fPET2020

On-line Forum on Philosophy, Engineering and Technology

17-19 November, 2020

Agenda and abstract book

https://philosophyengineering.com/

Proudly supported by:

UNIVERSIDAD TECNICA FEDERICO SANTA MARIA

DEPARTAMENTO DE ESTUDIOS HUMANÍSTICOS

*f*PET 2020 Conference Chairs

- Andrés Santa-María (Universidad Técnica Federico Santa María)
- Albrecht Fritzsche (Ulm University)

Program committe

- Marcos Alonso (Universidad Adolfo Ibáñez)
- Luciano Andreatta Carvalho da Costa (Universidade Estadual do Rio Grande do Sul)
- José A. Aravena-Reyes (Universidade Federal de Juiz de Fora)
- Philip Chmielewski (Loyola Marymount University)
- Shannon Conley (James Madison University)
- Rockwell F. Clancy (TU Delft)
- Michael Davis (Illinois Institute of Technology)
- Neelke Doorn (TU Delft)
- Claudia Eckert (The Open University)
- Matthew Harsh (California Polytechnic State University)
- Deborah Johnson (University of Virginia)
- Yanna Lambrinidou (Virginia Tech)
- Diego Lawler (CONICET, Argentina)
- Glenn Miller (Texas A&M)
- Édison Renato Pereira da Silva (Universidade Federal do Rio de Janeiro)
- Patricio Quintana Gallo (Universidad de Valparaíso)
- Sabine Thuermel (TU München)
- Steven Umbrello (Institute for Ethics and Emerging Technologies)
- Carlos Verdugo Serna (Universidad de Valparaíso)
- Pieter Vermaas (TU Delft)

*f*PET steering committee

- Richard Evans (Cornell University)
- David E. Goldberg (ThreeJoy Associates, Inc.)
- Diane Michelfelder (Macalester College)
- Carl Mitcham (Colorado School of Mines)
- Byron Newberry (Baylor University)
- Joe Pitt (Virginia Tech)
- Ibo van de Poel (TU Delft)
- Natasha McCarthy (Royal Society)
- Viola Schiaffonati (Politecnico di Milano)

*f*PET2020 – Program

(The agenda is set according to UCT/GMT +0)

Tuesday 17		
11:45		Opening
12:00	**Minoru Asada** (Osaka University)	Key note: **"Robot sense of agency: self, autonomy, pain, and ethics"**
13:00		Break
13:15	Albrecht Fritzsche (Chair)	Interactive session on international collaboration, project development and research opportunities
14:00		Break
14:15		Concurrent sessions I
	Chair: Geoff Crocker	**Track A: Knowledge in Engineering**
I-A1	Tomas Undurraga R	Forest fires and the new climate regime in Chile: Interrogating how forest engineers produce knowledge about the environment and its value.
I-A2	Claudia Eckert, Martin Stacey and Mark Addis	Past designs are repositories of tacit collective knowledge
I-A3	Mitch Ambrose	Applying 'National Values' in Risk Assessments of International Engineering Collaborations
	Chair: Ronald Álvarez	**Track B: Técnica, vida y praxis**
I-B1	Luiz Abrahão	A Teoria do Triato de Peter Engelmeyer no contexto da germinação da Filosofia da Técnica a partir de "Questões gerais sobre a Técnica" (1899) e "Esboço de uma 'Heurologia'" (1911)
I-B2	Juan David Reina-Rozo	Solapunk e ingeniería: Apuntes desde la ciencia ficción
I-B3	Maria Jose Rios Araya	TRIPTICO (Nuevas tecnologías, nuevas percepciones y usos) Participación e interacciones híbridas desde la propuesta wearable:
15:45		Break
16:00		Concurrent sessions II

	Chair: Albrecht Fritzche	**Track A: Transitions of Technical Experience**
II-A1	Juan David Reina-Rozo	The role of innovation in transitions towards alternatives to development
II-A2	Jose Aravena-Reyes	Engineering, Xamanism and the Concretization of the Human
II-A3	Cristiano Cruz	How can Brazilian grassroots engineering help decolonize engineering and philosophy of engineering/technology?

	Chair: Rick Evans	**Track B: Engineering Education, Ethics and Equality**
II-B1	Jimena Pascual, Patricia Jimenez, Franco Guidi and Sofia San Martin	Women's disengagement in computer programming courses, a look through critical realism lenses
II-B2	Neelke Doorn, Lavinia Marin, Sabine Roeser, Taylor Stone and Janna van Grunsven	Ethics for Comprehensive Engineers: A Retrospective and Prospective Sketch of TU Delft's Engineering Ethics Education

17:30		Break
17:45		Concurrent sessions III

	Chair: Barbara Silva	**Track B: Filosofía e Ingenería en América del Sur**
III-A1	Alexei Ochoa-Duarte	Integración de los Objetivos del Buen Vivir en la educación en ingeniería para la cuarta revolución industrial
III-A2	Mauricio Aguilar-Molina	Uma proposta para formação em Ética no curso de Engenharia Civil da UFJF
III-A3	Andrés Leonardo León	¿Es posible la enseñanza de una ingeniería con las comunidades en un contexto neoliberal?

19:45		Networking and socializing opportunities

Wednesday 18

10:30		Concurrent sessions IV

	Chair: Claudia Eckert	**Track A: Engineering, Risks and Standards**
IV-A1	Erik Aslaksen	Freedom, Risk, and Standardisation
IV-A2	Dazhou Wang	On Engineering Imaginary
IV-A3	Michael Poznic	Models in Engineering and Design: Modeling Relations and Directions of Fit

	Chair: Lavinia Marin	**Track B: Engineering Education, Ethics and Practice**
IV-B1	Priyan Dias	The Formation of Reflective Engineering Practitioners
IV-B2	Andres Santa-Maria	How practical philosophy of technology can be? Some considerations on the teaching of philosophy of technology in Engineering programs
IV-B3	Diana Adela Martin, Eddie Conlon and Brian Bowe	Engineering ethics education: exploring attempts of defining a fragmented discipline

12:00		Break
12:15		Concurrent sessions V

	Chair: Sabine Thuermel	**Track A: Digital Technology and Sovereignty**
V-A1	Matías Quer	The problem of Digital Direct Democracy (DDD) and its philosophical foundations
V-A2	Albrecht Fritzsche	Digital Sovereignty and Innovation – Setting the Foundations for a Never-Ending Project
V-A3	Shuhong Li, Aimee van Wynsberghe and Sabine Roeser	Robots and human autonomy: an assessment on the impacts of care robots on the autonomy of caregivers in elderly care

	Chair: José Aravena-Reyez	**Track B: Complejidad, riesgos y diseño**
V-B1	Cinthia Varella, Francisco Lima, Marcelo Alves and Raquel Manzanares	Condicionantes sociais em processos de concepção: o caso da esteira de triagem nas cooperativas de catadores de materiais recicláveis
V-B2	Álvaro Armijo Torres	Complejidad social e incertidumbre: Bases para el estudio de los fenómenos sociales desde la ingeniería de sistemas sociales
V-B3	Alberto Lecaros Urzúa	Anticipación de riesgos en el uso de la Inteligencia Artificial en medicina

13:45		Break
14:00		Cocurrent sessions VI

	Chair: Édison Renato Silva	**Track A: Design and Construction fo Engineering Artefacts and Agendas**

VI-A1	Zahra Meghani	The 'construction' of GE mosquitoes with gene drives as the solution to the high incidence of mosquito-borne diseases among the socio-economically marginalized in parts of the global South: An epistemically and ethically responsible engineering practice?
VI-A2	Barbara Silva, Cecilia Ibarra and Mauricio Osses	History of Solar Engineering as a Collaborative Practice in Chile
VI-A3	Claudia Eckert	Modular design to maximise reuse

	Chair: Carolina Vega	**Track B: Desafíos éticos de la ingeniería**
VI-B1	Jose Aravena-Reyes and Walter Bazzo	A Inadequação Filosófica das Normativas da Engenharia no Brasil
VI-B2	Daniel Toscano López	Tecnología y biomejora humana: desafíos actuales a la ética
VI-B3	Luciano Andreatta-da-Costa, Walter Bazzo	A importância da interdisciplinaridade em engenharia para a formação do pensamento crítico

15:30		Networking and socializing opportunities
15:45		Break
16:00	**Donna Riley** (Purdue University)	Keynote: **"Engineering Principles: Public Values in Professional Life"**
17:00		Break
17:15		Concurrent sessions VII

	Chair: Zachary Pirtle	**Track A: AI, Design and Ethics**
VII-A1	Ken Archer	Agency, Ethics and AI
VII-A2	Steven Umbrello	Designing AI Towards Sustainable Development Goals: A Value Sensitive Design Approach
VII-A3	Laura Corti	Towards a New Trend in AI Engineering: the Human-Centric Approach

	Chair: David Goldberg	**Track B: COVID 19 Pandemic**
VII-B1	Carl Mitcham, Alfred Nordmann and Liu Yongmou	Should the pandemic invite a rethinking of technocracy?
VII-B2	Diane Michelfelder	US Public perception of science and engineering in pandemic times: Dejà-vu all over again?

VII-B3	Jason Borenstein, Joseph Herkert, Yvette Pearson and Keith Miller	Autonomous Vehicles and Pandemic Response: Ethical Challenges and Opportunities

19:15 Networking and socializing opportunities

Thursday 19

10:30 Concurrent sessions VIII

	Chair: Priyan Dias	**Track A: Stakeholders and Power Relations in Engineering**
VIII-A1	Paul Firenze	Engineering Consensus: Crowdsourcing a Moral Machine in a Pluralistic World
VIII-A2	Hugo Pereira	Engineers vs political and financial stakeholders in Portuguese railways: a sociotechnical approach to a peripheral nation (1850s-1910s)
VIII-A3	Ira Monarch, Eswaran Subrahmanian, Muriel Mambrini-Doudet and Anne Francoise Schmid	Transduction of power in engineering research and practice: an inter-disciplinary and extra-disciplinary approach

	Chair: Michael Poznic	**Track B: Concepts, Representations, Ontologies**
VIII-B1	Nina Jirouskova	An Upper Ontological Model proposal for the engineers of today: why should we think about it, and how can we formulate a tractable solution in support of practice?
VIII-B2	Jose Aravena-Reyes	Conceptualizing Engineering for Educational Purposes
VIII-B3	Antonio Ruiz Capilla	Discontinuist pluralism in philosophical materialism: preliminary notes

12:00 Break

12:15 Concurrent sessions IX

	Chair: Erik Aslaksen	**Track A: Engineering, Action and Reflection**
IX-A1	Carolina Vega Muñoz	Theory of action in technical objects: automation and mediation
IX-A2	Albrecht Fritzsche	The potential of cinema to address multiple layers of technical action
IX-A3	Daiana Martinez Monteleone	What do overhead lines reveal?

	Chair: Patricio Quintana Gallo	**Track B: Repensando la Ingenería, la Ciencia y la Filosofía**

IX-B1	Ronald Alvarez Vera	Ciencia y filosofía en el Antropoceno. La necesidad de la reflexión filosófica en el progreso tecnológico
IX-B2	Martin Parselis	Tecnologías Entrañables para una nueva ingeniería
IX-B3	Miguel Jáuregui	El software libre como caso emblemático de desarrollo tecnológico alternativo y entrañable

13:45		Break

14:00	**Ibo van de Poel** (TU Delft)	Keynote: **"Worlds apart? What philosophy and engineering can learn from each other"**

15:00		Break
15:15		Concurrent sessions X

	Chair: Diana Adela Martin	**Track A: Engineering Education, Experience and Interaction**
X-A1	Hector Gustavo Giuliano, Leandro Ariel Giri, Fernando Gabriel Nicchi, Federico Vasen, Martin Parselis, Lydia Fabiana Ferreira Aicardi, Sergio Enrique Mersé and Walter Weyerstall	'Good Judgment' in Engineering. Philosophical discussions and pedagogical opportunities
X-A2	Humberto Arruda and Édison Renato Pereira da Silva	The Plausibility of an Active Learning Maturity Model for Engineering Schools: Practical and Philosophical Concerns

	Chair: Eswaran Subrahmanian	**Track C: Cities fo the Future**
X-B1	Anouk J.P. Geenen, Julieta Matos Castaño, Mascha C. van der Voort and Peter Paul C.C. Verbeek	Controversies as a means to elicit values in responsible smart city design
X-B2	Mark Bessoudo	Engineering Eudaimonia: Philosophical and Technological Considerations for Creating Healthier Cities
X-B3	Sabine Thuermel	The Exploration of the Unknown in Smart Systems and the Smart Society

16:45		Networking and socializing opportunities
17:30		Break
17:45		Concurrent sessions XI

	Chair: Andrés Santa-María	**Track A: Engineers in Society**
XI-A1	Zachary Pirtle	Engineering humility for society: The union between engineering epistemology and macro-ethics
XI-A2	Thomas Siller and Gearold Johnson	Should engineers be activists?
XI-A3	Nina Jirouskova	A new role definition for today's engineers: The "ethical engineer"

	Chair: Bruno Gransche	**Track B: Economics of Engineering**
XI-B1	Stanley Kranc	What is the "Cost Of Living" in a Technologized World?
XI-B2	Geoff Crocker	The Economic and Social Consequences of Engineering - how engineering creates economic dysfunction and social exclusion
XI-B3	Kristen Psaty Watts	Who is Talking Now? : Social Media Influencers, Speech, Exchange, and Identity

19:15		Closing session

ABSTRACTS

I.A1

Forest fires and the new climate regime in Chile: Interrogating how forest engineers produce knowledge about the environment and its value.

Tomas Undurraga (Universidad Alberto Hurtado, Chile)

Forest fires are one of the most serious environmental problems facing Chile today. Between January and February 2017 more than 587,000 hectares were burned, generating great human, economic and environmental losses. The fires have generated controversies around the anthropic origin of fire, the inability of the State to control the fires and the responsibility of the forest industry in these catastrophes. Scientist's claim, on the basis of mounting evidence, that large scale plantations of pine and eucalyptus have diminished the water supply in valleys dominated by forest plantations, reducing the native forests and increasing the occurrence of fires. Given that the capacity of the Chilean State to produce authoritative knowledge about the environment is weak, fires have triggered multiple disputes concerning the scientific credibility of pro-business and environmental experts. At the core of these disputes are forestry engineers. This paper discusses how different groups of forestry engineers have responded to the problem of fires and analyses their role in producing knowledge about the environment and its value. It contrasts different 'epistemic communities' of forestry engineers whose work reflects different interests, but mobilizes similar expertise: those concerning forest plantations, those focuses on native forest management; forest engineer academics and those who work on public institutions of forest management – i.e. Conaf, Infor. The paper contrast their professional identities, ways of producing knowledge, deploying expertise, processes of valuing and 'economizing' the environment. In particular, it explores seven critical disputes within the field triggered by forest fires: 1. Ontological: what is a forest? 2. Systemic: who is responsible for producing the fires? 3. Economic: in what lies the value of forests? 4. Ecological: how to reforest burned areas? What counts as a healthy forest? 5. Ethical: are there truly good and bad trees? 6. Industrial: what does the forestry industry contribute to the country and the environment? 7. Political: how to represent the forests interests? The paper discusses how these differing points of view, epistemic and social strategies mediate perceptions of forest fire in Chile.

Past designs are repositories of tacit collective knowledge

Claudia Eckert (The Open University)
Martin Stacey (De Montfort University)
Mark Addis (The Open University)

The design of complex products, such as cars, aircraft, or helicopters, usually builds on existing designs. In this talk we analyse the role of past designs as repositories of knowledge for a company, drawing on numerous empirical studies of design processes and a theoretical analysis of engineering knowledge. While the knowledge possessed by an individual is partial and typically only covers a small fraction of the entire product, the objects embody a significant part of the collective knowledge of an organisation. When looking at or referring to past objects, engineers use their general engineering knowledge plus their experiences with the product in question to reconstruct an understanding of the decisions that have been made and the rationales for them. Objects can express many aspects of a new design, that are difficult to express in other ways, such as solution principles, configurations, or details of the relationship between elements.

We can usefully divide engineering knowledge into explicit knowledge and tacit knowledge, that cannot be fully articulated; and into shared and personal knowledge. Much of the knowledge experienced engineers use is tacit understanding of relationships and effects, that they can employ to predict problems and guide testing and the application of computational methods. Much of the knowledge associated with objects, especially previous designs, is tacit. Tacit knowledge about objects includes both the context of use and specific details of the design. Individuals develop tacit knowledge from experience and the application of explicit knowledge; however it can be shared by individuals who have experiences in common and enables engineers in one company to develop a community of practice with shared tacit knowledge around specific objects. Explicit knowledge can also be shared or personal, and can also depend on awareness and understanding of previous designs.

For example, for several years we have been studying design margins, i.e. the amount that a parameter exceeds its requirements, which are critical for understanding whether a part of a system needs a significant redesign or can be adapted to the new design. During a design process, the relevant designers roughly know the margins, but they are typically not recorded so that only those who have personally experienced the design process know how easily a system can be adapted. While it is sometime possible to record margins explicitly, the actual margins arise from a complex interaction of the state of the design and the actual or intended context of use.

One of the challenges with object references is that designers are not necessarily aware of the limitations of their own tacit and personal knowledge. For example ,they might not know whether a system still has margins or whether they simply had not heard about problems or the effects of changes during the design process. This gives designers the illusion of understanding a past design. This can have practical implications, as people are assuming that the others' interpretations are similar to their own; and divergent understanding is only identified when problems in the implementation occur.

