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Book of Abstracts



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Monday Sessions

Keynote Address

The Majesty of the Technosphere and Twilight of Democracy

Langdon Winner

Rensselaer Polytechnic Institute

If American democracy were a patient being admitted to a hospital, it's condition would now be rated somewhere between "critical" and "serious" with a weakening pulse. Explanations for this widely recognized state of affairs range from the peculiarities of particular party "leaders" to long term fundamental shifts in the Republic's economic and political culture. In contrast, the Technosphere that surrounds us seems a thing apart and in much better condition, a domain that supports and inspires. Its marvelous devices, systems and media hold forth the promise of a world restored by continuing innovation, a godsend for individuals and society as a whole. Today we live and work within these two realms – one of civic sickness, the other of technical vitality. Is there a connection?

Session A-1

Into the Wild: Futures and Responsibilities in Technology Assessment I

Engagement as assigning meaning to NEST: the hermeneutic circle and its volatile nature

Armin Grunwald

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New and emerging sciences and technologies (NEST) are not per se subject to societal debates and responsibility reflections. The assignment of social meaning only makes them objects of debates and controversies beyond science and engineering. Social meaning can be assigned to ongoing lab research in two major ways: (1) by attaching techno-visionary futures about how the NEST developments under consideration could impact the future and change the world, and (2) by giving characterizations and definitions of those NEST developments to clarify their novelty and their relation to established fields of R&D. The early debate on nanotechnology about 15 years ago provides us with rich illustration of these both meaning-giving engagements of many actors and the resulting controversies and debates.

In my presentation I will propose a model of the assignment of meaning to NEST based on the experience of the nanotechnology debate but extending also to other NEST stories. The main figure of



this model is the hermeneutic circle as an ongoing process of the production, communication, deliberation and modification of meaning. By processing the hermeneutic circle not only the meaning of the NEST under consideration may be changed. Also the motivation of research funding or the emergence of public protest and rejection or other external effects can be impacts of specific assignments of meaning. Such real-world impacts will re-impact the hermeneutic circle and bring it to the next stage, and so forth. In these processes many actors are involved. STS scholars, science policy practitioners, science managers, scientists, writers and mass media may, amongst others, engage in assigning meaning to NEST and to influence the hermeneutic circle. This circle will be used as a model to develop a research program for a hermeneutic STS research. Its main task is to uncover the mechanisms of production and assignment of social meaning to NEST and to better understand how the many engagement activities in NEST debates achieve impacts.

Big Data and Technology Assessment: Research Topic or Competition?

Judith Simon, Gernot Rieder

Department of Informatics, University of Hamburg; IT University of Copenhagen

With its promise to transform how we live, work, and think, Big Data has captured the imaginations of governments, businesses, and academia. However, the grand claims of Big Data advocates have been accompanied with concerns about potential detrimental implications for civil rights and liberties, leading to a climate of clash and mutual distrust between different stakeholders. Throughout the years, the interdisciplinary field of technology assessment (TA) has gained considerable experience in studying sociotechnical controversies and as such is exceptionally well equipped to assess the premises and implications of Big Data practices. However, the relationship between Big Data as a sociotechnical phenomenon and technology assessment as a discipline assessing such phenomena is a peculiar one: Big Data may be the first topic TA deals with that is not only an object of inquiry, but also a major competitor, rivaling TA in several of its core functions, including the assessment of public views and visions, means and methods for exploring the future, and the provision of actionable knowledge and advice for political decision making. Our paper explores this dual relationship between Big Data and technology assessment before concluding with some considerations on how TA might contribute to more responsible data-based research and innovation.

TA as a myth buster - Deconstructing myths around emerging technologies

Daniela Fuchs, Helge Torgersen

Institute of Technology Assessment, Austrian Academy of Sciences

Responsible Research and Innovation requires debating emerging technologies ‘upstream’. When discussing radically novel technologies, comparisons are often drawn to older ones. This leads to a rhetoric transfer of assigned properties so that the new technology appears as a derivative of the older. Sometimes several comparator technologies are at hand, which may give the new technology different images, respectively. Subject to the choice taken, advantages for a group of actors over others may entail, establishing power relations and sometimes deciding over the fate of the technology. To analyse these processes as part of a ‘hermeneutic’ upstream TA, we propose to apply Roland Barthes’ concept of myths and apply it to the cases of synthetic biology and neuroenhancement, showing the role of comparators and the multi-layered character of myths. The potential role of TA as a ‘myth buster’, however, may render the task of stimulating a public debate more difficult.

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Session A-2

Shifting Narratives, Persistent Problems

Revisiting the Whale and the Reactor: Assessing Democratic Values in Current Energy Transitions

Jen Richter

Arizona State University

Almost thirty years has passed since Langdon Winner published his influential essay “The Whale and Reactor,” in which he developed the concept of technological politics, discussing the ways that political views and values can be embedded in our quotidian technologies. He also delineated the relationships between hard and soft technologies, as well as technologies that are inherently political, using the example of nuclear weapons as inherently authoritarian and solar technologies as ones that could be democratically distributed. This talk examines the political energy landscape in the present, by looking at the adoption of nuclear and solar technologies by different stakeholders. How is nuclear energy being positioned as an aid to democratic systems and a means to address energy access and distribution? Similarly, how has solar technology grown in different contexts? Can it still be seen as a democratically



distributed, decentralized technology, as adoption increases globally? This presentation will use discursive analyses of different geographical, political and technological contexts of nuclear and solar applications, from small modular reactors and siting nuclear waste repositories, to community and utility scale solar installations, to discuss how democracy is being defined through the technological politics of energy infrastructures.

Transitions of Concern in Nuclear Safety & Security Cultures

Annette Ripper

IANUS, TU Darmstadt

Nuclear technology has produced powerful imaginaries of concern which in turn have profoundly shaped nuclear safety & security cultures. However, these concerns have undergone changes: while in the beginning of the nuclear age they were frequently expressed in terms of apocalyptic language they now rather address problems of technological control. The end of the Cold War marks a paradigm shift which induced the emergence of new security concepts. Different objects of reference came into focus alongside the military and the state – evolving from the economy, ecology, and also humanity, juxtaposing and challenging the traditionalist approach. Particularly, the humanitarian initiative has steadily gained momentum after the Cold War and culminated in the UN-adoption of the Treaty on the Prohibition of Nuclear Weapons on July 7, 2017. On the one hand, these processes are to be understood as, both, effect and cause of political change and, thus, history. On the other hand, a situation perceived as problem will only become a matter of security policy if it is successfully established in security discourse. This may partially be achieved through scenario building. We consider scenario building crucial for rendering matters of concern salient. By assessing nuclear safety & security cultures through so called “scenarios of concern” we do not only address modes of action and functions of scenario building but will also be able to explain the changes these cultures have undergone.

