].

Among the prediction models, artificial neural networks are popular tools for financial decision making because they have very good adaptive and generalizing abilities while providing high accurate prediction results. Over the last decade brain inspired deep learning, originally introduced by [Hinton 02], has proven being a very robust and efficient mechanism for a variety of application areas, i.e. face detection, speech recognition and general object recognition, natural language and others. There are few applications of deep learning in finances only. This motivates us to investigate the effectiveness of deep networks to predict change in foreign exchange rates using state-of-the-art deep learning framework [Tensor Flow 15] and a proper use of exchange rate data as inputs to the models prediction. It states an urgent research problem to address that can allow creating profitable trading strategies and even beat the market in its semi-strong form. Our empirical study uses the exchange rates between the US dollar and three major currencies: Euro, British Pound, and Japanese Yen. Results with test data demonstrate that trained deep networks achieve satisfactory prediction accuracy.

Unsupervised learning presents difficult task to be properly conducted, so there are not a lot of experts in this domain. Hence, those who will be able to use these computational methods in finance in the near future could cause a significant competition to the chartists who implement baseline models. Secondly, if we surely want to investigate how market inefficiencies over brief periods can be exploited to create profitable trading strategies, we also want to reach accurate prediction of exchange-rate markets for the benefit of every citizen in every country. Thirdly, the task of the designer is rather complex as the market involves the modelling of human agents and artificial autonomous agents evolving on the market. Altogether, it is necessary to admit that even the most sophisticated deep learning tools are comparable only with the brain of an insect in terms of overall number of neurons. There is more scientific progress that needs to be made before one can realize the ambitions of researchers and traders working in this field and translates it to a fair competition where nobody will forget the final end-user.

45: Balancing Legal and Moral Aspects in Large-Scale Agent-Based Systems

Yves Demazeau (CRNS – LIG)

Engineering large-scale agent-based systems evolves towards more ethics, to better respect the end users these systems are designed to serve. In [Demazeau 14] we have proposed an iterative method of constructing such ethical systems, divided into six stages. In this process, the agents are the processing entities of the systems developed; some are representing the end users, some others may represent the designer herself. In

this paper, we are focusing on the two first stages of the method: 1. Modelling end-users in terms of preferences, capabilities, activities and expectations, and the environment in which they operate. The models are limited to what is necessary. 2. Protecting personal end user data by mechanisms to ensure privacy. These mechanisms have to be provided by the designer, or the end user should be allowed to provide the system with some of its own.

Some approaches like [Crépin 09] guarantee the user's privacy by constraining the agents to follow shared rules. This assumes the existence of some kind of unified legal frameworks. Such frameworks are usually based on communication protocols and normative logics. They exist at national levels; some of them are now getting unified here and there at a more international level, like recently in the EU; but our human world will always stay far from a worldwide unified regulation. Other approaches like [Piolle 11] propose to attach artificial agents to each human end-user agent, kinds of personal assistants to represent the end-user and to preserve her privacy over time. What is referred here is moral frameworks, each personal assistant reflecting the value system of the end-user. Personal assistants are usually grounded on deontic logic; but the models rarely embed religious and socio-cultural aspects while they largely vary all around the world. There is no hope of a fully integrated neither legal nor moral human framework, but artificial agents consists a rapidly growing domain and their use in complex problem solving is becoming crucial, for example in financial market prediction [Galeshchuk 16].

In this paper, we investigate how to determine for each artificial agent, at design time, the right balance between legal aspects and moral aspects of such agents. We propose that the designer builds the system on a domain basis, according to the end user's system of values, up to the maximum level the end-user is able to accept, in respect to the legal framework the end-user lives in. We show how this balance depends on the problem to solve, of the application domain, and how it should evolve over time. In autonomous transports, the agents' specifications depend on the kind of transport, of local regulations, and to social legal rules. In health informatics, the specifications to support people depend on religious, cultural, and of the individual moral values. In finance market simulation, the agents' specifications mix all these aspects together. With this work, we believe to pave the way to the development of more sophisticated autonomous agents and multi-agent systems that are "ethical-by-design", for the main benefit of the end users.