I-A3

Applying 'National Values' in Risk Assessments of International Engineering Collaborations

Mitch Ambrose (American Institute of Physics, Director of FYI: Science Policy News)

Several national governments are actively reworking their stance toward international science and engineering collaborations due to growing concerns that rival nations could misappropriate the technologies arising from such exchanges. The U.S. approach is marked by an emphasis on upholding "American values" within the research enterprise [1], and it has already restricted certain science and engineering exchanges in light of concerns about the "military-civil fusion" strategy of the Chinese government and human rights abuses in Xinjiang. [2, 3] Though previous literature has explored the application of "public values" in science policy [4], my paper will explore how "national values" are increasingly being applied in research evaluation, especially in the context of assessing prospective international collaborations. I will also compare two proposed risk assessment frameworks. [5, 6]

[1] "White House Looks to Bolster 'American Values' in US Research." By Mitch Ambrose. American Institute of Physics (2019) https://www.aip.org/fyi/2019/white-house-looks-bolster-american-values-us-research

[2] "Proclamation on the Suspension of Entry as Nonimmigrants of Certain Students and Researchers from the People's Republic of China." Issued by President Donald Trump. (2020) https://www.whitehouse.gov/presidential-actions/proclaThemation-suspension-entry-nonimmigrants-certain-students-researchers-peoples-republic-china/

[3] "Commerce Department Adds Eleven Chinese Entities Implicated in Human Rights Abuses in Xinjiang to the Entity List." Commerce Department (2020) https://www.commerce.gov/news/press-releases/2020/07/commerce-department-adds-eleven-chinese-entities-implicated-human

[4] "Public Value Mapping and Science Policy Evaluation." By Barry Bozeman and Dan Sarewitz. Minerva (2011) 49:1–23

[5] "Fundamental Research Security." JASON Science Advisory Group (2019). https://www.nsf.gov/news/special_reports/jasonsecurity/JSR-19-2IFundamentalResearchSecurity_12062019FINAL.pdf

[6] "Global Engagement: Rethinking Risk in the Research Enterprise." Edited by Glenn Tiffert. Hoover Institution Press (2020). https://www.hoover.org/global-engagement-rethinking-risk-research-enterprise

I-B1

A Teoria do Triato de Peter Engelmeyer no contexto da germinação da Filosofia da Técnica a partir de "Questões gerais sobre a Técnica" (1899) e "Esboço de uma 'Heurologia'" (1911)

Luiz Abrahão (CEFET/MG)

O engenheiro mecânico Peter Engelmeyer (1855-c.1940/1942) foi um pioneiro nas reflexões filosóficas sobre a Técnica. O pensador russo-germânico escreveu diversos textos sobre os princípios e a relevância de uma "Philosophie der Technik". Também dissertou sobre a invenção e da projeção técnica. Em "Allgemeine Fragen der Technik" (impresso em 12 partes no periódico politécnico "Dingler") Engelmeyer abordou as ideias de Ernst Kapp, Franz Reuleaux, Ernst Mach, Alfred Espinas e outros, além de refletir acerca do status social dos profissionais técnicos. Especificamente, defendeu que a Técnica consiste em um elemento civilizacional, e não apenas de produção material, afinal ela envolve uma transformação criativa do mundo material. Por isso, "a Técnica eleva a raça humana acima do reino animal". Nesse sentido, o pensador russo-germânico elaborou uma Teoria dos "três atos" (ou Teoria do Triato: "dreiaktige Theorie") da criação humana como parte de uma concepção geral da invenção (Erfindung). Uma versão mais acabada da Teoria do Triato de Engelmeyer foi apresentada no IV Congresso Internationale de Philosofia (Bolonha, 1911). Em "Essai d'une 'heurologie' ou théorie générale de la création humane" encontramos uma doutrina dos três atos constitutivos da criação (Schaffens; posteriormente "doutrina da invenção", Erfindungslehre): 1º ato – intuição: manifestação do desejo/intenção que forma a imagem ou ideia hipotética sobre o objetivo pretendido; 2º ato – raciocínio: estudo que transforma a ideia em plano de ação ou representação lógica (projeto); e 3º ato – reflexo organizado: execução do plano de ação, implementação. Assim, Engelmeyer conclui que o mundo da cultura, a Civilização, diferentemente da vida automatizada e instintiva dos animais, é a unidade de um mundo artificial manifesto interna e externamente ao ser humano em termos materiais, morais, estéticos e intelectuais. Nosso trabalho pretende explorar tais contribuições desse obscuro engenheiro-filósofo russo de origem germânica, um precursor da tendência contemporânea de aproximar Filosofia "e" Engenharia – de constituir um campo de saber autônomo, a recém-constituída Filosofia "da" Engenharia.

I-B2

Solarpunk e ingeniería: Apuntes desde la ciencia ficción

David Reina (Universidad Nacional De Colombia)

El arte y en particular la ciencia ficción tienen un papel fundamental para crear otros mundos posibles. Uno de estos esfuerzos se halla en la literatura, especialmente en el campo de la ciencia ficción, se trata del Solarpunk. El Solarpunk es un movimiento estético, filosófico y activista que emerge al final de la primera década del siglo XXI en Brasil como respuesta al pesimismo distópico de otros esfuerzos creativos. Este movimiento se caracteriza por crear mundos especulativos donde la ecología social, la tecnología democrática y las energías solar, eólica y maremotriz son elementos cruciales para el bienestar colectivo que superan al capitaloceno y sus raíces en la extracción y la combustión de combustibles fósiles y, la desigualdad social.

El término fue acuñado a través de un blog denominado Republic of the Bees el 27 de Mayo del 2008, inspirándose en una nueva tecnología, la "Beluga Skysail" para utilizar el viento y complementar el viaje de barcos de carga para reducir su gasto energético. Así, emergió esta estética del optimismo como alternativa al movimiento Steampunk, el cual, se basa en tecnología a vapor y estética victoriana. Entrando así, a complementar otros géneros de la ciencia ficción tales como el Dieselpunk, el Ciberpunk. Por tanto, es llamado para inspirar acciones etico-políticas, a través de una estética ecofuturista.

A nivel editorial, se han realizado varias antologías de narraciones basadas en el Solarpunk desde el año 2011. De esta manera surgen colecciones de cuentos en Brasil y Estados Unidos, referencias en diversas páginas web, eventos en ciudades como Portland (Estados Unidos), Barcelona (España) o Berlín (Alemania) y hasta en Universidades, donde Adam Flynn, un investigador y artista lanza un pequeño texto que gira alrededor de las notas hacia un manifiesto para el Solarpunk. Una obra adicional, es el libro The weight of light: A Collection of Solar Futures desde el Centro de Ciencia e Imaginación de la Universidad Estatal de Arizona donde confluyen escritoras y adicionalmente, académicos quienes analizan a través del libro cada uno de las historias allí plasmadas.

Ahora bien, se han eregido críticas por parte de Rob Cameron a este movimiento centradas en la relación aún ausente entre Afrofuturismo y Solar Punk y de la Justicia social como tecnología de supervivencia. Las cuales se espera que contribuyan a la pluralidad de este movimiento, en especial, para descolonizar las narrativas alrededor de la tecnología, la ingeniería y la imaginación. Recientemente el Solarpunk está ganando momento en diversos escenarios, en una parte colectivos de makers/hackers, mientras, en otro la academia. A la par del Solarpunk han surgido otros movimientos de ciencia ficción tales como la Ficción climática (Cli-fi) y la Ficción antropocentrica, complementando un escenario para nutrir de imaginación y arte a nuestro entendimiento de la ingeniería.

I-B3

TRIPTICO (Nuevas tecnologías, nuevas percepciones y usos) Participación e interacciones híbridas desde la propuesta wearable

Maria Jose Rios (Vestibles (www.vestibles.cl), Artista medial)

La idea consiste en presentar un proyecto de arte y tecnologías, que se está comenzando a ejecutar para ser finalizado y mostrado oficialmente en Mayo 2021, y generar sobretodo una instancia de preguntas, interpretaciones y análisis desde diversas disciplinas.

Lo destacable del proyecto es que el artefacto-objeto es considerado para ser presentado como un dispositivo que involucra un sistema descompuesto en sus partes, y que se concentra en posibilidades acerca del uso y sentido de nuevas tecnologías embebibles y dispuestas sobre nuestros cuerpos, lo que permite la presentación de escenarios futuros de especulación en torno a las acciones situadas de nuestra cotidianeidad y lo que implica a nivel personal y colectivo.

The role of innovation in transitions towards alternatives to development

David Reina (Universidad Nacional De Colombia)

According to the engineering narrative and practice, innovation has become a professional commitment for engineers. This is an age of the cult of innovation. It has already reached dimensions of human and natural life beyond products, services or processes. Innovation has generated consequences for the planet and all its beings, from the Schumpeterian approach of the engine of the capitalist and neoliberal economic system. That is, innovation is necessary for progress and development. Nevertheless, development is not questioned from the engineering community, as a neo-colonial hegemonic framework for territories, especially in the global south where indigenous, peasants, afrodescendants communities and other minorities reside. But also in the global north and its peripheries.

Thus, as a critical reflection of the history of innovation, from its initial use in the nineteenth century with a political and religious sense, through its aesthetic use in the dance "innovation", inspired by the Argentine tango, to its various conceptual paths aimed at creating social value. Therefore, there are 17 concepts found in the academic literature and they are evaluated according to the degree of involvement of the affected population and the collective agency that the impacted social group has in the innovation processes. To determine how some of these continue along the paths of the current dynamic economic model and therefore, of strengthening development at the expense of nature, ontology and epistemology of the communities.

In order to generate responsible innovation, we will have to transform the epistemological bases of it from a socio-technical paradigm. Considering the relations between the dimensions of the process of production of artifacts and services, and the dimension around the socio-cultural use of it. Thus, from this socio-technical framework, the perspectives that are framed of what can be called post-development are approached. This includes practical initiatives that people around the world have created from its ontology and its relationship with the territory, within them we can find the Buen Vivir in the Andean countries; the Ubuntu in the south of the African continent; the Swaraj in India; the Kongsi in China, and the concepts of Tazkijah and Falah in the Muslim culture.

In accordance with the above, communal innovation is proposed as an approach to socio-technical change that will make it possible to generate the conditions for responsible and fair innovation in conjunction with rural and urban communities within the framework of alternatives to development. This allows to dynamize the socio-technical processes for their permanence in the territory, the strengthening of the social fabric and the technological sovereignty. Finally, a series of final reflections are enunciated on the role of engineering and innovation in the transition towards a world where other worlds fit, in the words of the Zapatistas, or from another framework, into the pluriverse.

Engineering, Xamanism and the Concretization of the Human

José Aravena-Reyes (Universidade Federal de Juizde Fora, MG – Brasil)

The technical development signalizes that the next stage of human evolution will be promoted by a set of emerging technologies that could produce a new human or post-human condition. This new stage, highly technologized, is characterized by some authors as the homo-deus stage, where, people will live much more than now, without any illness and using a high efficient intelligence. All the efforts are directed to improve our limited body by enhancing its capabilities through the use of these emerging technologies. There is the conviction we are in the right direction, and that is, without any doubt, our natural evolution process. In this sense, the human body is the direct object of technology, and it became a technical object, allowing that it should be analysed and designed by technical principles. Under this premise, it is possible to build an interpretation of the human evolution process from the Gilbert Simondon's idea of technical object's concretization process goes in the direction of naturalization, that means, not against naturalization.

This perspective requires a renewed understanding of nature and technic, but also allows to take from ancient knowledge some references, like Xamanism as a basis for thinking human evolution, especially when related to the transhumanist project of 'mind uploading.' Xamanism practices are techniques of ecstasies, but we can also define them as spirit/mind technologies, which not requires to change the body drastically to arrive into a more evolved human condition. When transhumanism approaches the dichotomy body-mind, the focus is for finding the necessary material support (hardware) to enhancing mind capabilities, but by considering the matter as energy, Xamanism could represent another perspective to think how overcoming the limitations of the human body to expand mind capabilities without losing the human condition. We argue that that is possible by redirecting the technological evolution from body technologies to spirit/mind technologies.

How can Brazilian grassroots engineering help decolonize engineering and philosophy of engineering/technology?

Cristiano Cruz (Aeronautics Technological Institute)

Some Latin-American approaches to engineering seek to foster emancipation and the construction of other possible worlds (or socio-technical orders) as an integral part of the design or intervention process. For that, they can be called decolonial. One example of such approach is Brazilian grassroots engineering (GE). In conjugating action research and popular education, GE aims to support grassroots groups with the co-design of social technologies that can help build this other possible world they may desire (which usually means advancing some of the solidarity economy bases). For that to be accomplished, affective bonds and care are indispensable, operating as a complementary basis for emancipation and dialogue of knowledge (i.e., assisting team and assisted group sharing knowledge, learning from one another).

A closer analysis of GE and other decolonial approaches seems to reveal a non-rationalizable area of such engineering/design, despite all the effort of some philosophers and other scholars to try to prove the opposite and foster engineering's full rationalization. Eugene Ferguson called it engineering art, something that, in dialogue with Walter Vincenti's epistemology of engineering design, can be identified as part of his design instrumentalities. They have to do with ways of thinking (which are to a greater extent based on images and analogies), structured procedures, and judgemental skills (which are strongly shaped by values like symmetry, simplicity, beauty, and the like).

Studies concerning the impact of the pluralization of these knowledge's contents (i.e., imagery and analogy collections, structured procedures, and "aesthetic" values) on technical design reveal a widening of designers' capacity to conceive possible solutions or implement them. However, a point usually not addressed is how to proceed in order to promote such pluralization. GE does that through the dialogue of knowledge.

In this presentation, after introducing and rapidly providing the foundations of what was said above, some arguments in favor of decolonizing the engineering practice and philosophy of technology/engineering are sketched. Such decolonization is necessary not only because it can allow the co-design of other possible socio-technical orders (or worlds) but also because it can provide a more accurate understanding of engineering and enlarge even its mainstream achievements.

At any rate, what is presented here: 1) Are results of an ongoing investigation; 2) Has been much more detailly developed in two forthcoming papers (see below); 3) Is more of an introduction to how philosophy and engineering can be decolonized and to possible outcomes of that.

Forthcoming papers:

1. "Decolonial Approaches to the Technical Design: Building Other Possible Worlds and Widening the Philosophy of Technology" in Techné: Research in Philosophy and Technology.

2. "Brazilian Grassroots Engineering: a Decolonial Approach to Engineering Education" in European Journal of Engineering Education.

Women's disengagement in computer programming courses, a look through critical realism lenses

Jimena Pascual (Pontificia Universidad Católica de Valparaíso)
Patricia Jimenez (Pontificia Universidad Católica de Valparaíso)
Franco Guidi (Pontificia Universidad Católica de Valparaíso)
Sofia San Martin (Pontificia Universidad Católica de Valparaíso)
Javiera Espinoza (Pontificia Universidad Católica de Valparaíso)

Although the enrollment of women in higher education is currently comparable to that of men, the participation of women in programs related to engineering and technology remains low. Underrepresentation of women in engineering and technology programs has become a global problem reported by countries around the world and has led to a large number of policies and interventions to increase the enrollment and access of women to these educational programs, with little success in general. Existing literature recognizes a discourse on the relationship between technology and gender, according to which women are clustered at the soft end of technologies, and men are clustered at the hard end. In this study, the effects of social construction around the concept of technology on the experience of women in computer programming courses in an engineering program are researched. Based on the data collected in three computer programming courses in an engineering program and using critical realism as an analysis framework, (CMO) context configurations, mechanisms, and outputs are proposed. Different contexts are described according to the characteristics of the lecturer and the teaching-learning methodology. The outputs are the self-competence in the programming perceived by the students, as well as the approval rates by gender. From the interpretation of the data, the underlying mechanisms are proposed, which can help shed light to improve the experience of women in courses where technology is the protagonist.

Ethics for Comprehensive Engineers: A Retrospective and Prospective Sketch of TU Delft's Engineering Ethics Education

Neelke Doorn (Delft University of Technology)
Lavinia Marin (Delft University of Technology)
Sabine Roeser (Delft University of Technology)
Taylor Stone (Delft University of Technology)
Janna van Grunsven (Delft University of Technology)

That engineering comes with a high burden of moral responsibility may for many people appear as a truism explicitly acknowledged by most professional engineering organizations and engineering curriculum accreditation committees. Translating this burden into educational practices is no simple matter. For over twenty years, the Ethics/Philosophy of Technology Section at Delft University of Technology (TU Delft) has been at the forefront of engineering ethics education, offering ethics education to a wide range of engineering and design students. In this presentation, we will provide a retrospective and prospective sketch of our approach to engineering ethics education.

The approach developed at TU Delft, deeply informed by our research, centers around Responsible Research and Innovation [RRI], Design for Values [DfV] and Risk-ethics. RRI and DfV are premised on the notion that technologies are inherently value-laden, and as such contain the possibility of fostering or hindering moral values. Risk-ethics, furthermore, emphasizes the intrinsically normative nature of the notions risk and safety. Each of these theoretical approaches encourages students to take a proactive attitude with respect to their projects and profession, thinking creatively about – and taking responsibility for – how to both prevent harm and do good via the technologies they help develop. This proactive approach to the engineer and designer's individual responsibility aligns well with the engineer's creative problem-solving frame of mind. We consider these approaches the 'signature' of ethics education at TU Delft.

While we have worked with stand-alone ethics courses for more than 20 years, over the last five years we have also started to develop new approaches such as the so-called ethics learning lines at various bachelor programs. One of the main reasons for this transition is that we wanted to do full justice to the idea that ethics is inherent to engineering and thus should initially – at the Bachelor level – be an integral part of the overall engineering education curriculum as opposed to taught in one seemingly isolated stand-alone course. The ethics learning lines aim at fostering basic competencies in engineering ethics. This is done by embedding ethics into the standard curriculum, connecting context-relevant cases with existing courses and cooperating with engineering lecturers in the respective programs. In the master programs, students can deepen their engagement with ethics through thematic stand-alone courses, open to students from any master-level engineering program. This set-up allows students to work together on problems from different angles, in interdisciplinary ways. Examples of these thematic courses are climate ethics, water ethics, ethics of healthcare technologies, etc.

We are currently also exploring new pedagogical approaches, because traditional teaching and assessment approaches in philosophy seem predominantly focused on language-based skills, and not all engineering students are verbally articulate and might fare better by using other modes of reflection and deliberation. Examples include incorporating art-projects and serious gaming in our educational activities. With these innovations, we hope to continue developing an engineering ethics education that is based on the idea that ethics is not something 'out there' but rather a core element of engineering practice.

III-A1

Integración de los Objetivos del Buen Vivir en la educación en ingeniería para la cuarta revolución industrial

Alexei Ochoa-Duarte (Universidad Nacional de Colombia)

El modelo socioeconómico imperante atribuye a la ciencia y a la tecnología la capacidad para resolver gran cantidad de problemas a escala mundial, pero olvida que algunas veces, esas soluciones crean nuevos problemas, que ocasionalmente son más grandes que los iniciales. En este sentido, se han causado una enorme cantidad de conflictos y crisis sociales, políticas, económicas, culturales y ambientales en las diferentes geografías del planeta, siendo nuestro continente uno de los más afectados.

Actualmente, desde el discurso hegemónico existen esfuerzos con el fin de disminuir el impacto de estos conflictos a nivel mundial, como el planteamiento e impulso de los Objetivos de Desarrollo Sostenible (ODS) por parte de las Naciones Unidas. Adicionalmente, a partir del desarrollo tecnológico y científico que se ha producido desde el surgimiento de la cuarta revolución industrial, se plantea que la educación y los procesos educativos deben actualizarse con la finalidad de incentivar a las personas para el desarrollo de habilidades para la resolución de los problemas complejos y transdisciplinarios, que van mucho más allá de los ODS.