The ‘Burning of Ships’ of Space Exploration

Jimmy Voisine

Université Laval

After a brief hiatus, humanity’s ambition for space exploration seems on the rise again. Various new players, nationals and corporate, recently joined the race aborted somewhat with the end of the Cold War. Space exploration is indeed in flux; new goals are emerging alongside the ‘traditional’ ones. Along with the usual ‘advancement of science’ narratives, plans to explore, exploit and even to colonize the solar system

are increasingly leaving theoretical grounds to become actual practical goals (NASA, 2015). We will first argue that this phenomenon represents a reaffirmation and a continuation of the Idea of Progress, which have been increasingly challenged in the past decades with, for example the advent of nuclear weapons, the persistence and even widening of socioeconomic inequalities (Keeley, 2015), the occurrence of anthropogenic climate changes (IPCC, 2007) and a 'sixth extinction' (Leakey, 1995). The re-legitimation of this perspective is indeed linked to these changes; we will next argue that although this is an often unspoken-of motive, this may be philosophically equal to a 'burning of ships' like the one of Cortez of old (Hassig, 2006), in paradoxically allowing an escape route away from earth, where these problems could well become unsurmountable, leading to a catastrophic outcome. Space activities offer the conditions for this eventual escape, and in so doing, relieve a much-needed pressure to elicit the urgent societal response to avoid this outcome. We will finally argue for an opposite 'burning of ships', in a deliberate ban or near ban of space activities. There must be no possible escape for the earthbound earthlings, at least until the great perils of our time have been addressed.

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Gardening in the Anthropocene: our common socio-technical practices

Astrid Schwarz

BTU Cottbus-Senftenberg

The Anthropocene is a much-debated and controversial term however there is general agreement on the fact that it identifies a collapse of cultural and natural history. The garden is a place, in which this distinction never worked, it has always been a product of likewise human's and nature's agency. Furthermore, the garden is linked to humankind in a very fundamental sense, it nurtures not primarily physical but also metaphysical needs and desires. Accordingly, historical gardens provide a wide range of models and techniques to deal with dynamic processes and things in technoscientific settings. Recently, actors in quite different areas of science and engineering are talking of future 'gardening' and what this



practices may contribute to manage mitigation or/and adaptation to climate change in the Anthropocene while meaning quite different things. Anthropocenic gardening techniques are addressed in climate engineering as well as in urban design, in social gardening and in climate sciences. In my contribution I will discuss what kind of anthropocenic practices these gardeners propose and what kind of values they put forward in their gardening imagineries.

Session A-3

Exploring and Enacting Responsibilities I

Innovation, Complexity and Virtues

Martin Sand

Institute of Technology Assessment and Systems Analysis (ITAS)

In my last S.NET presentation 'Collective, Structural and Individual responsibility' I discussed and criticized two forms of collective responsibility (existentialist and corporate) and a form of structural responsibility (RRI). Stemming from my critique of these types of collective responsibility, I proposed to strengthen a type of individual responsibility that is neither deontological nor consequentialist, but virtue ethical. I want to pick up my argument at this point. The question 'What are we responsible for?' is a question of normative ethics. Normative ethics is concerned with theories of 'how one should live' (Kagan 1998) and the answer is largely depended on whether one believes consequentialism, deontology or other ethical theories to be true. In my presentation, I will argue that virtue ethics provides a reasonable and fruitful language scheme to discuss responsibility in complex innovation processes. I will outline two reasons for this. Firstly, the neglect of partial motivations like empathy and doing something for someone's own sake by other ethical theories (Stocker 2007). Secondly, innovations complexity, opaqueness and wickedness adds to the general difficulty of finding obligations or duties that apply universally and irrespective of peoples diverging backgrounds and abilities (Blok and Lemmens 2015; Sand 2016). The contexts of action in innovation processes are highly diverse. This makes them factually incommensurable and precludes finding universal obligations or duties. A similar argument has been brought forward by Aristotle and Martha Nussbaum (Aristotle 2004; Nussbaum 1992). I will revive and strengthen their arguments about practical rationality and outline how a virtue ethical framework can cover this problem and be fruitfully applied when assessing individual responsibility in contexts of innovation processes. My 'theory' complements ideas of structural responsibility such as RRI.

Reflectivity, Autonomy, and Public Reason in Science and Engineering Practices: A Political and Moral Standard to Evaluate the Behavior of Scientists and Engineers

Cristian Puga Gonzales

Arizona State University

This paper examines the idea of public reason as a standard to evaluate the individual behavior of scientists and engineers, qua scientists or engineers, from a political and moral standpoint. While public reason stresses the requirements that moral and political institutions should meet in order to be justifiable to all the members of a society, public reason can also serve to evaluate individual behavior in regard to the political rules and values that individuals should refrain from endorsing. Individuals should not support political rules that cannot be justified by widely endorsed public values. As a standard for individual behavior, thus, public reason could also apply to scientists and engineers when they face decisions, within their science and engineering practices, that could affect the political and moral rules that regulate public life. When facing these kind of decisions, they have, in Rawlsian terms, a moral duty of civility; scientists and engineers should *prima facie* give preference to those options that align with the political values of public reason. I conclude by showing that to meet the standard of public reason two necessary and interconnected conditions must be satisfied: reflectivity and autonomy. As a requirement for public reason, thus, science and engineering practices should provide spaces, or incorporate environments, that enrich the practitioners' reflective capacities about the social dimensions and implications of their work and that reduce the obstacles that would prevent the practitioners from acting upon such reflections.

Alea Machina Delatrice Jacta Est: Randomness and Responsibility in Machine Ethics

Alexei Grinbaum

CEA-Saclay/Larsim

The framework of Responsible Research and Innovation strives to attain the values of anticipation, responsiveness, reflexivity and transparency on the part of the innovator. In machine learning, however, the agent that takes humans by surprise is a computer. Deep learning techniques lead to fundamentally non-interpretable choices made by the machine. Although these choices do not have an explanation, they still impact the human user and the society in significant ways. If the ultimate innovator is a machine, what is the meaning of its responsible conduct? Machine values are surprisingly different from ours: anthropomorphism is a poor guide for exploring its ethics. We argue that a responsible digital innovator should be able to extract itself from human judgment, by reducing transparency in favor of opacity. The



use of randomness become an important instrument. We illustrate its ethical significance on the example of trolley dilemma.