11: Ethics and Compliance in Corporations

S Chandran and Anthony Lobo (both Tata Consultancy Services)

In the corporate world, one comes across titles such as Ethics Counsellor, Compliance Officer, Ethics and Compliance Officer, Conduct Officer, Ethics Officer and many others. Whatever the title, the common goal for all persons holding these titles is to promote responsible conduct in the corporation. The overarching goal being the same, the approach and strategies differ based on the chosen title: Ethics or Compliance. Under the Ethics approach, one either strives to select individuals with good character and depends on the inherent goodness of the chosen employees, or takes the approach of ethics exhortations. With the Compliance approach, one depends on

codified rules and adherence to the codified rules which might originate from the law, and be extended by the company policies. Both approaches have pros and cons, and the cons often outweigh the pros as evidenced by the various stories in the newspapers of corporate misadventures.

There is a third approach based on "values", "conduct", and "stakeholders", which can possibly be more effective in resonating with the employees of a corporation, and which can steer the corporation along the path of responsible conduct. Technology corporations are increasing in number globally, either based on their sphere of operations, or based on the extent of the impact of their products. The workable approach on promoting responsible conduct in a corporation must be applicable in the global landscape. By identifying the stakeholders in the corporation, by recognizing the interests of the stakeholders, committing to the values and obligations towards stakeholders, the appropriate conduct of the corporation towards the stakeholders can be steered to meet the overarching goal of responsible conduct.

The authors of the proposed paper are practitioners of business ethics in corporations, and draw on their experiences in implementing an ethics and compliance program in a global organization with a 300,000 strong multicultural workforce.

29: The Perceived Job Ethics in two Cultures: Contrasting Experiences of Laureates Shuji Nakamura and You You Tu

Ted Fu (National Cheng-Chi University)

In this paper we study the perceived compensation and job ethics of employees from their employer in two different cultures. The samples we choose are recent Nobel Laureates, Shuji Nakamura (US and Japan) and You You Tu (China).

Laureate Shuji Nakamura spoke to let people know the compensation and rewards experience with his previous hiring company Nichia. The longitudinal experience ranged from having great hardship at the beginning in early 1979 till successfully developed the world first bright blue LEDs in end of 1993. Shuji Nakamura won Nobel Prize in Physics in 2014 "for the invention of efficient blue light-emitting diodes which has enabled bright and energy-saving white light sources."

The following describes Nakamura's mixed experience at Nichia in Japan: "The only way a corporate researcher can contribute directly to the bottom line is through patent royalties. But fearful of losing trade secrets, Nichia did not permit patent applications. Thus Shuji's apparent sales were zero. In ten years [, from 1979 to 1988,] Shuji had not published a single scientific paper, because of Nichia's policy of keeping its technical know-how secret. From a professional point of view, he had no achievements." "Finally, in desperation, he approached the president with an audacious proposal: to develop the world's first bright blue LED." Shuji asked for five hundred million yen and he got it out of a total surprise.

Although Laureate Shuji's case was extraordinary, we learn from his detailed description of his hardship since he was as an entry-level specialist till becoming the star in his company. Shuji described the support and compensation on his way to success from

his first employer, "an obscure local chemical firm called Nichia." This experience is unusual and enlightening, since not all renowned Japanese scientists are so outspoken.

Even more unusual is the cross-culture experience of Shuji. Six years after he had developed the world first true bright blue LEDs at the end of 1993, he accepted a job offer at University of California, Santa Barbra at the end of 1999, at an age of forty-five. He described his experience in the very different cultures, in different period of his life, very vividly. "Shuji currently [as of 2014] holds more than 200 US patents, over 300 Japanese patents and has published more than 550 papers in his field."

Shuji was very thankful and satisfying about the support and compensation, except the patents ownership fights, of his Japanese employer. However, after being told by his American colleagues of the US prevailing compensations of making a series of exceptional technology breakthrough, he felt shocked and unsatisfied. Shuji's American experience broadened his research scope, enriched his life, and opened his eyes. We learn a great deal from the comparative views uniquely experienced and boldly expressed by Shuji Namamura.

You You Tu, who discovered the new anti-malaria drug 'artemisinin', saved millions of lives worldwide; and won the 2015 Nobel Prize in Physiology/Medicine had always held a very low profile like a philanthropist, on the other hand.