En este sentido, la educación en ingeniería y su praxis homogeneizadora y estandarizada, enfocada en ideas como el desarrollo sostenible, ha actuado como una base sobre la cual se siguen perpetuando las condiciones de opresión, inequidad, guerra y explotación.

No obstante, existen otras lógicas centradas en alternativas de desarrollo, como el Buen Vivir, basadas en ideas latinoamericanas, que tienen en cuenta principios como el biocentrismo, el postcapitalismo, la interculturalidad y la pluralidad. Estos principios se ven reflejados en la crítica que se realiza a los ODS, al plantear los Objetivos del Buen Vivir (OBV), que se basan en el concepto de armonía con la naturaleza, con los seres humanos y con nosotros mismos. Por esta razón, se propone el diseño e implementación de estrategias y herramientas que se contrapongan a los modelos hegemónicos y tengan en cuenta los saberes propios de las clases subalternas.

De esta manera, mediante la articulación de diversas propuestas metodológicas con prácticas propias de las pedagogías críticas y los procesos de investigación-acción, se plantea una propuesta para alinear las estrategias para la enseñanza/aprendizaje de habilidades en el nuevo contexto tecnológico, en el que se encuentra la sociedad junto con los objetivos del Buen Vivir en la educación en ingeniería, para que la praxis consciente, favorezca la creación de espacios de aprendizaje que fomenten la apropiación, la transferencia y la generación de nuevos conocimientos colectivamente, para reducir las brechas existentes en la relación entre la academia, la industria, el ambiente, los gobiernos y la sociedad, en los procesos educativos de los futuros ingenieros.

III-A2

Uma proposta para formação em Ética no curso de Engenharia Civil da UFJF

Mauricio Leonardo Aguilar Molina (Federal University of Juiz de Fora)

O crescimento da população e sua concentração urbana demandam soluções sustentáveis para atender à crescente necessidade de novas fontes energia, água potável, ar puro, tratamento de resíduos, além de infraestrutura para transporte massivo. Essa demanda adquire uma dimensão ainda maior pelo crescimento de atividade econômica extrativista, de alto risco para o meio ambiente. O aumento na ocorrência de catástrofes – seja pela ação da natureza ou pelo colapso de obras de grande porte (barragens, usinas nucleares, pontes ou prédios) configura um quadro complexo. Grandes custos em vidas humanas, materiais e ambientais trazem não apenas prejuízos financeiros, mas também sociais, no meio e longo prazo, e têm suscitado discussões em torno do papel dos engenheiros e sua responsabilidade profissional. O conceito de Ética fica, então, em evidência como uma dimensão essencial ao desenvolvimento de projetos. A formação dos engenheiros civis envolve grande rigor científico no aprendizado de métodos e técnicas para resolução de problemas em diferentes contextos, problemas esses que quase sempre estão definidos previamente, mas escassa atenção é dada à sua formulação, o que deixa pouco espaço para discutir o papel social e político do engenheiro em um contexto de projeto. As novas Diretrizes Curriculares para cursos de Engenharia promulgadas recentemente no Brasil abordam o tema da Ética, recomendando uma formação que garanta o desenvolvimento de competências para atuação nos moldes da legislação. Assim, as diretrizes prescrevem a implantação, desde o início do curso, de atividades que promovam a integração curricular das dimensões técnicas, científicas, econômicas, sociais, ambientais e Éticas. De modo similar, o código brasileiro de Ética para engenheiros descreve princípios, objetivos, atributos, obrigações, condutas vedadas, direitos que norteiam o exercício da engenharia. No entanto, mesmo quando a normativa prescreve a Ética como parte da formação do engenheiro, ela é omissa quanto à definição do próprio conceito e seu desenvolvimento como competência profissional. No Brasil, a partir de uma revisão nos principais cursos de Engenharia Civil, verifica-se que, enquanto grande parte dos cursos ainda não atende a esta exigência, uns poucos adotam abordagens teórico-conceituais a partir de disciplinas isoladas no currículo. No entanto, natureza prática do trabalho na engenharia faz necessário que a Ética seja vista estreitamente atrelada ao projeto de engenharia, o que traz uma dificuldade adicional: a falta de desenvolvimento do pensamento projetual na formação dos engenheiros. Embora a Ética na Engenharia tenha experimentado desenvolvimento significativo nos últimos anos, há poucas diretrizes quanto ao que e como ensinar nesse campo, a fim de formar melhores engenheiros para os desafios de um planeta em risco, inclusive porque a maioria dos professores de engenharia não está preparada para introduzir a Ética na Engenharia em suas disciplinas. Mesmo sua inclusão como disciplina isolada esbarra na falta de espaço nos currículos. Este trabalho se propõe apresentar o esboço de uma proposta de formação em Ética no curso de Engenharia Civil na UFJF, a partir de uma revisão da literatura sobre do tema. Além do seu caráter prático, será evidenciada sua estreita ligação com a competência de Projeto.

III-A3

¿Es posible la enseñanza de una ingeniería con las comunidades en un contexto neoliberal?

Andrés Leonardo León Rojas (Universidad Nacional de Colombia)

En un sistema de enseñanza en ingeniería donde la educación está enfocada al mercado y en el que al estudiante se le forma como mano de obra funcional al capital, la construcción de un modelo distinto, enfocado a la solución de las necesidades de las clases subalternas y que además tenga como principio el diálogo de saberes puede parecer utópico pero no es imposible.

Experiencias como la Cátedra Ingenio, Ciencia, Tecnología y Sociedad, en la Universidad Nacional de Colombia, en la cual se hacen trabajos académicos de ciencia y tecnologia con comunidades en búsqueda de resolver una problemática en los territorios (León & Molina-Soler, 2018), demuestran que otro modelo de enseñanza es posible aunque este tipo de iniciativas son muy frágiles ya que, al ir en contra de la corriente, no cuentan con un apoyo institucional sólido, lo que las hace dependientes de individuos o pequeños grupos académicos que se piensan la ingeniería de forma contrahegemónica.

En esta presentación, a modo de reflexión, se propone una serie de ideas que permitan generar procesos educativos en ingeniería al servicio de las comunidades vulnerables, que supere la visión asistencialista, que permita el empoderamiento de las personas, tanto de los habitantes de los territorios, como de los estudiantes, para que puedan tener una visión holística de su profesión, de manera que puedan actuar con ética profesional y una mirada crítica de la sociedad, que aporte a la paz con justicia social.

Para ello, se requiere dar una lucha en todos los niveles, dentro y fuera de la academia, incidiendo a nivel institucional, mediante la propuesta de cambios curriculares, la creación de asignaturas de humanidades para ingeniería, la incorporación de metodologías transversales como la de Aprendizaje Basado en Problemas, trayendo al interior de la universidad otro tipo de saberes, incluyendo los conocimientos previos de los estudiantes. Así mismo, creando y fortaleciendo redes nacionales e internacionales, de modo que no sean iniciativas aisladas, sino todo un movimiento en torno a una práctica distinta de la ingeniería. Todo ello entendiendo que "[c]onstituye una ilusión absolutamente errónea e ingenua el pretender cambiar la Universidad dejando intacto todo el andamiaje social, político e institucional del cual la Universidad es expresión en el terreno de la pedagogía y la ideología" (Kohan, 2011, p. 2).

Referencias:

Kohan, N. (2011). La Reforma Universitaria en el siglo XXI. Cátedra Che Guevara.

León, A. L., & Molina-Soler, A. (2018). Cátedra Ingenio, Ciencia, Tecnología y Sociedad, una experiencia de ingeniería humanitaria. International Journal of Engineering, Social Justice, and Peace, 6(1), 39-48.

Freedom, Risk, and Standardisation

Erik Aslaksen (Gumbooya Pty Ltd, Director)

The concept of freedom, and its place within philosophy, is the subject of a large body of work built up since antiquity and containing the treatment of numerous aspects. One approach to structuring this body of work is to divide it into freedom to something and freedom from something, and it is the former category that is germane to the comparison I wish to make in this presentation. Freedom to act is a complex concept, interdependent with the ability to act and the risks involved in acting; but above all, it is a concept that only makes sense in relation to the particular society in which the acting person finds itself, as is immediately obvious form such examples as dress code, male behaviour towards females, and which side of the road to drive on. As society evolves, so do the restrictions on personal freedom. However, this is compensated by the increase in the range of possible actions, mental as well as physical, presented by the evolving society, so that there is a subjectively experienced compromise between freedom and restriction. In the following, I would like to convince you that almost the exact same situation exists within the engineering community – suitably interpreted, with the purpose of interesting the philosophers among you to take a look at it.

Without entering into the contentious area of definitions of engineering, engineers, and technology, let me simply state that I consider engineering to be the process of applying technology in order to meet a need expressed by society or a group within society, and it is performed by engineers. Technology is engineering's resource base, consisting of a knowledge base and a construction base, and both of these present a dual interface to the engineer. The knowledge is presented partly as application-independent knowledge, often based on science, and partly as application-specific knowledge based mainly on experience, in the form of standards for the objects of the design as well as for the design methodology itself. The former enables creative design activity; the latter restricts the engineer's freedom in this regard, and tends to reduce the engineer to a technician. The innumerable standardised elements of the construction base provide the foundation for efficiency of the design process and cost-effective realisation of the engineer's design, but they also act as a barrier for the engineer to consider something new, to be original, to be free as a designer. Engineering, as a profession, is faced with the problem of satisfying an increasing demand for design services under the conflicting requirements of society's values and industry's demand for optimising the return on investment. And the engineers are subjected to the tension between exercising their creative abilities and minimising the design cost; a cost that includes the risk of departing from standards. I am sure Nietzsche would have had something to say about this, and I hope my presentation will inspire comments and further contributions from the philosophy side of the fPET community.

On Engineering Imaginary

Dazhou Wang (University of Chinese Academy of Sciences)

Knowledge has been the central topic in philosophical studies for thousands of years. In contrast, imaginary is always at the periphery of philosophical discourses. In the field of philosophy of engineering, the situation is quite similar. In recent years, engineering knowledge has been paid more attention to, while engineering imaginary has not been discussed as much as it deserves. Drawing on some insight on social-technological imaginary in the STS field, this paper attempts to clarify the ontological significance of imaginary, the relationship between imaginary and knowledge, and the ontological relationship between imaginary, knowledge and engineering practices from the perspective of phenomenology. It is argued that imaginary is the basic way for human being to grasp the world and he/she inhabit the earth in an imaginary way. On such an ontological basis, it is clarified that knowledge and imaginary are two inseparable and interactive aspects of being-in-the-world. If knowledge is for timelessness, imaginary is temporal. If knowledge is power, imaginary is the direction. An imaginary is a gestalt that defines a situation for the generation and application of knowledge. Only under the guidance of imaginary can the generation and application of knowledge have a direction, and the identification and integration of heterogeneous elements for human practices become possible. As one kind of imaginary, engineering imaginary is the imaginary about the engineering project, and is a social construction based on specific knowledge elements, not only preceding the engineering project, but also running through its whole life cycle from decision-making to design, construction, operation, all the way to decommissioning. Moreover, engineering imaginary is the basic way for the public as well as the stakeholders to understand engineering, so communications in engineering is not only the dissemination of knowledge, but also the dissemination and reconstruction of engineering imaginary. Such being the case, the concept of engineering imaginary has strong theoretical implications in that it can help deepen basic understanding of engineering ontology and engineering epistemology. It also makes clear that the engineering practice, especially the innovative one, needs strong imaginary-players, and that engineering education needs to pay more attention to cultivation of engineering imaginary ability other than the learning of knowledge and of the ethical norm. Only those who have strong ability of engineering imaginary can define the possible futures. In this respect, the arts shall certainly play a fundamental role in the ontological sense.

Models in Engineering and Design: Modeling Relations and Directions of Fit

Michael Poznic (Karlsruhe Institute of Technology, Institute for Technology Assessment and Systems Analysis)

This paper distinguishes two different modeling relations between vehicles and targets: design relation and representation relation. The relations are characterized by their different directions of fit. Three examples of modeling enterprises are discussed: a bioengineering model, called the "lung chip," an architectural model, called the "weekend cottage," and an engineering design model, called the "jet engine." The two modeling relations with different directions of fit are analyzed in the three examples. The lung chip is standing in a representation relation to its corresponding target and the modeling of the cottage involves a design relation to its target. The modeling of the jet engine involves both modeling relations. The first two examples also involve the other, complementary modeling relation: the protocol of the chip is standing in a design relation to the chip and the cottage model is standing in a representation relation to the design plan. With the help of these examples a basic assumption of philosophy of engineering and philosophy of technology is challenged. These examples show that it is not strictly speaking true that engineering modeling is exclusively about how things should be rather than about how things are. It is shown that a representation relation is prominently involved in the first model of the lung chip. This modeling involves reasoning about how things are rather than about how things should be. So, one modeling enterprise seems to be rather about what is than about what should be. The other two examples may be seen as confirming evidence for the basic assumption. What is common to all three models is that they involve design and representation relations.

The Formation of Reflective Engineering Practitioners

Priyan Dias (University of Moratuwa, Sri Lanka)

1. There is a gap between engineering entrants (who are used to precision and unique solutions in physics and mathematics); and engineering graduates (who need to deal with conflicting constraints in engineering design and uncertainties in engineering fabrication). Humanities courses within engineering programs can help to develop reflectiveness in students and better fit them for engineering practice.

2. Philosophy for Engineering (especially drawing on Heidegger) can help students to understand their role identity, and help them to see how "average everydayness" can be transcended by (i) reflecting on context to propose their "ownmost authenticity"; and (ii) using theoretical reflection at "breakdowns" for the advancement of knowledge.

3. Engaging with History can provide (i) A source of engineering case histories (especially failures) to learn from; (ii) A set of examples from the Science & Technology Studies domain to reflect on complexity in technological success (or failure); and (iii) An understanding that the discipline of history could be closer to engineering than science is.

4. A broader perspective on ethics, especially by moving from purely professional ethics to technological ethics, can promote reflective discussion on (i) the value laden-ness of technology; (ii) the unintended consequences of technology; and (iii) the somewhat ambiguous aims of engineering that need to be socially negotiated and hence can cause the profession to be held captive to vested interests.

IV-B2

How practical philosophy of technology can be? Some considerations on the teaching of philosophy of technology in Engineering programs

Andrés Santa-María (Universidad Técnica Federico Santa María)

In general terms, the philosophy of technology can be defined as the philosophical reflection on the nature of technology and its social effects. Having said that, one can ask who care and who should care about the philosophy of technology. Obviously, this is of interest of philosophers of technology. But, in addition, to whom it should be urgently interesting is to the engineers, whom Mitcham (2014) has characterized as "the unacknowledged legislators of the world", as far as much of the technological developments that determine human life today, even in its smallest details, have their origin not in an academic devoted to this area of philosophy, but in an engineer. That is why Mitcham states that the main challenge for 21st century engineering is self-knowledge, that is, knowledge of its own foundations and purposes.

If we understand engineering as the design and implementation of technology in order to solve complex problems, we could say, using the expression of Dewey (2012), that it is in engineering exercise and, previously, in engineering learning that Philosophical ideas about technology "become concrete and are tested".

In this paper, I will focus on the problem of the relevance of the teaching of philosophy of technology in engineering programs. Just as the mathematician or the physicist wonders what contents of their respective disciplines are relevant to an engineer (which are not the same contents that may be relevant to a prospect mathematician or physicist), I will address the question about what aspects of philosophy of technology can be considered significant knowledge in the training process of a prospect engineer, that is, as a knowledge that can provide elements of consideration in the decision making process of an engineer in the context of the resolution of complex problems using and/or creating technology.

As a conclusion, from the above considerations, I would like to discuss to what extent the philosophy of technology can be considered as a variant of practical philosophy, that is, as a reflection that can potentially guide the decision making of those who, indeed, make most of the great decisions today.

Engineering ethics education: exploring attempts of defining a fragmented subject

Diana Adela Martin (Technological University Dublin)
Eddie Conlon (Technological University Dublin)
Brian Bowe (Technological University Dublin)

The literature on engineering ethics education highlights the diversity of goals and topics employed in its instruction (Romkey et al, 2015). According to Hess & Fore (2018), there are multiple definitions of ethics in engineering education literature, but no consensus as to how the scope of the discipline should be conceptualized.

Our contribution aims to examine the conceptualisation of engineering ethics education in terms of how it is defined and how its goals are articulated. Our research is conducted in cooperation with the national accrediting body, and includes lecturers teaching modules self-identified by engineering programmes as having a strong ethical component, evaluators serving on accreditation panels and 23 engineering programmes. To achieve this aim, three research methods were employed: (a)interviews, (b)analysis of a mandatory rubric in the documentation submitted by participant programmes for accreditation in which the programme goals and graduate learning objectives are described and (c)participant observation at accreditation events.

The main findings that emerge confirm the existence of a varied and uneven understanding of engineering ethics education both at individual and programme level. The study encountered conflicting views and lack of clarity as to what falls under the scope of engineering ethics education, especially when considering the topics of sustainability and safety. In terms of goals, while lecturers emphasize fostering responsibility, enabling agency and developing broad and critical thinkers, programmes highlight developing awareness of the impact of engineering practice and upholding professional standards. Notable is also the prevalent macroethical concern in the goals formulated by lecturers, who aim to broaden the scope of ethics education as to encompass societal considerations and reflection on pressing contemporary challenges. At the same time, value sensitive design was found to have a lesser conceptual prominence.

The study also found that engineering ethics is preponderantly defined through its connection to engineering practice, rather than in its theoretical dimension. Participants reported a low engagement with ethical theories, with learning goals seldom targeting the development of theoretical knowledge such as knowledge of formal definitions, ethical theories and vocabulary, supporting the findings of Hess & Fore (2018; 2020) and Godfrey & Parker (2010, p.10). The emphasis on the embeddedness of ethical decision-making in complex contexts of practice is seen to require careful deliberation and critical reflection, pointing to the importance of what virtue theorists call phronesis (Davis 2012, Schmidt, 2014; Nair & Bulleit, 2019). In line with the precepts of virtue ethics, character development has been revealed as an important goal of engineering ethics education. Besides phronesis, other virtues that lecturers aim to foster through engineering ethics education are discipline, courage and empathy.