Synergies Between RRI, feminist theory and artistic practice: Responsibility as an ability to respond in/ through encounters with significant Others

Sophia Efstathiou and Ane Møller Gabrielsen

Norwegian University of Science and Technology

How can we build synergies between existing RRI frameworks and feminist approaches to science, and offer practicable tools for RRI? The influential framework of Owen and colleagues for Responsible Research and Innovation (RRI) emphasises the integration of values of societal “care and responsiveness” within the aims of current research systems (Owen et al. 2013: 35). In this paper we instead follow Donna Haraway and Karen Barad and propose to develop RRI as enhancing response-abilities in research and innovation. Our approach proposes to look at the micro- and local level, indeed at anything that counts as an encounter with an Other, as a key site for developing response-able research and innovation.

According to Haraway and Barad, the world emerges through encounters (Haraway 2003, 2008; Kleinman 2012). The process of becoming something or someone in the world is always a matter of becoming with Others, through meetings which do not happen randomly, but that are not fully determined either. The results of mutually constitutive bonds or intra- actions are what Haraway calls “companion species” or “significant Others”.

This raises the following questions for RRI:

- Who and what are allowed to emerge from RRI intra-actions? How can RRI call forth significant Otherness?
- How could RRI enable better encounters, better becomings?
- How may RRI enable researchers and innovators to respond, beyond merely considering different viewpoints?

We propose that art-based approaches to RRI targeted on surprising and sensuous encounters can open up space for intra-actions with an Other, enhancing response-abilities in research and innovation. We demonstrate by examples from our work in animal research and systems biology.

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Session B-1

Criticizing the Assumptions of Responsible Research and Innovation

Liminal Innovation Practices and RRI

Mayli Mertens

University of Twente

In the paper I'm presenting, I argue that the concept of innovation in responsible innovation (RI) doesn't always correspond to the practical realities of innovation processes. Having observed the state of continuous change -the state of flux- in medical innovation processes, I identified a specific way of innovating in clinical settings which I introduce as 'liminal innovation practices'. I first present the implied concept of innovation in innovation studies in general, and RI specifically, highlighting three assumptions regarding emerging technologies (Rotolo et al, 2015) and the implications for their assessment. Secondly, using my case study and other examples, I illustrate how a specific kind of innovation practice in clinical settings does not necessarily validate this model of innovation, or the assumptions that underpin it. Third, after clearly defining the word 'liminal', I introduce the concept of liminal innovation practices and explain the characteristics that call for such a concept: they are placed at, and on both sides of the threshold between research and care; they embody a transitional stage within a context of continuous transition; and the use of the emerging technology itself is liminal in this stage (not used, not 'not used'). Fourth, I suggest that assessment of liminal innovation practices requires a more specific, less anticipatory-based approach; echoing the existing pleas for practice-based methods, affirming the value of experiential knowledge, and pushing for an increase in multi-contextual analysis. Finally, I suggest that this re-evaluation of innovations and their assessment may offer a more general, fresh perspective on 'emerging technologies' for RI scholars in general.

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Slow Responsibility in an Agile Environment

Tsjalling Swierstra, Merel Noorman

Maastricht University

RRI is the sibling of ELSI/A (for the ethics approach) and STS-influenced forms of participatory TA, which stress stakeholder inclusion – both for epistemic (indigenous or local knowledge) and political (those affected by power deserve a say in determining that power) reasons. In our presentation, we focus on these political reasons, which are usually framed in a discourse of participatory democracy. This approach has certainly been successful, for example on the level of societal dialogues on large scale



research programs (e.g. genomics and nano- technology) or on the level of material infrastructures (windmills, dykes, energy). What these good practices share, is that there is usually a clear, central, choice at stake that will determine subsequent options for a foreseeable time. In this sense, the technologies at stake in 'best practices' of RRI are somewhat akin to the laws that are at the heart of normative theories of democracy: the demos gather, deliberate, and decide on collectively binding rules. However, not all decisions regarding technological development can or should follow such a traditional format. In the competitive market sphere, there are e.g. constraints regarding transparency and openness that hamper some normative ideals of RRI. (Blok & Lemmens 2015, Noorman et al. forthcoming). In our presentation, we focus on another domain of innovation that does not fit the paradigm cases of RRI: software innovations in a so-called 'agile' management environment. The agile innovation paradigm stresses acting over deliberating, fluidity over rigidity, and speed over caution. As the subject matter here is highly malleable software, the innovation style aims to mimic the volatility of its 'immaterial' subject matter. This in contrast to the - necessarily - rigid legislation that appears to be the implicit paradigm of theorizing on participative democracy. To what extent are the insights regarding participatory democracy compatible with this important new paradigm in innovation management?

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RRI and the Owl of Minerva

Marianne Boenink, Karen Dam Nielsen

University of Twente, Department of Philosophy

RRI approaches like the ones developed by von Schomberg (2013) and by Stilgoe, Owen and Macnaghten (2013) promote the ideal that innovation should be aligned with public values. To this end, societies should first of all anticipate more explicitly what innovations (or rather, technologies) emerge. Subsequently stakeholders should collectively reflect on and deliberate how these technologies might affect values and develop ways (whether by design, implementation, or by regulation) to make sure the 'right values' are realized. As one of us has argued elsewhere (Boenink et al 2016), the RRI exhortation to deliberate values all too easily suggest that existing values are readily accessible to stakeholders, and that it is easy to see how these values will be affected. The underlying conceptualization of values disregards that values are realized in practices. We therefore proposed a practice-based approach of innovation,

which starts by exploring which values are actually embedded in current practices (using for example ethnographic methods). This practice-based approach, however, creates serious challenges of timing: the groundwork for the exploration of values is so time consuming that moments to intervene in the innovation process reflected upon may have passed. Like the owl of Minerva, RRI risks always coming late. In this presentation, we will discuss and analyse a few experiences of being too late, and reflect on the role of timing in RRI.

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Session B-3

Science and Technology Governance in Global Contexts

Reimagining and Reconstituting Technological Societies

Clark A. Miller

Arizona State University

Humanity is at a cross-roads. The sociotechnical imaginaries and constitutions out of which the world's leading nations built vibrant, thriving 20th century democracies are rapidly breaking down. Emergent, global ontologies of risk (environmental, financial, health, security), combined with borderless ideologies of techno-markets, have set national and supranational projects adrift. Invisible infrastructural systems increasingly interpenetrate in complex, unknowable, unsustainable, inequitable morass, falling apart, falling short, yet still capable of undermining social and ecological resilience on scales from the village to the planet. Innovation enterprises are increasingly unhinged from human purpose and meaning, powered by unfathomable capital investments and amazingly unrealistic hyper-fictions of the future perfect to create robotic, transhuman, techno-human futures that few are likely to want to inhabit.