Session G2: Paper Set 11 – Teaching Engineering Ethics: Methods and Approaches

14: From Nanosystems to Ethical Eco-systems: Designing a Workshop for Graduate Researchers on Self-Powered Wearable Health Devices

Xiaofeng Tang, Sarah Clark Miller and Thomas Litzinger (all Pennsylvania State University)

In early spring of 2015, an engineering faculty member approached the Director of the Leonhard Center for Enhancement of Engineering Education and asked for a four-hour ethics workshop for Penn State University graduate students who were involved with the National Science Foundation Nanosystems Engineering Research Center for Advanced Self-Powered Systems of Integrated Sensors and Technologies (ASSIST). The faculty member explained that the training should be completed before the end of the same semester. This paper reports the process of designing an ethics workshop for graduate students by an interdisciplinary team. It also reflects upon the strategies used by the design team to overcome multiple constraints. The workshop consists of three components: a pre-assignment; a two-hour presentation and discussion, and a brief survey after the meeting. The objectives of the overall experience are:

1. Increasing participants' awareness of the sociotechnical systems within which their research exists and the fact that achieving the goals of ASSIST requires synergy from different components within the systems.
2. Helping participants to recognize that a variety of ethical issues—related to research integrity, broader impacts, and embedded value choices—arise

from distinct actors and connections in the system, and to develop their ability to identify these issues.

3. Providing the participants with resources and frameworks to support them as they engage in ethical reflection and reasoning.

The design team was confronted with, and successfully overcame, multiple constraints: developing the ethics workshop in a short timeframe; providing a learning experience relevant to students whose research field is unfamiliar to most of the team members; and adapting to the busy schedule of graduate students. The post-workshop survey shows that some of our objectives, especially assisting students' development of a broad, systemic view of ethics related to their own research, were successfully met. The survey also indicates areas for improvement.

51: Technology and Designing Flourishing Societies: Teaching Technology Ethics Using the Capabilities Approach

David Mcgraw (James Madison University)

Undergraduate science and technology students are more likely to be able to think about ethical problems in an organized and critical manner when given a theoretical framework. While the author endorses using ethical reasoning theories such as utilitarianism and deontological rights, the author suggests that an Aristotelean conception is also a promising technique for teaching ethics, and, in particular, finds that the capabilities approach, most frequently associated with Martha Nussbaum, is a particularly useful framework for students to apply to science and technology problems.

This paper will explore the use of the capabilities approach as an analytical framework for teaching students to think ethically about the design of technology. This will include teaching students to think about conventional professional responsibility problems and compliance with engineering codes of ethics, but the focus of the paper will be on teaching students to contemplate appropriate ethical issues when designing technologies. First, in the former category, the traditional professional responsibility problems are too often taught in the language of clear rules, violation of which will lead to certain punishment. "Don't cheat, because your career could be over if you are caught" is too often the only curriculum for a responsible conduct of research lesson. The author's approach suggests that a more useful way to frame the issue is to encourage the students to begin with the question, "how might we best create a flourishing society?," followed by contemplating a properly-functioning scientific community and its role in a flourishing society.

However, the emphasis of the paper is on strategies to teach students to imagine possible ethical implications of technological design alternatives. Rather than merely encouraging students to brainstorm about human impacts of technologies on humans, the suggested approach would start with the conception of a flourishing society and encourage students to think about the role of technologies in enhancing or threatening essential capabilities. The capabilities approach provides a list of important elements for human flourishing and, as such, can be used as a checklist for designers to consider in evaluating the potential impacts of technological designs.

15: Integrating ethics into engineering education without teaching ethics

Wade Robison (Rochester Institute of Technology), Deborah Mower and Mark Vopat (both Youngstown State University), and Adam Potthast (Park University)

When engineers solve a design problem, they are making a choice among a set of possible solutions. There are always alternatives, that is, to what ends up being chosen. The choice is driven by a variety of considerations — cost, safety, likelihood of breakage, ease of manufacture, ease of repair, and so on. The list is long, but it is effectively an ethical checklist. It is ethically wrong to cause unnecessary harm, and at a minimum any choice ought to produce less harm than the other alternatives, all else being equal. So one way to integrate ethics into engineering curricula is to change the way we look at choosing design solutions. Mark out the harms that each alternative will produce and the benefits and recognize that the ethically optimal solution is the one that produces the least harm with the most benefits.

The advantages are that no ethical theories need to be inculcated, no extra sessions need to be inserted into already crowded curricula, and no training in ethical theory is required for either faculty or students. We all already make judgments where we assess the harms and benefits of alternative choices. It is not possible to drive down a road without making such calculations. When we see someone texting, for instance, with the subsequent erratic behavior, we respond with a calculated move to minimize any harm that might ensue (e.g. by slowing down, or passing quickly). So students and faculty are not learning a new decision-procedure, but looking at the decision-procedure they already use in a different way. That new way of looking may permit a better understanding of why some choices are better than others and may open up new considerations (e.g., environmental harms) that might have been ignored in previous design solutions. Expanding the range of possible harms would be an advantage as well.

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