The findings of our study are envisioned to contribute to debates tracing the conceptual domain of engineering ethics education, given that clarifying educational goals is an important prerequisite for employing and designing consistent instructional methods (Li & Fu, 2012; Keefer et al, 2014).

V-A1

The problem of Digital Direct Democracy (DDD) and its philosophical foundations

Matías Quer (Signos Center, Universidad de los Andes, Chile)

Democracy as we now it is currently in crisis and this has generated a critical approximation to many of its characteristics. As democracies are mainly representative ones, there has been a tendency to propose more forms of direct democracy, but with the help of digital technology, and that is what we call Digital Direct Democracy (DDD). While DDD is one of many manifestations of the penetration of technology in democracy, which receives the broader name of E-Democracy, it is an especially problematic one. Through this paper we will: (i) explain the relevance of E-Democracy and the place that DDD has within it; (ii) make a critical assessment of the main philosophical arguments used by DDD promoters to justify its implementations, mainly the ancient Athenian model and Jean-Jacques Rousseau; (iii) resort to Montesquieu, The Federalist Papers and Tocqueville to prove the importance of political representation in democracy and the epistemic superiority of representative democracy over direct democracy, especially because representation facilitates dialogue and political deliberation. Finally, we will give a balanced assessment of the desirability of digital technological penetration in the different levels of citizen participation in democracy. For this, we will distinguish three levels of participation: (i) being informed; (ii) give opinions and feedback to political representatives; (iii) vote and make political decisions. Being DDD a proposal to use technology extensively and regularly in all these levels, we will propose to abandon any attempts of DDD and instead use technology mainly in the first level, less in the second and in very limited situations of the third. Finally, we will show hoy DDD may facilitate the appearance of new forms of populism.

We will recur to Aristotle, Politics; The Federalist Papers; Montesquieu, The Spirit of the Laws; Jean-Jacques Rousseau, The Social Contract; Tocqueville, Democracy in America; Jamie Bartlett, The People Vs Tech; European Union's Green Paper; Robert Goodin and Kai Spiekermann, An Epistemic Theory of Democracy; Aroon Manoharan and Marc Holzer (Eds.), E-Governance and Civic Engagement: Factors and Determinants of E-Democracy; Trevor Garrison, Politicizing Digital Space: Theory, the Internet, and Renewing Democracy; Leonhard Hennen et al. (Eds.), European E-Democracy in Practice; Barry Hague and Brian Loader (Eds.), Digital Democracy: Discourse and Decision Making in the Information Age; Alexander Sideridis et al. (Eds), E-Democracy, Security, Privacy and Trust in a Digital World; David Ríos and Simon French (Eds.), e-Democracy: A Group Decision and Negotiation Perspective; Sheldon Wolin, Democracy Incorporated. Managed Democracy and the Specter of Inverted Totalitarism.

V-A2

Digital Sovereignty and Innovation – Setting the Foundations for a Never-Ending Project

Albrecht Fritzsche (Ulm University)

Sovereignty is a term that has played an important role in the development of modern political philosophy. Roughly described as the possibility of self-governance, it has had a particular strong influence on international law, including the discussion of colonialism and justice between industrialized and developing countries. Since a few years, scholars show increasing interest in a new facet of sovereignty that is expected to play an important role in the twenty-first century: digital sovereignty, which concerns the ownership and usage of data.

So far, the discussion on digital sovereignty has put a strong emphasis on territorial issues arising from the usage of worldwide information networks. On the one hand, such issues concern administrative structures, such as taxation, education, military intelligence and defence. On the other hand, however, there are also related to other achievements of modern democracies, such as privacy, freedom of expression and access to information. Surveillance, censorship and filter bubbles therefore also belong to the topics discussed in the context of digital sovereignty.

Within all these issues, a tension can be recognized that has already attracted the attention of philosophers on various occasions. The tension results from the concerns the dilemma between the protection of property as a basis of individual agency and access to resources as a precondition for action. Despite all historical continuity, however, there are aspects in which the current discourse on digital sovereignty explores new frontiers. First of all, it tries to apply the notion of property to data as a source of information without being able to determine what this information actually is. Personal data are compared to raw material in physical form, but at the same time considered as part of human identity, which does not really fit together. As a consequence, the actions that can be performed by someone who is in possession of such data cannot be determined either. Extant concepts of use, abuse, usufruct, etc. are therefore difficult to apply. From the perspective of a philosophy of engineering and technology, one might say that the technical artefact as a point of reference is missing in the discussion – or at least remains so diffuse that it invites misunderstandings and contradictions.

This paper gives an introduction to the current discourse on digital sovereignty. It explains its origins in cultural geography and shows how ethicists approach digital sovereignty in the context of personal data sharing. On this basis, the paper drafts a more general approach to digital sovereignty in engineering regarding the ability to innovate. It shows how territorial issues of access and control arise in the context of innovation. Furthermore, the paper illustrates on the example of online conference management systems how digital environments challenge notions of territoriality. It is exactly this aspect of digital sovereignty that calls most for the involvement of philosophers.

Reconceptualizing nurses' professional autonomy in robot care

Shuhong Li (Delft University of Technology)
Aimee van Wynsberghe (Delft University of Technology)
Sabine Roeser (Delft University of Technology)

To bridge the gap between the growing demand for elderly care and a significant shortage of caregivers, care robots have been introduced in elderly care as a technological solution, which has extensive and profound impacts on both care receivers and caregivers. In robot ethics, care receivers' autonomy often takes precedent as they are the vulnerable group in healthcare (Borenstein & Pearson, 2010; Feil-Seifer & Matari, 2011; Körtner, 2016; Sharkey & Sharkey, 2012; Sorell & Draper, 2014). However, it is also significant to pay attention to the role that care robots will play in promoting and/or threatening the professional autonomy (PA) of caregivers as they play a central role in the care practice. Thus, this paper focuses on the PA of caregivers, especially the nurses as a core value and the impacts of care robots on the realization of this value.

According to Macdonald, there are two dimensions of nurses' PA. From an individual perspective, PA means that every nurse has the professional privilege to make discretionary decisions based on their professional knowledge. From a collective perspective, PA is used to emphasize "the privilege of self-governance accorded to a profession" (Macdonald, 2002). For the analysis of how would care robots impact nurses' PA at the individual level, we employ a taxonomy of autonomy and expand its application from explaining the complexity of care receivers' autonomy to the reconceptualization of PA in robot care (Collopy, 1988; Li, et al. Forthcoming). The detailed assessment by using the taxonomy as a practical tool adds richness to the understanding of nurses' PA in the robot context. For the robots impact on the nursing profession that cannot be explained by the taxonomy of autonomy, we find the human-robot-system interaction (HRSI) model provides an ideal framework for the analysis of PA at the collective level. It captures the multipartite interaction among care receivers, care robots, and a healthcare system, which encourages for a further understanding of nurses' PA on a large scale (van Wynsberghe & Li, 2019). We suggest that reconceptualizing nurses' PA on two levels and additional organizational efforts in HRSI are necessary to empower nurses to fulfill their PA and improve care quality.

V-B1

Condicionantes sociais em processos de concepção: o caso da esteira de triagem nas cooperativas de catadores de materiais recicláveis

Cinthia Varella (Universidade Federal de Minas Gerais)
Francisco Lima (Universidade Federal de Minas Gerais)
Marcelo Alves (Universidade Federal de Minas Gerais)
Raquel Manzanares (Universidade Federal de Minas Gerais)

Os processos de produção das associações e cooperativas de catadores (ACs), da coleta à comercialização, precisam passar por várias adequações para ampliar a produtividade, melhorar as condições de trabalho e aumentar a renda. A mecanização dos processos de trabalho, com a utilização de caminhões, prensas, empilhadeiras e esteiras de triagem, é uma opção que tende a ser reforçada. De modo geral, poucos são os equipamentos projetados especificamente para os processos de produção de coleta, triagem e processamento de materiais recicláveis. Além disso, a prática frequente de especificação de equipamentos em esferas distantes do cotidiano dos empreendimentos tem por consequência a aquisição de máquinas inadequadas, a ponto de algumas serem inutilizáveis. Finalmente, como a experiência dos catadores é pouco reconhecida para retroalimentar com melhorias a especificação e o projeto de novos equipamentos, as inadequações tendem a permanecer e a aprendizagem tecnológica, vital em qualquer processo produtivo, se torna bem mais lenta no setor da reciclagem.

O Núcleo Alternativas de produção, elaborou algumas diretrizes básicas para especificação, projeto e instalação de esteiras de triagem, com o objetivo de subsidiar as associações e cooperativas de catadores e os técnicos na elaboração de projetos de implementação de esteiras de triagem. Nessa nota encontram-se muitas considerações acerca das transformações no nível da organização do trabalho, sobre a inclusão de trabalhadores idosos e com deficiência, bem como recomendações a serem consideradas nas etapas do processo produtivo.

O objeto deste trabalho é discutir e confrontar as intervenções e pesquisas realizadas para construção desta nota técnica sob o ponto de vista da análise ergonômica da atividade com o conceito de Value Sensitive Design (VSD). VSD é sobre identificar e incorporar valores humanos nas primeiras etapas dos processos de concepção e desenvolvimentos tecnológicos, de modo a limitar ou eliminar potenciais problemas uma vez que as tecnologias tenham sido implementadas. Esse conceito busca considerar os valores de todos aqueles que serão impactados pela tecnologia desenvolvida, o que significa considerar tantos os usuários diretos quanto outros indiretamente envolvidos. Além de um conceito, VSD é também uma metodologia para desenvolver tecnologias que considerem a entrega de valor às partes direta e indiretamente interessadas. Para obter uma incorporação bem-sucedida dos valores humanos no processo de design, o VSD emprega uma metodologia tripartida integrativa e iterativa, comporta por investigações conceituais, empíricas e técnicas (Friedman et al., 2006). Assim pretendemos analisar as contribuições da ergonomia e da análise da atividade à incorporação de valores humanos nos processos de desenvolvimento tecnológicos.

V-B2

Complejidad social e incertidumbre: Bases para el estudio de los fenómenos sociales desde la ingeniería de sistemas sociales

Álvaro Armijo Torres (Universidad de Santiago de Chile)

Uno de las mayores dificultades a la hora de generar explicaciones y/o soluciones frente a diversos fenómenos sociales es el problema de la incertidumbre (Bulleit, 2018). Dicho problema ha sido objeto de una serie de debates, dentro de la filosofía de las ciencias y desde las mismas ciencias sociales, concernientes a la posibilidad de comprender las dinámicas que subyacen al comportamiento social y a cuáles son los factores a considerar al momento de construir modelos para estudiar la realidad social. En vista de esta discusión, el objetivo de este trabajo es construir una propuesta alternativa basada en la ingeniería de sistemas sociales (e.g., García-Díaz y Olaya, 2018). Específicamente se trata de una propuesta orientada a: (1) El diseño de simulaciones computacionales; y (2) Reducir la incertidumbre sin caer en supuestos poco realistas. La virtud de esta propuesta se encuentra en el hecho que al adoptar el análisis propio de la ingeniería de sistemas sociales, podemos generar explicaciones muchos más confiables que las desarrolladas mediante los métodos tradicionales de la ciencia. Además, la propuesta en cuestión abre las puertas al cruce entre la filosofía de las ciencias y la ingeniería en la medida que ofrece nuevas herramientas para abordar problemas clásicos dentro de la primera de las disciplinas mencionadas.

Para efectos de la exposición, la presentación está estructurada en tres partes.

En la primera, la discusión gira en torno la pregunta sobre cuál es el marco teórico adecuado para el estudio de los fenómenos sociales. Dada la existencia del problema de la incertidumbre, la conclusión es que la manera más precisa de caracterizar dicho estudio es a partir de la teor´ıa de los sistemas complejos adaptativos (Holland, 1992; Collier y Hooker, 1999; Miller y Page, 2007). Bajo esta perspectiva, la complejidad social puede ser descrita a partir de la existencia de agentes con un grado alto de interconexión, junto con la posibilidad que dichos agentes puedan adaptar su comportamiento a partir de las interacciones entre agentes (y también su ambiente). Hecha la precisión teórica, la segunda parte de la exposición está centrada en los aportes de la ingeniería para efectos del estudio de los sistemas complejos adaptativos. Entre estos aportes destaca el desarrollo de la ingeniería de sistemas sociales y los diversos métodos de análisis para tratar con el problema de la incertidumbre (Bulleit, 2008; Der Kiureghian y Ditlevsen, 2009). Para finalizar, la tercera parte se enfoca en la aplicación de simulaciones computacionales entendidas como un método para abordar el problema de incertidumbre en los sistemas sociales. Tomando las lecciones de la ingeniería de sistemas sociales, los modelos basados en agentes (Epstein, 2006, 2008; Squazzonni, 2012) surgen como una herramienta adecuada para la comprensión de la complejidad social. El diseño de tales simulaciones inauguran una nueva forma de pensar el estudio de la realidad social, con la virtud de poder establecer un diálogo entre la práctica filosófica y el análisis propio de la ingeniería.

V-B3

Anticipación de riesgos en el uso de la Inteligencia Artificial en medicina

Alberto Lecaros (Universidad del Desarrollo, Director Observatory Bioethics and Law)

Las perspectivas éticas utilizadas para enfrentar los riesgos de tecnologías disruptivas como la Inteligencia Artificial (IA) en medicina se pueden incluir en dos paradigmas de comprensión. En el primer paradigma, la reflexión ética se coloca fuera de la esfera de la medicina y la pregunta por sus fines y, por lo tanto, fuera de su control y regulación social. Está incluida en un nuevo paradigma social y político, el transhumanismo, que opera con una racionalidad instrumental (optimismo cientificista) en el análisis de los riesgos, expresada en el principio de proacción (proactionary principle). En el segundo paradigma, la reflexión ética parte de la premisa que estas tecnologías debiesen ser legitimadas desde el debate social sobre la medicina y sus fines, mediante la evaluación riesgo/beneficio caso a caso o la aplicación de alguna fórmula tradicional del principio de precaución o corregida del mismo.

Parto de la hipótesis de que la evaluación riesgo/beneficio aplicada caso a caso, esto es, por cada proyecto de investigación en el uso de IA en medicina, no es suficiente para dar cuenta de la dimensión anticipatoria de los riesgos que esta requiere, como tampoco lo es el uso del principio de precaución, ni su opuesto, el principio de proacción.

El argumento que quiero defender es que se requiere de una racionalidad más amplia para abordar los riesgos que implica el uso de la IA en medicina: una racionalidad anticipatoria o prospectiva, la cual no reemplaza a la racionalidad preventiva (minimización de riesgos en cada fase de desarrollo tecnológico) ni a la racionalidad precautoria (mientras exista un alto grado de incertidumbre de los riesgos, paralizar el avance buscando alternativas tecnológicas más seguras), porque tiene un estatuto epistémico de otro orden que puede integrarlas y modularlas, sin prescindir de ellas, por lo que resulta ser una episteme necesaria aunque no suficiente.

The 'construction' of GE mosquitoes with gene drives as the solution to the high incidence of mosquito-borne diseases among the socio-economically marginalized in parts of the global South: An epistemically and ethically responsible engineering practice?

Zahra Meghani (University of Rhode Island)

Laboratories and factories are not the only places where technologies are constructed; technologies are also 'created' (as solutions to particular problems) within the pages of scientific journals. This presentation will analyze a case of the latter kind of technology construction enterprises. Specifically, it will examine two scientific papers by genetic engineers that 'construct' genetically engineered (GE) mosquitoes with gene drives as the solution to the high incidence of mosquito-borne diseases like malaria in certain socio-economically marginalized regions of low-income countries.

GE mosquitoes with gene drives are being developed such that the modified insects and their GE offspring are compromised in terms of survival ability or their capacity to function as disease vectors. The former kind of gene drive is termed a population suppression gene drive, while the latter type is called a population replacement gene drive. The use of gene drive bio-technology entails the open environmental release of the GE organisms with intentionally altered heritable traits. If GE mosquitoes with gene drives are released in the wild and if they mate with their wildtype counterpart, then depending on the type of gene drive introduced in them, presumably, if everything goes exactly as planned, over multiple generations they could cause the population of their wildtype counterpart to either collapse or not act as disease vectors.

A defining characteristic of the scientific papers that will be analyzed is that they 'biologize' (or 'naturalize') the public health problem of the substantial prevalence of mosquito-borne diseases in certain poorer regions of the global South. Such papers do not appropriately acknowledge the structural, systemic factors that are partially responsible for the public health problems that disproportionately affect the poor. Safe living and work environments (including a safe supply of water, waste treatment processes, screened buildings), access to adequate, nutritious food, and preventative and therapeutic health care are important determinants of the high incidence of mosquito-borne and other vector-borne diseases in socio-economically marginalized communities in parts of tropical and subtropical low-income countries. The vulnerability of persons to infectious diseases of poverty, their experience of the illness, and their capacity to recover from it is not a purely biological matter.

Scientific papers that construe the high incidence of a mosquito-borne disease in poorer communities in regions of the global South as a purely (or primarily) biological phenomenon pose the disease vector (the mosquito) or the pathogen as the logical point of intervention. Those scientific narratives create the impression that the only (or most) effective way to reduce the prevalence of the disease is to use patented high tech scientific-technological interventions that target the disease vectors or the pathogens. Such scientific narratives obscure the role of political and economic inequities in creating and maintaining public health problems that disproportionately affect the poor.

This presentation will analyze the epistemic, and ethico-political significance of such technology 'constructions' endeavors in the pages of scientific journals. The larger aim is to contribute to the discussion about epistemically, ethically, and politically responsible practice of technology 'construction' by genetic engineers.

VI-A2

History of Solar Engineering as a Collaborative Practice in Chile

Barbara Silva (Universidad Alberto Hurtado)
Cecilia Ibarra (Universidad de Chile)
Mauricio Osses (Universidad Técnica Federico Santa María)

What can history do for engineers? What can engineering do for historians? History is more than a cumulative deposit of facts and anecdotes. By studying the past of a discipline or practice, we can understand how the discipline was built, and which was the role of different social actors in this process. As any other human endeavor, disciplines and practices such as engineering change and evolve through time; technology co-evolves with society. One the one hand, one of engineering's intentions is to move forward the horizon of what is technically possible. On the other, one of history's deepest goals is to understand things were not always meant to be as they are. Therefore, both engineering and history deal with what is and was possible, and what actually happened or could happen. By bringing together this articulation of time and possibilities, these disciplines reflect on the human condition. As such, to work with history and engineering is to unveil the humanity in every innovation as well as to acknowledge the importance of practices' temporalities.