In the face of these challenges, it is hardly surprising that the sociotechnical imaginaries and constitutions of the 20th century have emerged as a central focal point for 21st century political conflict. Experts and expertise rejected. Science budgets slashed. Sledgehammers taken to science-based regulations and regulatory agencies. Fundamental scientific understandings denied. At stake are the economies and societies of the future, the bodies and identities that will live and work within them, the ways that we will govern.



Now is the time for a radical leap forward in the creative work within SNET and its sister networks. Across dozens of technoscientific arenas, from energy to algorithms, the next half century promises transformative redesign. The question is: toward what future? Can the future be designed toward greater inclusivity, justice, democracy, freedom, security? I think it can, but only if we acknowledge that we are simultaneously designing not merely science and technology but bodies, minds, relationships, institutions, political economies, and societies— and that we privilege within the design process the possibility of human thriving. The energy revolution, by itself, will consume \$40 trillion in human investment--\$1 trillion per year for the next four decades—to create a clean energy future. What a shame if that investment is wasted merely on carbon. Humanity has not lost its capacity to understand what makes life worth living. Let's exercise that capacity and ask hard questions about whether the imaginative and constitutional resources we have available are positioned to get us there—or what kind of new ones we need instead.

Perverse Effects of Sustainable Fisheries Policy on Innovation of Sustainable Fishing Technology

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This presentation evaluates the effects of an unilateral action by United States towards Mexico to improve the sustainability of Mexican seafood but that perversely inhibited innovation of more sustainable fishing technology. The Magnuson-Stevens Fishery Conservation and Management Act (MSA) is the primary law that codifies marine fisheries management in United States federal waters. The MSA was amended in 2006 with Section 610, an international provision that requires the identification of foreign nations engaged in the incidental capture (bycatch) of protected living marine resources (PLMRs). Mexico was proactively engaged in a research program to study and innovate technological solutions to sea turtle bycatch. However, in 2013 the United States used data from this program to identify Mexico for bycatch of a PLMR – the North Pacific loggerhead sea turtle. In the wake of the unilateral identification intended to reduce bycatch, Mexico downplayed and denied the bycatch problem that their agencies had previously accepted and cancelled a bycatch research partnership between their federal fisheries science agency and U.S. researchers that had yielded successful innovation and adoption of sustainable fishing technology in the past. Moreover, fishers invested in programs to innovate technology to reduced bycatch ceased to participate in these programs. Policy recommendations to improve the law and its implementation include the need to: 1) better assess the socioeconomic, political, and environmental consequences of such unilateral actions; and 2) more consistent consideration of bycatch data across nations so as not to create a disincentive to assess, report, and innovate technology to reduce PLMR bycatch.

Learning the Art of Science Diplomacy

Megan L. Frisk

U.S. Department of State

How do science and technology impact foreign policy? And, how does foreign policy affect science and technology? The U.S. Department of State sits squarely at the intersection of these two seemingly disparate fields, in a space we call “science diplomacy”. Science diplomats use science, technology, and innovation (STI) to build and maintain relationships with likeminded partners around the world, as well as with countries with which we have had challenging relationships. Science diplomacy also crucially involves promoting American interests abroad and the development of international consensus around global science and technology issues, from ethical questions regarding gene editing, to fairness in the use of artificial intelligence (AI), to best practices surrounding neurotechnologies. The Office of the Science and Technology Adviser to the U.S. Secretary of State (STAS) plays a crucial role in science diplomacy by monitoring developments in STI and using this information to inform the Department’s international dialogue on scientific issues. I joined the STAS office in 2016 as a fellow, intent on learning the ways of science diplomacy, with a specific focus on emerging technology. With one year completed and one year to go, I will highlight the many mechanisms of science diplomacy and foreign policy development, focusing on different venues, players, agendas, and means of communication and negotiation. Notably, foreign policy and international dialogues go beyond the U.S. government, including inputs from academia, the private sector, and NGOs. Although I will speak from one perspective and one small piece of a very big puzzle, I hope to convey the challenges and opportunities in infusing STI into international relations and in ensuring that the United States stays at the forefront of emerging technologies.

Session C-1

Opening up Reflexive Engagements with the Flux

Stability of Transitions: the reversed GM crop transition in Burkina Faso

Caspar D. Roelofs

JAA Swart, Science in Society Group, University of Groningen

This paper describes a case study on the reversal of a seemingly successful transition towards genetically modified (GM) cotton in Burkina Faso. Insect resistant GM cotton was commercialized in 2008, and its adoption rate increased to 74% of all cotton by 2014. But in April 2016 it was decided to stop the cultivation of GM cotton and fully return to conventional cotton (Dowd-Urbe and Schnurr 2016).

In order to better understand this reversal, we apply a framework based on the multi-level perspective

on transitions (Geels and Schot 2007; Rip 2012). We describe two transitions: 1) the transition towards Bt cotton, and 2) the transition back to conventional cotton. We focus on the roles that niche-, regime-, and landscape levels have played in shaping innovation processes in these two transitions. The data was collected by means of stakeholder interviews, farmers surveys, and secondary analysis of scientific literature, newspapers articles, and conference proceedings.

Our analysis shows that while the reversal is commonly attributed to a mere technological issue with Bt cotton, the reversal should be understood as the outcome of multiple dynamics on different levels. These include a regime failure to facilitate incremental innovation, decreasing landscape pressures, and changes in the political constellation at regime level.

In conclusion, we argue that there is much to gain from studying failed socio-technological transitions, both for innovation policy in development and for transition theory. Firstly, we draw lessons from Burkina Faso's experience concerning (bio)technological innovation in an autocratic political context. Secondly, we raise theoretical questions concerning the stability of newly emerging regimes and the sustainability of transitions themselves.