In this presentation we will reflect on these ideas through the case of the contemporary history of solar engineering. Solar energy has a long history in Chile, and historiographical practices contribute in reconstructing its past intersected in global, national and local scales. The perspective of engineering provides the understanding of transitions and coexistence of passive and active solar technologies, thermal and photovoltaic applications and societal changes. These pieces needed to be articulated – though not always planned- for solar energy to have the development it had in the region with the highest radiation in the world.

Modular design to maximise reuse

Claudia Eckert (The Open University)

We are living in a world with limited resources and the need to reuse materials is becoming ever more apparent. At the same time the cost of system engineering projects is increasing when the overall world economy is shrinking and struggling. This requires a rethinking of the way we approach development projects. At present the focus of design lies often on meeting user needs or giving space for future growth. The focus lies on what is new and desirable. However, this emphasis could also be shifted towards what can be conserved to save costs and resources. This mindset to a certain extent already exists in product development products for very mature products such as diesel engines, where companies try to reduce newness (i.e. new components and new applications of existing components) to reduce both the risk associated with the product and the development cost of new components.

Our resource limitations also require us to take this mindset to large scale systems engineering and look what we can conserve on all levels from entire machines or buildings down to components. One of the reasons why in redevelopment or refurbishment projects everything is replaced is the cost of replacing something in an existing and running system, both in terms of the capital investment and labour, but also the cost of the disruption. If old systems are used until they reach the end of their practical lives, maintenance might become more difficult and costly. However these issues can be handled by adopting a clear modular structure in refurbished systems with clear interfaces as well as the discipline to record adaptations and carried them out in a structured way. For example in a case study hospital the 3rd floor bathrooms were plumbed through from the 1st floor and had to be replaced when the 2nd floor was refurbished.

The talk argues that the tools, methods and processes already exist to design to maximise reuse, but that the willingness of conserve does not exist. Paying more for a potential solution that appears less new is not appealing to many investors; however to achieve a more sustainable society this will be required.

VI-B1

A Inadequação Filosófica das Normativas da Engenharia no Brasil

José Aravena-Reyes (Universidade Federal de Juizde Fora)
Walter Bazzo (Federal University of Santa Catarina)

No Brasil, a profissão de Engenheiro se sustenta em dois pilares normativos fundamentais: a lei que regulamenta o exercício profissional e as diretrizes curriculares nacionais para os cursos de Engenharia. A primeira data de 1966 enquanto a segunda foi atualizada em 2019. Porém, grande parte dos conceitos utilizados para definir o marco legal daquilo que se deve considerar como próprio da profissão é abordado de forma muito geral e pouco esclarece sobre o que se deve entender por Engenharia e qual o papel que a esta lhe cabe no processo de desenvolvimento do homem. Tal fato acarreta aquilo que Carl Mitcham denomina de "inadequação filosófica", uma vez que diversas inconsistências e contradições tornam difícil entender o sentido dos serviços prestados à sociedade por essa profissão. O presente artigo apresenta uma reflexão sobre as normativas que reguem a profissão de Engenharia no Brasil, com especial atenção às novas diretrizes, uma vez que elas representam o entendimento acadêmico daquilo que deve ser o essencial do processo formativo no país. A partir da leitura da lei que regulamenta o exercício profissional se argumenta que o solo filosófico que sustenta essa normativa legal se ancora na chamada "perspectiva instrumental da tecnologia", a qual define implicitamente à Engenharia como instrumento para a exploração de recursos naturais, o que por sua vez representa o motivo que leva a Engenharia brasileira a fomentar uma subjetividade de viés predatório e de pouca responsabilidade social e ambiental. Tal situação pode ser entendida em função da falta de adequação da lei em torno das grandes mudanças que tem experimentado a forma de produção técnica global desde a data de criação dessa norma aos dias atuais. Em relação às diretrizes curriculares, o assunto é mais complexo e evidencia as dificuldades que o processo formativo encontra para promover um Engenheiro engajado com as atuais demandas por processos produtivos baseados em cuidados para com a Terra e todos seus seres vivos. As diretrizes curriculares utilizam conceitos que parecem ser autoevidentes, fato que permite impor um único modelo de entendimento da realidade, o que induz à Engenharia desenvolver um papel obediente à lógica de produção predatória do sistema capitalista, mediante a promoção de diversas ideias que se apresentam como obvias e fora de qualquer contexto crítico. No intuito de mostrar que o conjunto de premissas que tornam implícito o entendimento de Engenharia não é um mero descuido epistemológico, diversos conceitos são analisados e suas contradições apresentadas para concluir que existe uma filosofia implícita que promove uma Engenharia predatória e obediente que não se ergue numa reflexão em torno do papel que a Engenharia deve ter nos tempos atuais.

VI-B2

Tecnología y biomejora humana: desafíos actuales a la ética

Daniel Toscano Lopez (Universidad del Desarrollo)

Las prácticas de «human enhancement» o de biomejora humana, nacidas a partir del avance de las ciencias biomédicas que se usan para mejorar deliberadamente a individuos considerados «normales» (Cortina 2017: 105), están transformando de forma radical nuestra subjetividad, así como las nociones de cuerpo y salud, produciendo efectos desconocidos e insospechados para el individuo, la relación entre estos y el conjunto de la sociedad. Tal manera de intervenir la vida en su «normal desarrollo» con el fin de potenciarla (Rose 2012), está también desbordando al homo ethicus. A este, porque los efectos de las tecnologías biomédicas desafían y sobrepasan las «viejas categorías éticas» (Jonas 1995: 52). Esto no es sólo consecuencia de la vertiginosa rapidez con la que avanzan las tecnologías y de la naturaleza inédita de los problemas que suscitan, sino también, es resultado del ámbito en el que el discurso ético y bioético se sitúan, el de los valores y las normas que no contemplan en toda su magnitud las tensiones que en realidad generan esas mismas prácticas.

El propósito de esta ponencia consiste en analizar los actuales desafíos a la ética como resultado de la transformación y el modelamiento producido por las tecnologías de mejoramiento humano tanto al individuo como a la sociedad. Para esto se exploran, brevemente, las condiciones histórico-ontológicas y epistemológico-conceptuales que han hecho posible el «Dispositivo de Biomejora Humana» (DBH) y se indaga el tipo de subjetividad, de concepción del cuerpo humano y de la salud a que dan lugar dichas prácticas de biomejora tecnológica, lo cual plantea interrogantes importantes para la ética.

A importância da interdisciplinaridade em engenharia para a formação do pensamento crítico

Luciano Andreatta-da-Costa (State University of Rio Grande do Sul)
Walter Bazzo (Federal University of Santa Catarina)

Studies on STS already present some important outcomes, such as the need of establishing a new civilizing equation1. Technologies are designed to optimize time, but we have less and less time. Society is increasingly dependent on companies whose assets are founded in the data and information freely provided by individuals2. Although we apparently have the world in our hands, we are no longer happy3

In the classroom of Engineering courses, we observe the suffering of students, from the beginning, in the already known failures in Calculus, making the course a true epic, without time for sociological reflections.

In Brazil, Engineering has played the role of restricting any critical view, always placing itself on the side of hegemonic power. This option is, in many cases, naturalized, as if it were a contingency of reality and there was nothing else to do4,5

The consequences of the current civilizing process are already observed: separatist movement in Spain; BREXIT; construction of a wall between the US and Mexico; and in Brazil, the proliferation of an ideological and even cultural hatred, where the coexistence of differences has been increasingly difficult.

We are reaching levels of inequality in the so-called Belle Époque period6, with implications for developing countries. While in the 60s to 80s of the last century the direct interference of the great powers, especially the US, was necessary from the support to the dictatorships that were implemented in Latin America, the same was not necessary from the 90s. The agenda of the Washington Consensus, promoted a cultural revolution whose main and immediate focus was the end of the USSR, but which in fact contributed to initiating the ruin of social democracy, especially in Europe.

This reality has important repercussions for Engineering, and in this article we analyze the role that the councils, associations and engineering schools have played while facing of some historical facts which had a high impact on Engineering, such as the movement called "O Petróleo é Nosso", the EMBRAER case and the discovery of the pre-salt oil reserve.

In these three important historical moments, there was no mobilization of engineering institutions, even in the face of a broad and polarized discussion held in society. The same is true of the recent privatization of EMBRAER, a Brazilian company considered the third largest aviation jet producer in the world. The silence of the engineers in the face of this transaction was embarrassing.

Last but not least, the recent discovery of the Pre-Salt oil reserve was on the agenda of a recent impeachment of a President of the Republic. Once the process was consolidated, the pre-salt exploration market was internationalized and the national exploration monopoly was eliminated, restoring, in a way, the ideological context of the "O Petróleo é Nosso" movement.

It is concluded that the interdisciplinarity between different themes, integrated to Engineering, can contribute to the critical formation of the Engineer, helping in the mobilization of the class when imminent historical decisions with high professional impact.

Agency, Ethics and AI

Ken Archer (Upwave, VP – Product)

This paper is motivated by two decades of work in technology firms, observing the wide gulf that exists between the normative appeals of technology ethicists and the daily decisions made by the builders of technology. From technology ethics one hears the normative claims that practitioners should do many things differently. When asked how to account for the fact that engineers do not do these things, even after learning that they should, the response is generally that this is a question for psychology, or for business ethics, or for some other field.

Motivated to answer this question, to account for decisions that engineers make day-to-day, I have found such decisions to be largely mischaracterized. Projects in technology ethics tend to teach a set of exogenous principles that practitioners and designers are expected to apply. The message, sometimes explicit, of such projects is that, whereas artifacts may not be morally neutral, those who build them are applying instrumental, calculative reasoning to build towards a design, and must be taught the ethical ramifications of their finished designs. The upshot of this framing of technical work is that technology is an applied science, which allows little room for agency, and that the builders of technical products have agency primarily in the decision whether to build something. Once that decision is made, however, the agency of the builder is narrowed significantly to the instrumental application of physical and mathematical sciences.

This paper argues that technical rationality is never just calculative and is always embedded in self-interpretive practices with competing goods, such that technical decisions are more authentically understood as hermeneutic interpretations of practical predicaments. The critical role of technology ethics, it seems to me, is to unpack and account for the full ethical content of the decisions faced by the designer and engineer, including the competing internal moral visions of the engineer at play in these decisions. Such an account would restore the sense of ethical agency that the notion of technology as applied science espoused by engineering educators conceals from engineers.

Contemporary technology, as is explored below, is oriented by one of two self-interpretations predominant in modernity, two goods internal to technology – the self as applier of exact and universally valid science, rather than superstition or subjective prejudice, and the self as self-responsible for one's decisions, rather than being bound by authority.

Calls for ethical guidance of technology from the outside carry a tinge of elitism and reinforce the narrow agency afforded engineers. By avoiding engagement with specific technical decisions, ethics as an external guide to technical reasoning enables ethics-washing of such decisions at a tactical level.

Nothing less than an appeal to competing internal goods within technical reasoning itself, and a concomitant reframing of technical knowledge and training, will change the current trajectory of technology and of modernity. This may be a tall order, to disclose a moral compass from within the most technical areas of practice, but there is no way around it.

VII-A2

Designing AI Towards Sustainable Development Goals: A Value Sensitive Design Approach

Steven Umbrello (Institute for Ethics and Emerging Technologies)

Although not much work has been done regarding the practical implementations of AI4SG principles for design, initial first steps provide promising ways forward. This presentation proposes that the Value Sensitive Design (VSD) approach to technology design maps symbiotically onto the initially formulated AI4SG principles and that the VSD bolsters these principles by providing designers and engineers a principled approach to incorporating human values into AI systems design. Likewise, it distinguishes several sources of values in AI systems' design that not only aims to design these systems to prevent harm (boundary conditions) but actually contribute to social good. In doing so, the United Nations Sustainable Development Goals (SDGs) are proposed as these higher-level objectives that AI systems can be designed for. A case study regarding COVID-19 tracking/tracing apps is used to illustrate this approach. In doing so, the VSD approach is argued to be at least one of the most salient ways that designers can adopt as part of their daily practices to ensure safe and beneficial design flows in AI design spaces.

VII-A3

Towards a New Trend in AI Engineering: the Human-Centric Approach

Laura Corti (University Campus Bio-Medico of Rome)

Nowadays we are witnessing a new summer of Artificial Intelligence since the AI systems, developed by ML techniques, are being adopted in a growing number of contexts and applications domains, ranging from medical, to finance and legal decision-making.

If the first part of the history of AI systems was based on a product-based approach, characterized by the use of technology by the experts; the ongoing situation reveals the introduction of technology in our everyday life and the necessity to think about a human-centricity.

In this contribution, I will consider the problem of the centrality of the person starting from the involvement of human being in the process of developing the AI systems.

In literature, it is possible to find three ways of interconnection between human and AI systems:

HITL (Human-in-the-loop) entails the capacity of human intervention in the "decision cycle of the system";

HOTL (human-on-the-loop) is the ability not only of human intervention but also of human monitoring the system's operation;

HIC (human-in-command) is the possibility for humans to "oversee the overall activity of the AI system and the ability to decide when and how to use the system in any particular situation".

These three positions reveal a human involvement in the AI system with different degrees of freedom; this analysis of human-AI systems relation lacks a more general statement about the positioning of humans in the relation.

This contribution aims to deeply analyze the switch from a human-centred to a human-centric approach, as the necessity to involve human beings in a powerful and efficient way in the process of developing AI systems and not only to take into consideration the human's point of view.

According to Roman Shtykh and Qun Jin (Shtykh & Jin, 2011), the human-centricity has to be a relevant trait in the web information engineering because "a human is its essential and central part actively processing (receiving and interpreting) and even contributing information" (Shtykh & Jin, 2011)

Notably, the term human-centric is not entirely separated from the human-centred approach, a design issue that is described as the ability to take into consideration the users' point of view in the design of a product. We can think about this ambiguity as a genetic pathway that highlights a more and more active involvement of the person in the engineering processes.

On the other hand, the user-centric approach involves the person directly in the process; the active involvement guarantees that the personal experience of users influences "both the design process and the product." (Bekker and Long, 2000)

Therefore, this contribution aims to investigate, from an epistemological, ethical, social and design perspective, the involvement of the person in the development of AI systems and the possibility to

rethink about a philosophy of human-technology relation in the light of the centrality of person. The central questions are: how can we describe the human-centric approach? How are the engineers deal with this perspective in the practical ideation and creation of software? What are the values of the human-centric approach?

References:

Abdul, A., Vermeulen, J., Wang, D., Lim, B. Y., & Kankanhalli, M. (2018, April). Trends and trajectories for explainable, accountable and intelligible systems: An hci research agenda. In Proceedings of the 2018 CHI conference on human factors in computing systems (pp. 1-18).

Bekker, M., & Long, J. (2000). User involvement in the design of human—computer interactions: Some similarities and differences between design approaches. In People and Computers XIV—Usability or Else! (pp. 135-147). Springer, London.

Doran, D., Schulz, S., & Besold, T. R. (2017). What does explainable AI really mean? A new conceptualization of perspectives. arXiv preprint arXiv:1710.00794.

Hleg, A. I. (2019). Ethics guidelines for trustworthy AI. B-1049 Brussels.

Mueller, S. T., Hoffman, R. R., Clancey, W., Emrey, A., & Klein, G. (2019). Explanation in human-AI systems: A literature meta-review, synopsis of key ideas and publications, and bibliography for explainable AI. arXiv preprint arXiv:1902.01876.

Shtykh, R. Y., & Jin, Q. (2011). A human-centric integrated approach to web information search and sharing. Human-Centric Computing and Information Sciences, 1(1), 2.

VII-B2

US public perception of science and engineering in pandemic times: Dejà-vu all over again?

Diane Michelfelder (Macalester College)

At the time this abstract was being prepared, the US National Academy of Engineering's website (2020) announced a call for engineering action to address the pandemic caused by the novel coronavirus SARS-Cov-2: "Along with the medical and scientific expertise that is being brought to bear on this challenge, the engineering community is ideally suited to address these challenges by sharing knowledge, skills, systems approaches, and an innovative mindset." Indeed, researchers within a number of engineering fields, including electrical, mechanical, biomedical, computer, civil and environmental engineering have been actively involved in responding (Grose 2020). At the same time, at least in the US, compared to the voices of epidemiologists and other scientists, those voices associated with pandemic-related engineering expertise (see for example ASHRAE 2020) have tended not to be publicly uplifted by getting media attention. As a result, they have remained largely in the background with respect to public perception of the pandemic.

A key driver behind the emergence of the philosophy of engineering has been the desire to show that engineering is a disciplinary field in its own right, with, among others, distinctive methods (Poser 1998), epistemology (Bucciarelli 2003), evidence identification (Kerr 2017), etc., and so to combat the perception that engineering can best be described as an applied science. The now-familiar pandemic mantra: "Listen to what science says", along with signaling just how politicized public health measures in the US have become, does very little to dismantle this view. The saying: Listen to what engineering says" is largely absent from public discourse. What are the reasons for this? What could be done about it, before the next pandemic hits?

The paper makes an initial pass at responding to both these questions, with a particular emphasis on mechanical/HVAC engineering. It offers three reasons as to why this kind of engineering has not been given as much "front-page" acknowledgement in the current context as one might anticipate. First, while "sanitarium treatment principles" were seen as a front-line defense against the devastating 1918 pandemic (Hobday & Cason 2009), public health and engineering grew apart from one another in the US in the second part of the 20th century (Gelting et al. 2019). Second, scientific advice regarding masking, hand-washing, etc. align with both individual responsibility and shared values (for example Appiah 2020) in ways that are more transparent that with respect to advice from engineering. And third, air exchangers and other devices, as well as the processes, involved in ventilation systems are largely invisible to a building's users.

The suggestions advanced in this paper as to what might be done about this follow from each of these reasons. A tighter connection could be drawn between engineering and government agencies responsible for guiding the national response to infectious disease such as the Center for Disease Control. HVAC engineering might benefit from being "rebranded" to make its connection to the collective good more apparent, and more could be done to make these systems more transparent to users and so within public life as a whole.

Autonomous Vehicles and Pandemic Response: Ethical Challenges and Opportunities

Jason Borenstein (Georgia Institute of Technology)
Joseph Herkert (North Carolina State University)
Yvette Pearson (Old Dominion University)
Keith Miller (University of Missouri - St. Louis)

The COVID-19 pandemic has brought countless profound changes to society. Information and computing technologies (ICTs), such as facial recognition systems and smart phone apps, are becoming prominent, including in disease identification and tracking. A form of ICT that is in the process of being integrated into our lives, in part due to the pressures and challenges resulting from the pandemic, is autonomous vehicles (AVs). The use of AV technology predates COVID-19. Yet the pandemic could accelerate the integration of AVs onto streets (and elsewhere) while generating new or unanticipated challenges.