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Post-Truth Technology Assessment in an Era of Global Populism & Neoliberalism: Proposal for Black Swan Futures Barometers & Second Order Reflexivity

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Independent Scholar

(1) Independent Scholar and Writer, Innovation in Global Governance for Science, Emerging Technologies and Health, Toronto, Canada; (2) Adjunct Professor, Amrita University, Kerala, India

This paper is focused on the emergence of Post-Truth Technology Assessment (PTTA) in the current era of global populism and weakening of liberal democracies. My thesis is that decades of unquestioned neoliberal framings of technology assessment, with resurgence of populist and authoritarian politics advocating protectionism and parochialism,^{1,2} create a deadly and fertile ground for compromised reflexivity of innovation actors as well as social sciences and humanities (SSH) scholars, and consequently, increased odds for technology unknowns, ignorance and black swan events.

PTTA is emerging in the face of, and coalescing with, other narrow technology assessment

epistemologies that have already inflicted intellectual injury through, for example, the concept of elsification^{3,4} emergent from the past exercises of the Ethical, Legal and Social Issues (ELSI) Project often attached to the “Big Science” projects, with an embedded neoliberal or bioeconomy ethos that still remains unquestioned. In particular, the elsification of technology assessment has been noted as a form of “compressed foresight”, the idea that “the future is imminent in the present”, endorsing a singular (rather than multiple) technology future, and whereby the future is framed based on precedent, as an extension of the past. Elsification has served well the agendas of neoliberal and bioeconomy-driven academics and stakeholders in part because the future is made a calculable and manageable extension of the present, supporting deceptively future-proof ends.

Such elsified, neoliberal - and now populist - technology assessment epistemologies have been insidiously (read: unreflexively) adopted by many, if not all, SSH scholars over the past three decades, lured in part by generous (but with strings attached) neoliberal SSH research funding built on certain narrow epistemologies noted above. Little has been discussed of the “regulatory capture”⁵⁻⁷ associated with future-proof technology assessment epistemologies or ways to cultivate “second order reflexivity” and alternative futures thinking in SSH, as opposed to first order reflexivity among technology experts.

I ask, how do we engage with and respond to the flux of technology unknowns, for example, ignorance or black swan events, threats that are unprecedented, off the known charts and pose existential threats? At the very least, how do we register dissent, and resist the lures of neoliberal and populist SSH funding for PTTA, without risking retaliation and compromising our safety and livelihoods?⁷⁻¹⁰ Moving forward, I propose two new governance instruments to resist, register dissent, and foster reflexivity in SSH in response to the PTTA of the early 21st century.

(1) A Black Swan Alternative Futures Barometer comprised of Independent Blue Skies Scholars (IBSS)⁷ with orthogonal epistemologies to prevent entrenchment via group thinking that is not uncommon across the elsified Big science projects, thus cultivating alternative futures thinking. IBSS refers to independent, non-entrenched blue skies thinking scholars who are not immediately vulnerable to sociopolitical or socioeconomic cooption, or preoccupied with career advancement at all costs and self-preservation. Such independent free agent scholars might be willing to pose the hitherto dismissed or overlooked questions on the epistemology and alternative futures of emerging technology and innovation, the rigor and motives of normativity in SSH and technology ethics. A fresh continuing supply of IBSS will likely be necessary, however, due to the risk that free agent scholars may over time succumb to co-option and entrenchment by professional and/or funding networks.⁷

(2) A new mechanism to enhance second order reflexivity among the SSH trainees in responsible innovation, enriched by a clinical rotation in a psychology program with strength in psychoanalysis. For example, insight-oriented questions such as “What are my own values that are motivating me to seek PhD training in responsible innovation? How do my values impact the type of conclusions I arrive at concerning

technology future(s)? How do my funders' or my colleagues' PTTA and neoliberal orientations impact the scope and epistemological focus of my own SSH research?" can be posed as part of such a PhD+ plus psychoanalytical training rotation.

After all, nearly all psychiatry students in training for psychoanalytic psychiatry are required to undergo their own psychoanalysis as a mechanism for "second order insights" before analysis of patients' psychology and graduation as qualified healthcare professionals. I ask why we shall expect any less in terms of second order reflexivity from future SSH scholars in training who will examine the first order reflexivity of other innovation actors such as engineers and life scientists? To the extent that "reflexivity starts at home" with introspection and an inward look at the "self", a time spent in psychoanalytic psychiatry clinic as an interdisciplinary SSH scholar-in-training may pay enduring intellectual dividends and cultivate veritable second order reflexivity for next generation SSH scholars.

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Mindfully Embracing and Engaging Social and Technological Flux

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This paper analyzes how practicing mindfulness can help empower individuals, organizations, and societies to embrace and engage social and technological flux. Law students, lawyers, and law professors face accelerating and novel social and technological flux in legal education, legal practice, and legal academia. Our country and planet now face a less predictable and rapidly changing political climate. Democratic deliberation, institutions, and societies must learn how to deal with the increasing polarization resulting from "post-truth" and "alternative facts" discourses. In this brave new world, understandings of

education, higher education, and legal education also have to adapt and adjust. There also has been and continues to be great flux in the economics of education, higher education, and legal education.

Other parts of the current social and technological flux disrupted public discussions about societal policymaking. The role that deliberative, fact-based inquiry plays in national and international affairs is now so unclear and unsettled there is not even any consensus on the value that scientific knowledge plays in addressing domestic and global challenges. Today, people have illusions regarding the amount, depth, and precision of their knowledge. These knowledge illusions affect how and what people think about finances, science, and politics. Moreover, knowledge illusions can lead to individually and socially undesirable decision-making. Mindfulness offers a practical way to develop awareness of such knowledge illusions. This paper applies research from biology, decision science, finance, management science, medicine, neuroscience, psychology, psychiatry, and serious games to examine how about mindfulness practice can improve people's decision-making, ethics, and leadership.

Session C-2

Products and Productions of Visions

Visioneering the Future with Solar Fuels

Roger Eardley-Pryor

Chemical Heritage Foundation

Speculations on impending environmental and social crises have spurred visioneering scientists to pursue solar fuels via artificial photosynthesis as a techno-solution to those envisioned crises. For over a century, several thinkers and tinkerers have imagined ways to engineer artificially what plants have done naturally for billions of years: produce fuel from water and sunlight. Today at Caltech, the visioneering chemists Nate Lewis and Harry Gray pursue dreams of “powering the planet” with renewable solar fuels.¹ Their collaboration began with an accidental discovery brought to light under the bright California sun. Their efforts with artificial photosynthesis—which would split water to generate hydrogen as a storable chemical fuel—offer a consummate example of visioneering.² They do scientific research and engineering to enable a hypothetical hydrogen economy that could fuel growth in an energy-hungry world, while saving it from fossil-fueled climate catastrophe. In order to achieve their vision, they have harnessed support from policymakers like Barack Obama, philanthropists like Bill Gates, as well as substantial funding from both government and private industry. Yet Lewis and Gray's visioneering is part of a deeper history of solar sociotechnical imaginaries.³ Over the past century, several scientists—from Giacomo Ciamician in 1912, to Harrison Brown in the 1950s, to Richard Smalley in the late 1990s—all saw photosynthesis's ability to



harness hydrogen from sunlight and water as an engineering model to manufacture solar fuels. Solar fuels thus represent an enticing sociotechnical imaginary for solving various environmental and social problems.

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Collaborative anticipatory practices as an intermediary between policy and innovation actors?

Kornelia Konrad

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Among the various forms of anticipatory practices, roadmaps have recently become more and more popular. Roadmaps are supposed to combine anticipatory with strong coordinative and guiding functions. Originating in corporate settings, they are nowadays more and more applied at the crossroads of policy, research and industry, e.g. in the definition of research and innovation agendas and programmes (McDowell 2012). Examples are the Dutch National Science Agenda, which received attention, as it started out as a participative process inviting the Dutch population to submit suggestions for research topics, which were distilled by research and innovation actors into a set of roadmaps, or the roadmap developed in the process of applying for the 1 billion graphene EU flagship programme. In parallel, in a recent project studying innovation practices of 700 European companies, we see that companies engage in various forms of networked foresight practices, including but not limited to roadmaps, which are conducted within innovation networks and ecosystems. In my talk, I will reflect on the opportunities and shortcomings of these collaborative anticipatory practices, in particular with regard to their potential to serve as an intermediary between policy and research and innovation actors.

The Flux of Needs: the Case of Space Tourism

Harro van Lente

Maastricht University

The paper will address general and pertinent questions about the malleability of needs: how are novelty and needs co-produced? Can such changes be anticipated? Also, when needs are not pre-given, but dependent upon socio-technical configurations, and, in fact, both cause and effect of technological change, the question emerges what the role of publics, policies and experts can be. While the public is the carrier of the novel need, the public is also mobilized as the critical instance of the technological possibilities and the novel needs. To unravel the emergence of new needs, this paper investigates the contested case of space tourism and the various ways it generates and mobilizes novel needs. Space travel has its roots in the Cold War arms race and in science fiction novels and movies. This century, various operators like SpaceX and Virgin Galactic seek to offer space travel for private persons, and promise to organize such travels on a regular basis in the near future, with dropping costs. An array of orbital and sub-orbital space flights are being developed, based on new technologies and new business models. In their attempts to define and inhabit the prospective market for space tourism, these operators bring forth particular visions of the future of space tourism and why people would need it. Data are drawn from newspaper articles (2005-2015), websites of operators, popular books on space travel and governmental documents.

Yachay: Socio-technical imaginaries in place

María Belén Albornoz

Latin American School of Social Sciences (FLACSO)

It has become common practice for policy-makers, institutional managers, and consultants, to look instrumentally at successful practices of innovation and to include them into their local policy design. As a result, innovation policy is driven by traveling imaginaries of what innovation is and how it ought to be implemented. This paper reviews the socio-technical imaginaries about innovation that have gained authority in the implementation of the Yachay project in Ecuador, based on the South Korean innovation model of Cities of Knowledge. This note explains how socio-technical imaginaries travel and are constructed through time, and how they lay the foundation for social and technological orders. I use the practice turn in innovation policy to trace a plug-in solution in a diverse society based upon legal analysis, policy programs, and interviews in the period between 2006 and 2016. I combine public policy analysis with STS studies to demonstrate how innovation models work as standardized packages. These models are able to combine several boundary objects with standardized methods that facilitate interactions and cooperative work between global imaginaries of innovation and local best-practice transfers. Keywords: socio-technical imaginaries, policy design policy networks, innovation models, innovation transfer.

Session C-3

Special format session: Interactive panel

Jane Calvert, Emma Frow, Pablo Schyfter, Deborah Scott, Rob Smith, Erika Szymanski

- Jane Calvert (University of Edinburgh, UK);
- Emma Frow (Arizona State University);
- Pablo Schyfter (University of Edinburgh, UK);
- Deborah Scott (University of Edinburgh, UK);
- Rob Smith (Kings College London, UK);
- Erika Szymanski (University of Edinburgh, UK);

We would like to propose an interactive, 1.5-hour session at S.NET, taking inspiration from the conference theme of “Engaging the Flux”:

Are you worried your object of research is dying, or just losing its luster? (Is there a part of you that wishes for the death of said object of research?) Do you wonder how much longer you can write grants studying the “emergence” of a field that is going on multiple decades? Join us in exploring how to diagnose / eulogize / kill / reanimate that which is no longer new or emerging.

As researchers involved with and studying the field of synthetic biology, we are beginning to see a decline in the prominence of the term ‘synthetic biology.’ Some of the promises and features that characterized early initiatives in synthetic biology – for example, a celebration of openness, and a desire to work outside of the traditional spaces and places of biological research – have begun to fade. In their place we are seeing more familiar patterns of R&D emerge – a strong push to patent and commercialize innovations, and an influx of public funding from defense research funders like DARPA. To the extent that synthetic biology is yielding new products, they are largely substitutes of existing products of industrial biotechnology.

This pattern is hardly unique to synthetic biology. But as scholars critically entangled with synthetic biology, how do we respond when our objects of research transition from ‘new and emerging’ to ‘old and established’ or even ‘decaying towards death’? When emerging technologies with seemingly bright futures degrade or die, what does this mean for the imagination of alternative futures? In this session we will use a creative set of readings and provocations to set up group exploration of this cycle from several vantage points, including: identifying tangible measures of the decline of a scientific field (is it death, brand fatigue (Maynard 2017), or simply the end of one hype cycle and beginning of the next?), exploring theoretical lenses we can bring to bear on the study of no-longer-emerging technologies, and considering how we might situate ourselves as STS researchers with respect to such fields as they age. While our chief concern is synthetic biology, similar patterns are evident across nanotechnology and other would-be

transformative fields. We look, therefore, to provoke consideration of and conversation about theoretical frameworks for aging-but-young, dying-but-emerging technosciences.