This presentation will explore ethical concerns emerging from the use of AV technology during a pandemic. For instance, are there particular uses of AVs that are justifiable during a pandemic but not as justifiable afterwards? Moreover, will usage patterns occasioned by the pandemic continue after the pandemic recedes, and are those patterns largely beneficial or harmful to society? There are many rapidly evolving changes; for example, New York City restaurants are using the lanes of roads for outdoor seating. Questions are arising regarding whether and to what degree such patterns will continue. Analogously, which kinds of space usage decisions will emerge in relation to AVs and how will those usage decisions impact different groups?

Another category of concerns centers on whether the increased use of AVs during the pandemic will lower the barrier for their use in general in such a way as to decrease overall safety or generate other problematic consequences. For instance, automated trucks could (increasingly) become the norm rather than the exception for deliveries. Will safety concerns raised during "normal times" be sidestepped due the need imposed on us by the pandemic? Will the new uses of AVs remain in non-pandemic conditions but without sufficient reflection on the potential consequences? Along related lines, automating tasks traditionally undertaken by people can be fraught with ethical complexities. Because of the pandemic, we may deploy machines, such as AVs, to perform tasks that are suddenly more hazardous. For example, AVs could disinfect rooms that house infected patients. Such automation has ethical significance, especially if its use continues after the pandemic and results in job loss or other negative impacts.

A series of ethical concerns also stems from the potential role that AVs may have in monitoring cases of infection and contact tracing. In principle, travel data collected by AVs could be very useful (e.g., compiling the number of visits to hospitals). Along these lines, such data might assist with contact tracing (by keeping track of where an infected person was picked up and dropped off). And more generally, the data from the cars could shed light on travel patterns during different phases of a pandemic. On the other hand, is the use of AVs for such purposes justifiable considering that smart phones could perform similar functions (and perhaps in a more efficient way)? In addition, an overarching issue pertaining to many advance computing devices, i.e., transparency about data collection and sharing practices, would need to be addressed.

Engineering Consensus: Crowdsourcing a Moral Machine in a Pluralistic World

Paul Firenze (Wentworth Institute of Technology)

Crowdsourcing moral decisions of machine intelligences can expose a dilemma between moral relativism and "moral colonialism." In November 2018, the UK journal Nature published the findings of the Massachusetts Institute of Technology Media Lab's Moral Machine (MM), a massive online experiment to gather human input into projected decisions made by machine intelligence, in particular, autonomous vehicles (AVs) in situations of unavoidable fatalities. Inspired by the "trolley problem" thought experiments, MM presents the user with the choice of two paths an AV can take, each resulting in at least one fatality. The user is asked to choose the "lesser of two evils," taking into account up to nine dimensionalities, including the number, age, gender, physical fitness, and social status of potential victims.

Among the experiment's provocative results are a dendrogram showing "clusters of countries with homogeneous vectors of moral preferences" and radar charts of three major cultural clusters and their (sometimes) distinct preferences regarding the nine dimensionalities. The designers of MM argue that the kind of descriptive ethics provided by this experiment (revealing people's actual, considered choices) is a necessary first step toward creating a "machine ethics" (a type of applied ethics). To this extent, MM is built on good impulses toward democratizing design and away from technocracy. Even if engineers and ethicists could agree on normative principles for machine intelligences, say the designers of MM, this agreement could be rendered "useless if citizens were to disagree with their solution….Any attempt to devise artificial intelligence ethics must be at least cognizant of public morality."

But as the MM dendrogram and radar charts show, implementing "public morality" raises the possibility of instituting a kind of moral relativism if local or regional preferences are programmed into the machine. On the other hand, disregarding differences and implementing a "universal" standard could be seen as "moral colonialism" by communities whose preferences are ignored. How should this apparent dilemma be handled?

This paper uses the work of philosopher J. David Velleman on moral relativism to attempt to dissolve the dilemma. Velleman argues the action-guiding force (normativity) of facts are relative to an implicit frame of reference. For an AV to be a moral agent, its actions must be recognizable as moral from within a frame of reference. Thus, for AVs to be genuinely moral machines, they should be programmed to act in recognizably moral ways, necessitating implementation within an interpretive (relative) context. But this relativism may only be provisional. Velleman argues that while the frames of reference are relative, the goal of the frames, providing pro-social, mutual interpretability, is universal. As AVs become more prevalent, there will be more occasions for a consensus to arise about the frames of reference described in the MM's results. A plurality of frames may remain, or a more global frame may emerge. But to implement a universal frame at the outset would risk unleashing a morally unrecognizable agent onto an unprepared public.

Engineers vs political and financial stakeholders in Portuguese railways: a sociotechnical approach to a peripheral nation (1850s-1910s)

Hugo Pereira (CIUHCT - FCT NOVA)

In the 1850s, after thirty years of political turmoil, Portuguese technocrats agreed to put investment in science and technology before sterile ideological disputes and to set progress as the aim everyone should aim for. Benefitting from the adherence to the gold-standard in 1854, the country began an ambitious public works program, spearheaded by railways. Throughout the second half of the nineteenth century, the main branches of the Portuguese railway system, which extended for roughly 2,500 km, were built and surveyed (Alegria 1990). Historiography about Portuguese railways usually considers the rationale behind their discussion as entirely technological and focuses mainly on their outputs, taking railways for granted, or black-boxed. However, the planification of large transportation systems depends on the sociotechnical context and on hierarchies of power of their time (cf. Latour 1999: 304-306 and Kranzberg's Fourth Law – Kranzberg 1986: 550). In this paper, I propose to open the black box of Portuguese railways. I use technical and military reports, parliamentary debates, and sundry bibliography to analyse the influence different stakeholders (or system-builders to use the expression of Hughes 1983: X), like engineers, army officers, policymakers in the central government, and corporations, had in the final design of the Portuguese railway network, considering their expectations, priorities and agendas. Specifically, I will focus on the input of Portuguese engineers (most with specialized training in the Saint-Simonian schools of France and Belgium, Matos 2009: 180-181) and compare it with the lobbying of decision-makers at central government, local caciques, and private financiers and entrepreneurs. I claim that engineers played a decisive role in the planning of the network (besides being responsible for the transfer of knowledge about railway construction and operation from the European core), but a large part of its design was due to non-technical issues, including political and diplomatic machinations, budgetary constraints, and corporative lobbying. I aim to add to the debate about the co-construction of society and technology, the importance of social factors to technological implementation and how technology is a sociotechnical construction (Hackett et al. 2007).

Keywords: planning, policymaking, black-boxing, Saint-Simonianism, co-construction

References:

Alegria, Maria Fernanda (1990) A organização dos transportes em Portugal (1850-1910): as vias e o tráfego. Lisbon: Centro de Estudos Geográficos.

Hackett, Edward J., Olga Amsterdamska, Michael Lynch, and Judy Wajcman, eds. (2007) The Handbook of Science and Technology Studies. Cambridge, MA: The MIT Press.

Kranzberg, Melvin (1986) "Kranzberg's Laws", Technology and Culture vol. 27, no. 3: 544-560.

Hughes, Thomas Parker (1983) Networks of Power. Electrification in Western Society, 1880-1930. Baltimore, MD: The Johns Hopkins University Press.

Latour, Bruno (1999) Pandora's hope: essays on the reality of science studies. Cambridge, MA: Harvard University Press.

Matos, Ana Cardoso de (2009) "Asserting the Portuguese Civil Engineering Identity: the Role Played by the École des Ponts et Chaussées, 1825-1866", in Ana Cardoso de Matos, Maria Paula Diogo, Irina Gouzévitch, and André Grelon (eds.), The Quest for a Professional Identity: Engineers between Training and Action. Lisbon: Colibri.

Transduction of power in engineering research and practice: an inter-disciplinary and extra-disciplinary approach

Ira Monarch (Carnegie Mellon University)
Eswaran Subrahmanian (Carnegie Mellon University)
Muriel Mambrini-Doudet (INRAE)
Anne-Francoise Schmid (Mines Paris Tech)

The question of power is infrequently considered in collective design, whereas its expression in and its effect on the conception process are crucial. Treatment of power is often avoided in engineering management process. Our aim is to throw light on the silent treatment of power in order to understand better the conditions for collective conception, engineering and design.

We formed an interdisciplinary research group almost five years ago to study collective design processes, and especially the conditions favoring the sharing of knowledge and the production of innovative concepts. Only now have we begun to ask finally the most effective question: What are the relationships between our intentions and power in design?

Design innovation nearly always takes place in areas where multiple actors share knowledge and agree on concepts to design new objects. Such collective design necessarily deals with networks of intentions. Indeed, our assumption is that there is no design without intention. We can also say, following received opinion, that there is no intention without power. Thus, the design process is caught in sets of heterogeneous knowledge and networks of power. However, if there is no intention without power, perhaps also there is no power without intention. In design, as in engineering, interactions between intentions create exchanges of energies, thus transforming the sets of intentions into vectors. This transformation enables intentions to combine and create forces necessary for conception. Our view is that, in design, conditions can be mobilized that transduce power without reducing intention to power or the play of forces.

Based on our own sets of knowledge and practice, we have proposed two concepts that help realize such design conditions: shared memory and collective intimacy.

Power is scripted by shared memory. Scripting facilitates shared memory being provoked in ways that transcend typical doubts and criticisms ensconced within single disciplines and current shared paradigms. Design, as cross-disciplinary and extra-disciplinary, provides increased opportunities for transduction of one formation of shared memory and collective intimacy to another. Collective intimacy, enables intentions to become vectorial powers intertwined in a matrix oriented towards producing common goods. In this way, power, as the inter-play of contra-forces, is transduced so that power or counter-power does not devolve into power-over. Collective intimacy is not the addition of distinct identities. Rather, it produces trajectories across disciplines, allowing the combination and compatibility of heterogeneous fragments of knowledge and the production of intermediary theories and mobile truths. Thus collective intimacy enables development of an intention that maintains a multiple identity executed unilaterally. Our orientation is that collective intimacy is crucial for the way engineering will be practiced in the future, especially in regard to ethics and esthetics.

We are proposing a collective exploration of the way engineering treats intention and power based on the framework that we have elaborated for design innovation. This framework has allowed us to propose and work collectively. We will conclude our presentation with a short experimental text of a design fictional dialog on design, intention and power.

VIII-B1

An Upper Ontological Model proposal for the engineers of today: why should we think about it, and how can we formulate a tractable solution in support of practice?

Nina Jirouskova (Imperial College)

This paper presents an ontological model developed for the benefit of the engineer of today, thereby addressing a key gap in literature and engineering practice. In an era where the world is seeing some key civilisational transformations and where society has to face the intrinsically significant underlying uncertainties that come with those transformations, the need to take the time to consider the concepts at the front-end of engineering has probably never been greater to ensure a robust, reliable and transparent, ethical practice. The model proposed is derived from a thorough multidisciplinary review of relevant works, reaching out not only to philosophy, but to physics, cognitive science and other disciplines as well. It is designed to be used and embedded in standard engineering practice utilising a model-oriented systems engineering approach (MOSE). A new language is defined for the model to decrease the level of expertise in the field needed to use it, thereby facilitating access to powerful system's engineering principles and laying down a steppingstone towards truly integrated multi-disciplinary work. The elements of the model answer the ontological questions of "what IS?" and "how does a being come to be?". Consistently with the fundamental law of conservation of energy in Physics, the proposed model relies on a monistic approach whereby all exiting entities are considered part of a whole: the substantial Holon. The elementary partition of the Holon is considered to be a three-part structure, consisting of Substance, Essence and Existence. The realisation of an entity in its space of existence is defined as its actuality. This proposal embraces the perceptionists' view that the only accessible truth to the human is what he/she perceives (through body and mind) of the actuality. A dual anchoring system of realisation of these levels of being is suggested: the first anchor being the external environment, and the second the internal existence coherence key element of memory. Consistently with quantum theory, the theory of World of Possibles and some aspects of biological and psychological developmental and evolutionary theories, the dynamic model of "becoming" is set out to consider the evolution of being as a probabilistic draw of state of being

from a world of possible, where probabilities are assigned based on the likelihood of the states to be successful in satisfying criteria of the upper levels of being, asserted through the experience of the

entities typologies that the being belongs to. Based on these upper ontological paradigms, this study suggests that any entity may ultimately be modelled as an interaction between its two anchor systems. This ontological stand is in adequation with the experientialist thesis, advocating that the reality consists solely of the result of interactions among entities. Such approach may act as a conceptual validation to operational modelling, and specifically service-system modelling with regards to its value-based satisfaction driven realisation criterion. Overall, this paper provides key contributions to engineering through the consolidation and integration of meta-engineering principles and the proposition of a new, tractable, ontological model which may be used in multi-disciplinary engineering solutions development.

VIII-B2

Conceptualizing Engineering for Educational Purposes

José Aravena-Reyes (Universidade Federal de Juizde Fora)

In Brazil, the mission of professional high education is not only to prepare people to the market but also to prepare them to participate in the development the Brazilian society. In the case of engineering education, this implies in developing competencies to management and produce technologies and also to produce effective changes in society through technology production and use.

The traditional engineering education model explains Engineering as a sort of problem-solving process using scientific knowledge, and this is the primer and principal idea acquired by students about engineering, but that it is not formative enough to insert them in society as social change's agents. The notion of engineering problems is restricted to these kinds of issues that can be solved by natural science approach. The social science perspective is not privileged in engineering formation, which produces a limitation in achieving the objective of developing society due to including only technical but not social variables. The idea of an interdisciplinary approach to engineering's problematic situations fails due to the weak basis on social sciences of students. The most important part of the time, the engineering object is produced under the domain of economy and natural science.

For overcoming these limitations, we propose that Engineering should be interpreted differently from the problem-solving dominant paradigm. To promote a more socially engaged perspective of students, we should move to a broader understanding of Engineering as an inventive and productive existential mode of living which is culturally ordered. Through this approach, we want to rescue some philosophical contributions that show that the inventive aspect of engineering (its métis) is as powerful as its current order based on external factors like economic and natural sciences (its lógos) and must be included in the educational processes of engineers.

VIII-B3

Discontinuist pluralism in philosophical materialism: preliminary notes

Antonio Ruiz Capilla (UNED/UGR)

It should be started by stating that pluralism is defining. However, there are several types of pluralism, for now there are continuist pluralisms and discontinuous pluralisms. The defining feature of philosophical materialism is discontinuist pluralism. Such precision is important to face the two deceptions that, in my opinion, scientific pluralism commits: thus, practical-moral deception has to do with the idea that science will solve all problems in the future, and deception theoretical-practical is related to the idea that science will solve all the theoretical problems that we pose; different sciences want to carry out this project in ways that are incompatible with each other. Thus, the question is the following: is the fact that there are many sciences gnoseological or is it ontological? That is, does it simply have to do with the way we have to know the universe and we will solve it little by little or is it because there are real discontinuities in matter? That's to say, real discontinuities in matter and in the world that constitutively prevent an idea of science in the future.

In this way, we will face the following problem: are the different scales discontinuities or ontological failures or, on the contrary, are they historical-sociological? Can there be a solution of continuity or not? From the gnoseological discontinuist materialism the thesis is defended that some of these discontinuities are ontological. In this regard, I will raise the relationship between the material turn and propositionalism; the relationships between gnoseology and epistemology with a view to overcoming the subject-object distinction and, finally, I will focus on the critique of monism from the history and philosophy of science. Regarding this last point, I will take advantage of the theses that defend the existence of metaphysical foundations for scientific pluralism, thus having natural classes that explain the irreducibility of some sciences with respect to others and thus generating an ontological discontinuity that is in which gnoseological pluralism is sustained. Having defined the above, I will focus in the last analysis on the open problems as a result of a typology of discontinuities; both those referring to the genres of materiality (versus swarms as agents for breaking ontological hierarchies), and those relating to separability or inseparability (with special attention to the problem of lack of connection).

Theory of action in technical objects: automation and mediation

Carolina Vega (University of Concepción)

Within Gilbert Simondon's theory and conception on the Mode of existence of technical objects, I intend to give an account of an interpretation of the theory of action regarding systems and relations of technical objects in general and regarding AI and Robotics in particular, if this is possible; furthermore, if it is possible to conceive it in terms different from an analogy of human action.

Long is the path that philosophy, and in detail the Philosophy of the Mind, has traveled in terms of analyzing how a human action or agency is generated, and how to reduce this to ground elements from which such action can be regenerated or replicated. This latter act, has been used in science and engineering as a method to be applied in their disciplines and in the objects they produce. On this, it is necessary to indicate that the persecution for the imitation of the human being in the technical objects is a path that will not be taken in this work, in which precisely it becomes absolutely necessary to emphasize that the technical objects, concrete and abstract, are conceived from their own structures, processes, operation and relations (Simondon, 1958), therefore without an imperative of similarity strictly engaged to human beings; nevertheless, the relation of invention and as we will see, of mediation, appear then as fundamental.

Thus, from the technical object conception, I will develop two not exclusive approaches: automation and mediation, as two notions that from a theoretical and practical point of view produce relations in the objects, among these same ones, between these and their creators and users, as well as in the technical culture and its valuation. Instead of extolling one or another focus of agency, the distinction between automation and mediation aims to distinguish the fields of possible actions in the generation of objects with complex technical relations and the scope of these actions.

If in the past automation was the aim to be pursued in the progress of machine; mediation, as we shall see later, is considered as a new approach that allows the study of technical objects to be separated from the Philosophy of the Mind and its limits, to be studied now from the Philosophy of Technology and therefore from its own status or mode of existence. Although this development is abstract, we cannot ignore the influence that the approaches, theories and perspectives have on the imagination and invention of both people who generate objects and all living beings that are related to them.

Finally, we will also realize how automation and mediation can be understood without pointing to definitions or reductionisms, but rather with respect to the relation that occur when creating a technical object from one or another system.

The potential of cinema to address multiple layers of technical action

Albrecht Fritzsche (Ulm University)

As embodiments of determinate, repeatable operation, technical artefacts require efforts of construction on many different layers and over different periods of time. The chain of cause and effects that is implemented in a physical object is only one of them. Other efforts of construction concern the perception of utility, the provision of a technical infrastructure and the routines of application, maintenance etc. One of the problems of the ongoing discussion on technical artefacts seems to be that its focus tends to be set on one specific layer of construction. Depending on the given disciplinary background and subject of the investigation, scholars usually discuss either cause-effect-implementations or perceptions of utility or another aspect, which all the others are considered as given in one specific form or another. However, all efforts of construction have continuity over the lifetime of artefacts – a fact that is usually not denied, but ignored because of the complexity it adds to the discussion. This raises the question how the multi-layeredness of artefacts can best be addressed.