Tuesday Sessions

Keynote Address:

Emerging asynchronicities: The challenges of rearticulating technoscience and democracy
in contemporary timescapes

Ulrike Felt

University of Vienna

Recently, analysts of current transformations of academic landscapes have begun expressing concern about the changing temporal regimes that govern research on the structural, social and epistemic levels. Discourses of impact and immediacy, aspirations for increased efficiency and productivity, dense references to emergence and “the new”, deep engagement in promising activities in order to compete on the future expectation market, or the multiplication of exercises of anticipation and visioning—these are but a few signs of a quite profound process of retiming research. And so is the fact that “the project,” with its multidimensional temporal scaffold, has gotten a firm grip on the ways we live and know in academic research and innovation environments. A tension seems to emerge worth exploring — between the iron cage of new temporalities and sociotechnical fluidities; between synchronicity and asynchronicities created by uncoordinated developments in the technosciences and society; or between the multiple rhythms of contemporary academic research systems and those of its environments. Instead of taking time for granted as a straight-forward physical entity to be managed and accounted for, I want to argue that profound change in temporal regimes needs to be understood as inseparably intertwined with questions of power, knowledge and control. It is the struggle over time, the time conflicts, that define us and thus need our attention.

It thus seems promising to study the challenges of finding satisfactory articulations of technosciences and society from a time-sensitive perspective. The following two questions will be at the core of my talk: How does the retiming of research matter when it comes to successfully implementing “responsible research and innovation” in academic practice, i.e. to making space for reflecting on and embedding societal values, interests, visions and concerns in processes of generating knowledge and innovation? And what kinds of democracies are possible under these changing temporal conditions? It will thus explore some of the consequences of potentially conflicting temporal developments in technosciences, contemporary democracies and academic lives (emerging asynchronicities) and ask what challenges this

poses to a sustainable and responsible development of both technosciences and society.

Session E-1

Into the Wild: Futures and Responsibilities in Technology Assessment II

Responsible Innovation as a Critique of Technology Assessment

*Harro van Lente**, *Tsjalling Swierstra**, *Pierre-Benoit Joly#*

*Maastricht University, #LISIS-INRA

The notion of 'responsible innovation' has become fashionable amongst policy makers and knowledge institutes. In the new Horizon 2020 calls of the European Union 'responsible research and innovation' (RRI) figures prominently as a condition and an aim in itself. The rise of RRI shows considerable overlap with the aims, philosophies and practices of Technology Assessment (TA). The overlap, though, is not perfect and this raises questions about how RRI relates to TA. While it is plausible to interpret the relationship as RRI being a sequel of TA ambitions, we explore an alternative interpretation: RRI as a critique of TA. Based on short histories of the two, we follow two core issues in RRI that, with hindsight, seem to have been problematic in TA: the role of normativity and the role of stakeholders. In this way of reasoning, TA can be said to neglect moral ambiguity and to downplay the desired direction of innovation. Thus, RRI with its aspirational logic of Grand Challenges appears as a response to the orientational failure of TA, and could be interpreted as an urge to include normative concerns about the societal goals of innovation.

Interactive reflection trainings on RRI for multiple stakeholder groups

Ilse Marschalek, *Maria Schrammel*, *Elisabeth Unterfrauner*, *Margit Hofer*

Centre for Social Innovation, Vienna / Austria

The paper builds on the perceived gap between "RRI in theory" and "RRI in practice" and demonstrates the need for RRI training for different stakeholder groups so as to overcome this gap. The RRI Tools project has developed different kinds of materials and tools that can be used in RRI trainings. Based on the umbrella notion of RRI, as elaborated in the RRI Tools project which spans the six key dimensions of RRI, its process requirements, outcomes and stakeholders, the training illustrates exemplary exercises that would serve a different purpose: to raise awareness for RRI, to enable mutual understanding of different stakeholder groups' perception on RRI, to reflect on RRI and to implement RRI in daily practices. Experiences gained from the various training exercises are described, which result in recommendations

and guidelines on how to set up a multi stakeholder workshop in terms of setting, methodology, content and participants. Moreover, these guidelines served as basis for a multi stakeholder setting to discuss and further elaborate the practical implementation of RRI in research and industry which has been applied within the NewHoRRizon and SMART map project.

Laboratory Settings as Built Anticipations – Prototype Scenarios as Negotiation Arenas between the Present and Imagined Futures

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As opposed to the recent tendency in Responsible Research and Innovation and in some approaches of Technology Assessment (like Vision Assessment) to reduce the role of socio technical visions and scenarios to their impact on present debates, our contribution argues that a specific type of future concepts – situational scenarios and especially their manifestations as prototype scenarios – should be conceptualised as hybrid realities and as negotiation arenas between the present and imagined futures. Based on empirical evidence from the field of ubiquitous computing we apply this concept for analysing three major functions and uses of situational scenarios in the process of technology development: specification, evaluation and demonstration. We argue that recalibrating the relation between the present and imagined futures is an important aspect of all these functions and uses of situational scenarios, especially when they occur as prototype scenarios.

Session E-2

Frames and Framings of Nature

Questioning values and narratives of xenobiology in the laboratory

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University College London

Recent developments in synthetic biology, more specifically in xenobiology or ‘orthogonal biology’, include ‘bottom up’ approaches that aim to build ‘new to nature’ forms of nucleic acids and proteins and incorporate them into living systems, along with organisms whose genetic code is expanded or recoded. These technologies embody forms of governance, as pioneers of the field have made promises to develop safe-by-design, ‘contained’ genetically modified microorganisms, incapable of transmitting genetic material to ‘natural’ organisms. This paper is based on five focus groups conducted during a year-long participant observation in a xenobiology laboratory, where one of the goals was to promote



reflexivity about the scientists' work. The argument I present is that scientists are focused on advancing positions in the career ladder, earning prestige, and achieving professional security, and as such, they do not see as convenient to challenge the status quo of their discipline, or question its foundations. This relates to conceptions of scientists who claim that are developing 'tools', hence liberating themselves from future responsibility. I also discuss implications of the field related to control, distribution, intellectual property, toxicity and environmental impact, and barriers for entry. This is connected to the technoscientific imaginaries and narratives in the field in of creating new biological worlds. This study aims to develop STS thinking into a more engaged mode with the sociopolitical and ethical implications of developments in the life sciences.

Framing the Problem and Solutions for Rice Straw Burning in Northern India

Poonam Pandey

Maastricht University

Clearing the fields by the burning of leftover biomass after harvesting is an age-old practice, dating back to centuries, among different farming communities all over the world. In those farming systems (such as Shifting/Jhum cultivation in northeastern states in India which are still the most biodiversity rich regions of the country) a distinct understanding of nature and ecology (with human beings as part of it) exists leading to sustainable practices of agriculture. In the knowledge system of Green Revolution inspired farming, this age-old practice of burning biomass has become a curse in the Northern states of India recently as large amounts of rice straw is being burned twice a year causing severe damages to air, soil and water quality as well as health. How is it that a sustainable practice in one knowledge system becomes a problem-causing, unsustainable practice in the other? Is it possible to transport practices from one system to another without transporting the knowledge claims from that system. This question becomes very relevant in the present context when resistance to homogenization and support to diversity is the need of the times. This study would show that homogenization and diversity are not necessarily incompatible and sometimes in order to just keep their knowledge systems (diversity) alive, groups often opt to associate to regimes of homogenization.