Drawing on earlier work, this paper interprets the artefact as a staging of technology: it puts something in the spotlight for the audience, behind which the surrounding efforts remain in the dark. While some other papers have looked at stagings in theatre and dance, this paper turns the attention to cinema. In particular, it studies films by Werner Herzog from the late twentieth century. Herzog's films are chosen because they, unlike mainstream cinema, make the different layers of contributions to cinematic experience visible. Herzog switches between documentary and fictional elements, past and present, in a way that allows the audience to experience the presentation on screen as a complex hybrid that does not fit in any given discourse. As this year's fPET conference takes place in South America, Herzog's filming activities in Brazil, Peru, etc. for the films "Fitzcarraldo" and "Aguirre – Wrath of God" will receive particular attention.

Based on the discussion of Herzog's films, the paper explores how investigations of the multi-layeredness of technical artefacts can proceed and what they can contribute to the ongoing discourse on philosophy, engineering and technology. The paper will also show correspondences between the artistic treatment of artefacts in Herzog's films and the current challenges of the digital transformation. Although the films do not include any digital effects of other sophisticated technology that would have been available at the time, the way how performances in the course of creating the film are displayed may help us to gain a better understanding of today's social media, internet of things and comprehensive innovation.

What do overhead lines reveal?

Daiana Martinez Monteleone (University of Hildesheim, Civil Engineer - Philosophy Student)

Overhead lines belong in Germany since the 1920s to the anthropogenic landscape elements. Due to the increased energy-demand, so-called "electricity highways" are currently being planned to cross the country from north to south. However, this project has been delayed for years: among other Reasons, plenty of the local initiatives concentrate on the claim to lay the cables underground, which will replace the widely tested technology of the Pylons by laying cables at a depth of 1.50 m.

Beyond the - sharply discussed - technical arguments such as the questioning of the necessity of the proyect itself and its indispensability for energy transition, the comparison of the two technologies in matters of environmental protection, agricultural activity, human health, etc., stands out among the plea for the underground alternative, their absence of impairment of landscapes. This argument constitutes the focus of my reflection.

I researched, what the widespread repudiation of the image of the Pylons is based on and I discover that the protesters find it enough to refer to the concept of a need for contact with an idealized nature, such as a counterweight to urbanity, very much in line with an old-fashioned dualistic, essentialistic and bourgeois world understanding. This assertion does not seem to require a second "why?" among the public. However, from a philosophical perspective we can ask ourselves what the meaning of technical objects in relation to the existence of man is, so that we can think about doing something else than just hide them.

Following Simondon I discuss why there should not be an opposition between technology and nature and I reflect on the possibility of seeing in that a crystallized human gesture. Without forgetting the theory of alienation, I discuss how human beings could feel in dialogue with the technical objects. I maintain that we live in a world of relationships and constant creative transformations, so that it could be possible to find an alternative to the attitude of "man as a stranger in nature" and consider technology as "socially constituted nature" so that building can be understood as a way of being on earth.

On the other hand, I focus on the systematic connection of sight to opinion-formation. Because it is understood that technology allows abuse and therefore massive effects, I investigate whether the aesthetic intervention or the "placebo effect" of underground wiring could have a negative impact on our process of awareness of excessive consumption. In doing so, I present a phenomenological position opposed to Simondon's and consider whether the examination of the technical object can be left to perception alone or not.

Finally, the voice that only the engineer can raise in these reflections as witness and agent of the relationship between human society and the world of technical objects is discussed. Because public opinion does not demand from an engineer his/her participation in these political problems, nor does the engineer assume that they are issues of his/her professional concern, the problematization of the role of the engineer is a matter of urgency.

IX-B1

Ciencia y Filosofía en el Antropoceno. La necesidad de la reflexión filosófica en el progreso tecnológico

Ronald Alvarez Vera

Debido a la influencia e impacto de las actividades del ser humano en la tierra, alterando los ecosistemas en los últimos dos siglos, nos encontramos ante una nueva era geológica denominada Antropoceno (nuevo ser humano). Si bien el termino, que fue usado por Paul Crutzen, no ha sido totalmente aceptado dentro de la comunidad científica internacional, el Antropoceno es más bien una postura política que científica.

Somos testigos de un creciente avance tecnológico, que no solo ha provocado la creencia de la supremacía de la especia humana sobre todos los seres vivos, sino también amenaza, con una separación y desigualdad nunca vista en nuestra historia. El modelamiento de la tierra (Earth-shaping) por la intervención humana desmedida, crea desbalance y pone peligro a la biodiversidad del planeta, incluyendo al hombre mismo. La interrelación entre la tecnología y el hombre genera nuevos planteamientos bioéticos. Por ejemplo, la gran herramienta de la biotecnología, mediante la nanotecnología o la eugenesia para curar nuestros cuerpos. Pero además también puede alterarlos, mejorarlos genéticamente ¿Quiénes serán los afortunados en beneficiarse con estas maravillas y dónde residen los límites de esta optimización?

Además, sin duda, las aplicaciones de la inteligencia artificial en la informática y la robótica han creado nuevas formas de interacción hombre-máquina y máquina-maquina.

El hombre se autodefine por lo que dice ser y por lo que es capaz de hacer. Está en su naturaleza el crear y, de ahí, emana la tecnología. Sin embargo ¿somos nosotros los que usamos la tecnología o es ella la que nos usa? Nos definimos mediante la tecnología o, tal vez, nos estamos alienando de nosotros mismos. Ante el progreso tecnológico irreversible debemos seguir cuestionándonos qué somos, con qué propósito construimos o modificamos el mundo y a qué costo.

Replantearnos los chiches de la postmodernidad: fluidez, multiplicidad, nomadismo, oportunidad, igualdad, comunicación, libre información, etc. Muchos problemas aún están presentes en nuestra era tecnológica. En el ámbito biopolitico-economico, si no enfocamos nuestra atención y verdadero interés por ayudarnos como especie, podríamos separarnos aún más entre países hiperdesarrollados y subdesarrollados. Por otra parte, las posibles consecuencias socioculturales debido a la individualización radical de la persona, también amenazaría con una disgregación de la comunidad entre seres humanos, donde la otredad se nubla bajo el lema de la universalidad y el sentido por la pregunta del ser se desvanece.

La ciencia no es límite de la filosofía y tampoco la filosofía delimita a la ciencia, sino, deberían coexistir siempre entrelazadas. La ciencia refleja lo que somos, es una amplificación de la consciencia humana. En definitiva, para tener una mirada positiva del humano del Antropoceno, la producción de conocimiento científico y el progreso tecnológico deben ser paralelos a un humanismo filosófico. La heterogeneidad del ser humano es inexorable y por lo tanto su evolución coherente y en justa interconectividad con el medio que lo rodea, con el otro y consigo mismo.

Engaging Technologies (Tecnologías Entrañables) for a new engineering

Martin Parselis (Pontificia Universidad Católica Argentina)

Engineers are major players in the production of technologies that change the world and our way of life. Therefore, they are creators of culture and a fundamental part of the technical phenomenon, understood as a general phenomenon that has always accompanied humanity, and whose influence is increasingly accentuated with an acceleration never seen in recent decades.

Engineering maintains an encapsulated perspective in its specialties, taking into account “exchanges with its environment”, and studies on the relationships between science, technology and society (CTS Studies), which mostly come from philosophy, sociology, and science and technology policies, do not seem to admit some of these reflections. Thus, engineers as main actors often become subjects that must be "evangelized" by sociologists, or are accused of being insensitive to social problems. According to this diagnosis, the “mainstream” of reflective publications on technology seem to show that these are irreconcilable fields.

There is an incipient group of authors from engineering who are making reflective efforts without denaturing engineering, systematizing, reflecting and proposing analytical models, constituting a corpus of engineering epistemology and accounting for the complex interplay between technical creation and societies.

One of these models is that of Engaging Technologies (Tecnologías Entrañables), which are a set of criteria for technological development aimed at avoiding the phenomenon of "estrangement" that we have with technologies and which derive from the analytical models of Quintanilla and Parselis in their contributions to philosophy of technology.

These identify key instances where different types of estrangement occur between the intentional agents who design and the agents who use the technologies. They describe four modes of estrangement: technical (the possibility of exploring technologies), socio-cultural (the possibility of legitimizing the purposes of designs), representational (the differences between social representations about technologies and their technical aspects), and finally the possibility of deciding and managing common goods (commons) associated with them both in the context of design and in the context of use.

This article seeks to show the power of the concept of Engaging Technologies to identify the different disconnections between designers and users, proposing design criteria that are broader than engineering classics. This model can also guide ethical principles in design and guidelines for the training of future engineers.

You can go further on this concept here: https://link.springer.com/chapter/10.1007/978-3-319-71958-0_8

The brief presentation: https://docs.google.com/presentation/d/e/2PACX-1vSZiaFys0jHyxCFkf36N_pGVjHvlvy5Sd9wmk2iGxd9ez4KLFVmpr4I7-P2tshp6Q/pub?start=false&loop=false&delayms=3000

El Software Libre como caso emblemático de desarrollo tecnológico alternativo y entrañable

Miguel Jáuregui Arévalo (Universidad de Valparaíso)

Resumen

Una de las problemáticas de las técnicas y tecnologías contemporáneas es su enmascaramiento. Esto es producido en parte por la opacidad en su diseño tecnológico (Quintanilla, 2017: 21) y por las restricciones que se le aplican en procesos posteriores, ya sea para proteger los derechos de explotación comercial vía patentes, marcas registradas, propiedad intelectual u otro «cercamiento del conocimiento y la cultura» (Bollier, 2016: 69-81). De esta forma, al no ser liberados los contenidos intrínsecos de los artefactos (el detalle de sus componentes estructurales), estos se hacen extraños, difíciles de entender para quienes no pueden acceder a conocimientos que estén aplicados en y por su diseño «cerrado», generando con ello un enmascaramiento que favorece la representación de artefactos o sistemas técnicos como si fueran «inteligentes». Es indudable que en el confeccionar de lo mecánico y de las actuales tecnologías está plasmada una expresión de la inteligencia, dado ello, podríamos inferir erróneamente que todas las máquinas y/o artefactos poseen inteligencia. En la actualidad los dispositivos –en especial los que se conectan a Internet– han sido adoptados como smart, sin embargo, debido a una alta complejidad del sistema que embeben y a la opacidad plasmada por y en sus diseños, estos artefactos han quedado malentendidos como inteligentes, y a su vez, adquiridos y usados en un tono de «sonambulismo tecnológico» (Winner, 2008: 11–16).

En movimiento disímil, el software libre es un ejemplo de tecnología que aunque puede ser compleja, debido al uso de la programación de distintos niveles y lenguajes, se entrega a la comprensión humana por que la usanza de este puede llegar a ser culturalmente adquirida, comprendida en todas sus facetas. Los factores que propician este proceso práctico-cognitivo van desde la disponibilidad o acceso libre al código fuente (en el cual podemos apreciar su ingeniería), los manuales que vienen con dichos artefactos (escritos de una forma legible, en diversos idiomas) y si esto aún no nos alcanza para captar cómo estos algoritmos están hechos y/o cómo funcionan, podemos recurrir a comunidades o usuarios/as que saben su aplicación, cómo modificarlos y mejorarlos acorde a nuestras necesidades. Debido en parte a estas características, el software libre puede ser enmarcado como caso emblemático de desarrollo tecnológico alternativo y entrañable (Quintanilla, 2017).

Keywords: Desarrollo tecnológico alternativo, enmascaramiento, software libre, tecnologías entrañables.

Abstract

Free/Libre Software as an emblematic case for an alternative and engaging technological development

One of the difficulties of the contemporary technics and technologies that they are shrouded in a veil of secrecy. In part this is due to opacity in its technological design (Quintanilla, 2017: 21) as well as the restrictions applied to posterior processes, being these copyright, trade mark, patents to protect the intelectual property or other «cultural and knowledge enclosures» (Bollier, 2016: 69-82). Without the full intrinsic value of the objects revealed, they become strange and inaccessible to those who

have no way in to the knowledge that may be being referenced and, due to its closed structure, a veil of secrecy is created which favours the representation of artifacts or technologies as if they were «intelligent». Undoubtly the mechanic in the making of new technologies are manifestations of intelligence, therefore, we could erroneously assume that all artifacts and/or machines are intelligent. At present, devices, specially those connected to Internet, have been denominated as smart, given that contain highly complex embedded systems and their manifest opacity in and for its design, these artifacts have been misconceived as intelligent, they also are purchased and used in a way like «technological somnambulism» (Winner, 2008: 11-16).

Free/Libre Software as a contrasting movement is an example of technology that although complex due to different levels and languages programming it contains this technology is liberated for public knowledge. The use of this technology can be culturally accrued and understood in all its stages. The factors that promote this learning varies from free access to source code (where we could see its engineering) manuals that comes with the software (plain written, easy to understand and in several languages) even when all this is not enough to understand how these algorithms are built or how do they work, we can access web communities and users that know how to modify, adapt them according to our needs. Due in part to their characteristics Free Software can be stablished as a emblematic alternative and engaging* technological development.

Keywords: Alternative technological development, engaging technologies, Free/Libre Software, veil of secrecy.

* There is not an accurate translation in English for the term entrañable (Quintanilla, 2017)

'Good Judgment' in Engineering. Philosophical discussions and pedagogical opportunities

Héctor Gustavo Giuliano (Pontificia Universidad Católica Argentina)
Leandro Giri (IIF-SADAF / CONICET)
Fernando Gabriel Nicchi (Universidad de Buenos Aires)
Federico Vasen (Universidad Tecnológica Nacional)
Martin Parselis (Pontificia Universidad Católica Argentina)
Lydia Fabiana Ferreira Aicardi (Universidad de Buenos Aires)
Sergio Merse (Pontificia Universidad Católica Argentina)
Walter Weyerstall (Universidad Nacional de Tucumán)

Inclusion of human oriented knowledge in engineering careers is indicated in Resolution 1232/01 of Argentinian Ministry of Education: “the curriculum must include topics of social and human sciences directed to train engineers aware of their social responsibilities” [1]. This statement is collected by Federal Council of Deans of Engineering Faculties (CONFEDI) who in his last document of Proposals of Second Generation Standards for Accreditation of Engineering Careers affirms the need to “propose a curriculum with a balance of competences between academic, scientific, technological and management knowledge, with human oriented look” [2]. Despite this, the inclusions of these topics faces in practice with conceptual difficulties rooted in an extensive tradition of conceiving engineering as an instrumental discipline based on technoscience [3].

The objective of this work is to present for discussion a foundation of the importance of philosophy in professional training sustained in their own definition of engineering provided by the Accreditation Board for Engineering and Technology (ABET) which is adopted by numerous national organizations, among them Argentinian CONFEDI:

Engineering is the profession in which a knowledge of mathematical and natural sciences gained by study, experience, and practice is applied with judgment to develop ways to utilize economically the materials and forces of nature for the benefit of mankind [4].

We believe that this definition includes a central point to which little importance has been given and going unnoticed in its complexity and potential. The point to which we are making reference is the enunciation of the particle "with judgment", which officiates as a link between epistemological aspects associated with knowledge, and pragmatic aspects referring to the purposes that such knowledge should have. In turn, and with regard to the question of the objectives, we consider that the statement "for the benefit of mankind" must also be the object of philosophical analysis so that it can be translated into didactic content, both general and specific.

In this paper we wish to provide some details about the notion of “good judgment” in engineering and how philosophy is of substantive importance in order to locate the profession through the emergence of underlying preconceptions in its training and exercise. As Edgar Morin points out: “in fact, general ideas cannot be eliminated and end up reigning in a hidden way in the specialized world. [...] These are general ideas about the order of the world, about rationality, about determinism, etc.” [5]. In conclusion, it will be observed that impossibility of defining a single rationality opens the opportunity to define clear institutional profiles between different engineering schools.

[1] https://www.coneau.gob.ar/archivos/538.pdf
[2] https://confedi.org.ar/librorojo/
[3] Moler, E. (2006), “Procesos de acreditación en las carreras de Ingeniería: ¿Mejoramiento en la calidad o adaptación a las normativas?”, Serie Estudios, 5, CONEAU, Ministerio de Educación, Ciencia y Tecnología.
[4] https://www.abet.org/
[5] Morin, E. (1994), Introducción al pensamiento complejo, Barcelona, Gedisa, p. 91

X-A2

The Plausibility of an Active Learning Maturity Model for Engineering Schools: Practical and Philosophical Concerns

Humberto Arruda (Universidade Federal do Rio de Janeiro)
Edison Silva (Universidade Federal do Rio de Janeiro)

Due to the COVID-19 pandemic and social distancing actions, Higher Education Institutions (HEI) around the world had to take actions to keep activities running. Online courses became the norm, and Active Learning is pointed out as one of the key ingredients for their success [1, 2]. "Active Learning" is an umbrella term that refers to different models of instruction, including cooperative and collaborative learning, discovery learning, experiential learning, problem-based learning, and inquiry-based learning [3]. Studies about Active Learning started in the 1970's, in specific fields such as education of exceptional children [4]. Since the early 1980s, health [5, 6, 7], management [8] and education [9, 10] embraced active learning. In the field of Engineering, Active Learning methods gained attention due to the popularity of approaches to modernize education, such as STEM [11] and CDIO [12].

Engineering Schools eager to modernize educational practices do not have a tool to understand their current maturity of Active Learning, which can be the first step for an improvement plan. Therefore, this presentation points out to practical and philosophical problems in the development of an Active Learning maturity model. We discuss if, why and how the adoption of active methods in disciplines, the adequacy of technological and physical infrastructure, and staff's capabilities can be measured objectively under a scale, or whether there is some degree of irreducibility in engineering education.

Controversies as a means to elicit values in responsible smart city design

Anouk Geenen (University of Twente)
Julieta Matos Castaño (University of Twente)
Mascha van der Voort (University of Twente)
Peter Paul Verbeek (University of Twente)

The development of smart city projects and its accompanying discourse have led to responses of both optimism and opposition. Smart city visions are rapidly gaining foothold worldwide as they intend to optimize city processes and improve city life. However, many criticize smart city concepts for being ill-defined and too tech-driven. As such, smart city initiatives generate socio-technical controversies: social conflicts that emerge from the coexistence of conflicting viewpoints due to the introduction of technology in society (Callon et al, 2001). Because of their public nature, controversies are conceptualized as critical places of informal technology assessment (Rip, 1987). This emphasizes their relevance for gaining insight on stakeholders' perception and evaluation of new urban technologies. Current smart city practices however often ignore areas of conflict by seeking for consensus or introducing a techno-fix in an attempt to solve the issue at hand.

In the spirit of Latour (2005) and Marres (2007), this paper takes controversies as places where politics 'happens': a plurality of perspectives comes together, values are negotiated and new social practices emerge, forming spaces of self-organized participation and value-assessment (Cuppen, 2018). As a result, we consider it important to gain a better understanding of socio-technical controversies and look into their mediating role to elicit human needs within the smart city. How can controversies shed light on what citizens and other stakeholders expect from a smart city?

This work empirically studies socio-technical controversies related to smart city innovations in the Netherlands. To discover and discuss smart city controversies, we apply scenario based methods that allow participants to frame and reframe the impact of smart technology in the city to elicit underlying values and conflicting concerns. In two workshops, over 60 participants from all legs of the quadruple helix -government, commercial sector, research institutions and civil society - joined and gave input on the issues at stake in the Dutch smart city discourse.

The workshop results show that controversies are a viable means to access underlying values in order to formulate value tensions. We identify concerns on the micro (individual), meso (social) and macro (societal) level, coexisting at different dimensions. Controversies are often the result of conflicting concerns between two levels, revealing explicit tensions between individual and societal stakes.

These results give insights into the value conflicts that emerge in smart city projects. By taking these as a point of departure to identify and construct shared solutions, this work supports a human-centered approach to responsible smart city engineering and design. In particular, making controversies explicit opens up the debate of what is desirable for stakeholders, and supports the development and implementation of technology that acknowledges a plurality of societal values.

Engineering Eudaimonia: Philosophical and Technological Considerations for Creating Healthier Cities

Mark Bessoudo (WSP)

Today, over four billion people – more than half the world's population – live in cities. By 2050, two-thirds will live in urban areas. Meanwhile, changes to modern lifestyles have contributed to many of the public health concerns emerging around the world, such as stress, poor diet, social isolation and sedentariness. Better urban planning and building design could therefore help alleviate these issues.

The correlation between urbanization and decreasing physical and mental health has garnered significant attention in recent years, not just among public health agencies and policymakers, but also within the urban planning, real estate, and building design and construction industries, where a new market demand is emerging, one that more intentionally addresses human experience, health, and wellness as core elements of architectural and engineering practice.

Research has shown, however, that wellbeing is influenced by three main factors: 50 percent is related to a person's "setpoint" (their baseline level of happiness); 40 percent to intentional activity (their actions, thoughts and routines); and 10 percent to external circumstances (their surrounding environment and possessions). This suggests that wellbeing cannot be significantly improved through better design interventions alone. In other words, it isn't enough to work in a beautiful office, live in a walkable neighbourhood, have access to healthy food and be close to loved ones. One must also cultivate a certain type of positive attitude towards these things.

Various practices have emerged throughout history that promise to do just that. For example, mindfulness and Stoicism — a school of thought first developed in Ancient Greece with the goal of human flourishing, or "eudaimonia" — can provide people with the cognitive tools necessary to better adapt and increase resilience, leading to better health outcomes, regardless of circumstance or external conditions.

This raises both technical and philosophical questions: How finely tuned or optimized for health should we make buildings and cities if wellbeing largely depends on a person's setpoint and intentional activity? Are efforts to improve wellbeing solely through technology, engineering and design ultimately futile? Does it matter how terms like "health" and "wellbeing" are defined?

To achieve better health and wellbeing outcomes in our increasingly urban world, these questions will need to be addressed. Create better buildings and cities – and ultimately, healthier and happier people – will also require a complementary approach, one that integrates both "top-down" technology and design strategies with "bottom-up" philosophical considerations.

X-B3

The Exploration of the Unknown in Smart Systems and the Smart Society

Sabine Thuermel (TUM)

"Smart" means "operating by automation" (Merriam-Webster) when used to describe the smart systems currently under development. These systems aim at regulating and controlling resources by means of autonomous IT systems based on predefined objectives. The goal is identical for the smart home, smart energy systems, the smart mobility infrastructure, and the smart medicine environment supervising the chronically ill. All these smart systems are intended to anticipate the needs of their users and act accordingly. In current smart systems, we find both predictive and prescriptive algorithms for the engineering of the "not yet". The purpose of these algorithms is on providing knowledge under conditions of uncertainty in order "to know ahead and act before" intending to streamline processes towards enhanced efficiency. These systems combine data gained in the past for influencing the immediate behaviour in sociotechnical systems. The focus is on anticipating and forming the near future at the same time. When the transition from prediction to prescription takes place, future behaviour is not only anticipated but formed. Context-specific, adaptive micro-directives (Casey/Niblett 2015) may be incorporated in future intelligent infrastructures to guarantee optimal service from a system's perspective and nudge or even coerce the human participants towards the desired behaviour. Thus, in smart systems two variants of anticipatory behaviour exist: when deploying smart predictive systems anticipatory actions are executed both by machines and humans. In smart prescriptive systems, anticipatory measures are delegated to the systems and human supervisors are at best in the loop.

Smart can also mean "mentally alert" (Merriam-Webster) and that is what a prudent society should be when pondering which smart systems to develop and to use "preparing for the unexpected in the world as we know it" (Nordmann 2014). A smart society, a mentally alert one, intends to imagine ahead and act accordingly. Support may be found in the perspectives and techniques provided by the humanities and the arts (see e.g. Miller 2018). "Futures literary" may be also supported by games and simulations of possible worlds letting the gamers explore potential utopias as well as dystopias to be avoided. In a first step, its exploration of the unknown relies more on science fiction than science fact. In a second step, feasible innovations may be explored. Thus, anticipation in the smart society reflects the cultural accomplishments of a society. It takes the core values of its citizens into account. Yet, it is open to novel developments. It is an art form and not a technology-driven perspective. The development of future smart systems will profit from such an approach.

Engineering humility for society: The union between engineering epistemology and macro-ethics

Zachary Pirtle (Independent, Researcher and Engineer)

Humility about what engineers know – and can do – is an important part of helping engineering to best serve society. In this talk, I will support this claim by drawing on my experiences as an engineering/policy practitioner as well as reviewing conceptual research about engineering. By covering three relevant vignettes, I will show useful ways in which to combine the study of knowledge in engineering (engineering epistemology per Vincenti 1990) and the study of macro-ethics in engineering (Herkert 2005). My summary here is meant to be suggestive and illustrative of important connections, but I do not seek to be comprehensive in describing all areas in which engineering ethics and knowledge should interact.

Specifically, the area of macro-ethics that I discuss here is about how society establishes policy on what engineering projects to pursue, sometimes called policy for engineering. It thus differs from 'micro' ethical considerations that deal with issues facing individual engineers, such as topics in whistle-blowing and ensuring safety. I have published some work on how to improve democratic decision-making surrounding technology, supporting both general reflections on engineers' obligations to democracy (Pirtle and Szajnfarber 2017) as well as encouraging participatory technology assessment deliberations among citizens as part of efforts to inform national policies on human exploration (Betrand, Pirtle et al 2018, Pirtle and Tomblin 2018).

These reflections on the goals for engineering deeply depend on claims about the nature and depth of engineering knowledge and what engineers do (Pirtle 2010, 2013). There is always uncertainty surrounding engineering activities – every complex system has some degree of risk, and the potential cost and schedule of an engineering project can serve as major opportunity costs, where pursuit of a project precludes other potentially beneficial works.

I will explore potentially fruitful connections between engineering epistemology and macro-ethics by discussing three vignettes that I have dealt with in my professional life:

• Uncertainty in cost and schedule of major aerospace programs, as seen in both management conversations and in facilitated public deliberations;

• Participating in management discussions about the importance of funding research and development (R&D) to enable future systems, and the proper way for innovation to occur; and

• Participating in policy discussions about acceptable levels of risk in human and robotic space flight.

I will show how the ability to support a macro-ethical deliberation on these topics requires close scrutiny on the nature of engineering knowledge, specifically focusing on three types of uncertainty: 1) Uncertainty about functions and performance of engineered artifacts, including emergence and how human users engage with them; 2) uncertainty on the role of social and ethical value commitments alongside cognitive values (Douglas 2009); and 3) Uncertainty about the creation of engineering knowledge, including efforts to reduce uncertainty via increased development, testing and performance as well as issues of R&D innovation policy.

Proper consideration of such uncertainties and knowledge can encourage humility in macro-ethical decisionmaking about engineering, but can also encourage increased confidence in areas where engineers are capable of making progress.

Should engineers be activists?

Thomas Siller (Colorado State University)
Gerry Johnson (Colorado State University)

Engineering must change. Ultimately the engineering profession depends on engineers to define it. We as educators, therefore, think that it is valuable to explore potential 'philosophies' for individual engineers to adopt. Over the years, one of the concerns we have tried to address is the potential for engineering to be an 'instrumental' contributor to society -engineers serve as problem solvers (at least that is the goal) but not as problem definers (Downey, Lucena et al. 2006, Siller, Johnson et al. 2018). Our earlier thoughts on how to counteract this instrumentalist trend, which we think is an inappropriate role for engineers and engineering, was to push the profession to become more interdisciplinary in nature. This requires rethinking the educational system, as we have advocated by adopting approaches such as Interprofessional Education (IPE) (Siller, Johnson et al. 2016) as is used in some medical education institutions. Now, it is time to question whether this is even enough? To us, the role of education is learning how to live (Maxwell 2019)—how to realize what is of value in life, yet science and technology, two core disciplines within engineering education, are traditionally taught value free because it is thought that values have no role to play in knowledge and knowledge acquisition. But value free teaching is a value and instructs students that values are not important. Therefore, engineering education fails to support learning how to live.

The Earth and human society face a growing list of catastrophic threats including climate change and its impact; economic and racial inequities and inequalities; global pollution of the land, air and sea; economic stagnation and decline; warfare and terrorism; new pandemics; social and environmental injustice; and environmental degradation including loss of wilderness and biodiversity. The current SARS-CoV-2 pandemic highlights how fragile civilization is to disruption from crises. Many of these threats appear beyond the capacity of engineering but engineering should play a role and be a stakeholder in each. Confronting these challenges will require engineers with a different mindset.

Our premise is that what we need now are engineers who believe in, and take on, the role of activists. Why? Because the world needs activist engineers who bring the passion and commitment to change in order to effect change. If engineers remain content to let society define problems for engineers to 'solve,' then engineers become the ultimate tool of society. And as is the case with all tools, their real value is in how they are used. We contend that engineers must decide for themselves how to be used by society, and not let society make that decision. Activists, on the other hand, actively pursue change. This is why an activist philosophy -believing in advocating for change, not just implementing change -will help bring new values to the engineering profession. Now, the important question to address is: What does it mean to educate engineering students to be engineering activists? The presentation will provide suggestions for how engineering education can promote an activist philosophy in developing future engineers.

References

Downey, G. L., J. C. Lucena, B. M. Moskal, R. Parkhurst, T. Bigley, C. Hays, B. K. Jeseik, L. Kelly, J. Miller and S. Ruff (2006). "The Globally Competent Engineer: Working Effectively with People Who Define Problems Differently." Journal of Engineering Education 95(2): 107-122.

Maxwell, N. (2019). Science and enlightenment: Two Great Problems of Learning. New York, NY, Springer Berlin Heidelberg.

Siller, T., G. Johnson and R. Korte (2018). Engineering as problem solving: A need for a different apporach. fPET 2018, fPET 2018.

Siller, T. J., G. R. Johnson and W. O. Troxell (2016). What Do Sustaining Life and Sustainable Engineering Have in Common? New Developments in Engineering Education for Sustainable Development. W. L. Filho and S. Nesbit. Switzerland, Springer International Publishing: 273-282.

XI-A3

A new role definition for today's engineers: The "ethical engineer"

Nina Jirouskova (Imperial College)

This paper suggests a redefinition of the role of the engineer in today's context, marked by digitalisation, climate change and other key challenges. Holding a prime place to shape the world of tomorrow, engineering indeed also needs to face increasing accountability towards it. The current setting of the engineer's role purpose, its space in solution delivery and its associated scope of work show clear inadequacies in addressing these challenges. In order to truly unlock the engineers' power to face these issues and structure the work to support that effort, a new role concept is proposed for today's engineer: the concept of the "ethical engineer". Underpinned by robust ontological foundations, this concept relies on the clear definition of a vision as a key enabler of a successful and coherent realisation of the engineer's role. Such vision is proposed in this study as: "Contributing to a resilient development of Humanity". In an endeavour to render this vision actionable, the research presented in this paper suggests revisiting the engineer's engagement space. Rather than bounding an engineer's involvement to her/his technical speciality over time-restricted phases, this study's proposal consists in envisaging the possibility of reshaping the engineer's role so that engineers would be involved at higher strategic levels of project development, during the whole-life cycle of the solutions designed. The new ethical engineer role would therefore also see its scope of work modified. This study suggests a new four-point structure of the new role hence defined, as: Strategist; Integrator; Innovator; and Scientific and Technical Solution Dynamic Knowledge Repository. Incidentally, such transformation of the role of the engineer builds resilience in the role for the future. It indeed has the advantage of addressing the competitivity issue associated to the rise of computational tools increasingly able to develop the "standard" engineering solutions autonomously, by anchoring the engineering work back in ingenuity and creativity as well as strategic thinking – characteristics that are currently by far too complex to be computed.

XI-B1

What is the "Cost Of Living" in a Technologized World?

Stanley Kranc (University of South Florida)

Who, in the past, made those choices that shape the technologized world today? For instance, we did not vote (directly) to build super highways, to invent and market robot room vacuums or develop nuclear power, yet we find ourselves situated with and paying for these entities. Other innovations are always already on the way. However, is this "progress" simply a consequence of a technological imperative? Not surprisingly, the cultural response to the distinctly uneasy relationship we have with our technologies has been the creation of mythic projections. Robert Sheckley's short story Cost of Living (1952) reads as a cautionary allegory, concerning the benefits and burdens to future generations resulting from the adoption of technologies in the present.

The Economic and Social Consequences of Engineering - how engineering creates economic dysfunction and social exclusion

Geoff Crocker (Basic Income Forum)

This paper examines the analytics of the economic and social consequences of automation, and embryonic corrective proposals such as job guarantees, and a universal basic income.

Through its creation of the artefact of the engineered world, engineering has immense impact on nature and humanity, re-defining their ontologies and their interaction. This raises major philosophical questions on the nature of the engineering process, and the ability and responsibility of humanity to exercise cognitive control of its outcomes. Aesthetics, ethics, ecology, and unforeseeable perverse value outcomes of engineering and technology arising from epistemic constraint, are amongst subjects of keen interest in the philosophy of engineering.

Engineering includes automation. Human activity, and therefore human ontology, become 'machined'. The economic production matrix is transformed. Through automation, engineering creates the consumer society. Huge increases in productivity generate ubiquitous infrastructure and mass-produced commodities, radically altering the human life experience, its consumption, and the role of work. Meanwhile, nature's resources are depleted and its ecology eroded.

Automation reconfigures the relationship between living standards and work. In some scenarios, eg Brynjolfsson and McAfee's, *'The Second Machine Age'*, a new generation of automation threatens massive increases in unemployment and social exclusion. The worry is that this then leads to extensive poverty, reduced macroeconomic consumer income and demand, extensive household debt, consequent economic crisis, and pervasive austerity policy. These are key examples of the potential dysfunctional economic and social outcomes of engineering.

Corrective proposals frequently advanced include job guarantee schemes, universal basic income, universal basic services, in each case potentially funded by government issue of debt-free 'sovereign money'. These proposals are reviewed and critiqued in the paper.

The paper will include an update on the work of a 3-year project at the University of Bath UK, testing an explanatory hypothesis that technology inevitably reduces the wage content of output, leading to deficient aggregate macroeconomic income, with consequent increased consumer debt.

References

1 Erik Brynjolfsson and Andrew McAfee, *'The Second Machine Age: Work, Progress, and Prosperity in a Time of Brilliant Technologies'*, W. W. Norton & Company (18 Feb 2014)
2 Philippe van Parijs and Yannick Vanderborght *'Basic Income: A Radical Proposal for a Free Society and a Sane Economy'*, Harvard University Press (May 2017)
3 Geoff Crocker, *'A Managerial Philosophy of Technology : Technology and Humanity in Symbiosis'*. Palgrave (2012) www.philosophyoftechnology.com
4 Geoff Crocker *'Keynes, Piketty and Basic Income'*, Basic Income Studies (June 2015), www.degruyter.com/view/j/bis.2015.10.issue-1/bis-2015-0015/bis-2015-0015.xml?format=INT

Who is Talking Now?: Social Media Influencers, Speech, Exchange, and Identity

Kristen Psaty Watts

As early as 2017, the Federal Trade Commission in the United States and the Advertising Standards Authority in the UK, both industry regulators, began issuing explicit guidance to social media influencers. The purpose is to regulate speech shared on social media to prevent consumer confusion about posts made in exchange for commercial benefit. These developments provoke questions of self-identity, value, technology, and exchange.

In the United States, speech is regulated in accordance with the First Amendment of the Constitution as interpreted by the Supreme Court. Consequently, speech has been placed into categories. Free speech protection extends to all speech unless it falls within narrow exceptions. Commercial speech, which proposes a commercial transaction or relates solely to economic interests, is included an exception.

The FTC mandates "[if] you endorse a product through social media, your endorsement message should make it obvious when you have a relationship ("material connection") with the brand." This regulatory activity deals specifically with speech that is mediated by technology. Examples include content uploaded to YouTube, Instagram, Pinterest, and Twitch, among others.

Companies have long sought to associate their brands with people, but there has been a behavioral shift in the avoidance of commercial speech. The 1990's included revolutionary technology like TiVo, taking steps to make commercials obsolete, whereas today's youth actively seek commercial speech, evidenced by the popularity of "unboxing videos", for example.

On social media platforms, individual identity is forged through profiles, accounts, and avatars. There is much interesting work being done regarding the sense of self experienced as an avatar and the validity of experiences in digital spaces, as well as how digital choices are propelled by and connected to our real-world identity.

Does the communication made by a social media influencer lose the protection of human free speech, and degrade into commercial speech? When the identity and representation of the influencer is so entwined with the advertisement, how do you distinguish the two? What role does the fact that the speech is intermediated by technology play? How do engineering decisions impact these considerations?

Does the exchange of a constructed identity for a "material connection" with a brand result in a net loss of integrity of self?