The paper relies on an empirical study that involves interaction with different groups of farmers (organic, natural and chemical), scientists, policy-makers, industry and civil society organizations in Punjab and Delhi, to understand how they frame the problem of rice straw burning and solutions to stop it. How do the different groups of farmers understand and use their knowledge in relation to scientific knowledge of farming produced by government agencies and industries. The paper will also look at the space which the knowledge claims of different farmer groups have in the top-down (scientists, policy-makers and industry)

understanding of the problem and solution of rice straw burning in India.

Extraction as a new technical paradigm. What consequences for our ethical relation to nature

Louis-Etienne Pigeon

Laval University

The field of environmental ethics has for decades identified the exploitation of nature as a general way by which modern society relates to nature. Industrial production has often been presented as the main issue in matters of pollution and consumption of resources (Naess, 1989). Moreover, our industrial culture is now known for demanding resources even beyond the threshold of sustainability (Sachs, 2015). If this central idea is now well confirmed, no theorist has yet directly identified this culture of exploitation with a corresponding technical paradigm, a largely accepted instrumental method from which technological innovation and industrial culture evolve. Our objective is to demonstrate that actions of extraction, such as mining and clear cut forestry, are not only to be associated with an economical imperative of industrial nature, but also proceed from a technical paradigm that influences innovation beyond these specific activities. Furthermore, we will highlight how an 'autonomist' conception of technique (Ellul, 2008) prevents a real assessment of this paradigm, thus making extractivism a socially accepted, if not celebrated, way of relating to nature.

Session E-3

Governing Blindspots: Omission, Obsolescence and Discontinuity

Taking Tech Away: An Anticipatory Framework for Technology Withdrawal

Heather M. Ross

Arizona State University

Many technologies are designed to improve the human condition. Individuals, institutions, and societies often approach such technologies with a clear vision for implementation. However, visions of technology withdrawal are often less clear.

Consequently, technologies often remain in use beyond their productive contribution, ultimately exceeding their capacity for benefit as individual, institutional, and social goals and contexts shift. Although some professional ethics organizations have articulated guiding principles related to technology withdrawal, clear frameworks rarely exist to guide decisions about when and how to withdraw



technologies that no longer serve the aim of improving the human condition. Using the case of lifesaving implantable cardioverter-defibrillator (ICD) technology in biomedicine, this paper examines a technology that shifts from augmenting quality of life to diminishing quality at the end of life. People entering hospice care often have an ICD in place that remains active as a result of being overlooked or misunderstood. At the end of life, an active ICD can deliver painful electrical shocks in an effort to keep the body alive, clearly at odds with the shifted human context in the hospice setting. This case highlights the need for a pragmatic anticipatory framework for technology assessment and withdrawal that is introduced early in the technology innovation and implementation process. The framework introduced in this project extends beyond the ICD case to address technologies across sectors and contexts with relevance for new and emerging technologies to avoid discongruity and harm as societal needs and goals shift beyond a technology's design capacity.

Gene Editing for Artists and Hackers: Ethics and Governance

Nora S. Vaage

Maastricht University

Since 2012, a range of new gene editing techniques based on CRISPR (prokaryotic immune systems) has enabled easier insertion and removal of genetic material in organisms, which has potentially groundbreaking ramifications of societal transformation – a vital example of technology's role in the social flux. Artists and hackers have, in these few years, shown great interest in such technology. The non-profit Broad Institute holds the patent for use of CRISPR gene editing techniques in eukaryotic cells, and has declared that academics worldwide can use the technology free of charge, but that companies need to pay to use CRISPR (Regalado, 2017). It is, as of now, unclear where that leaves actors who do not belong in either category. The proposed paper will address questions of artists and hackers' respective roles in the use, development and dissemination of gene editing techniques, focusing on ethical quandaries and governance options.

Rapid Changes and Obsolescence of Electronic Devices: Effectiveness or Counter-Productivity?

Frédéric Dubois

Universite Laval

The increasing speed of technological changes, especially in the field of electronics, tends to make technologies more rapidly obsolete. We hereby understand "obsolescence" as the state of a technology

being outdriven in favour of a constant renewal of technological products, mainly either for economical or efficiency purposes. Planned obsolescence is a commonly discussed type of obsolescence, whereas marketers would deliberately employ strategies to design flaws as to reduce one's product lifetime expectancy. Yet, a technology might be outdriven simply as a matter of technical evolution, as a newer product hits the market and therefore comes to replace an older one. Other times, it is rather a matter of fashion, whereas a technology becomes obsolete given its esthetic or functional aspects being considered as unfashionable. In all cases, we tend to consider the idea of obsolescence either as a deliberated act designed for greater consumption, either as the inevitable result of socio-technological evolutions. Without invalidating such views, we wish to discuss another type of obsolescence which, we argue, has not yet been given the same amount of attention. It is the fact that the growing speed of technological developments may, in some cases at least, brings about an even faster depreciation in terms of electronic components reliability. This depreciation may be observed despite the promises of productivity and economical growth projected by Moore's law. We argue that our devices break faster partly because the efficiency we aim to achieve through micro-miniaturized components implies the use of more unstable or more fragile components, thus resulting in a shortened product lifetime. Our approach draws both from engineering and social sciences to answer the question: are short-term increases in efficiency result in an increase of productivity, or rather may they be in the end counterproductive if we take into account the ecological, economical and social costs brought by this type of technical obsolescence? Our study will cover theoretical aspects from electrical engineering, political and economical studies, as well as quantitative studies on technological consumption and obsolescence.

Race governance, militarism, and legal subjecthood in AI and human enhancement

Sylvester A. Johnson

Virginia Tech

Introduction

In July of 2016, the Dallas Police Department set a precedent when officers deployed a Remotec robot to detonate one pound of C4 explosive in order to kill an African American suspect, Micah Johnson, who was wanted in the shooting deaths of five police officers. Just two months earlier, a human driver, Joshua Brown, died in a Florida traffic collision while his Tesla sedan was employing autonomous "Autopilot" driving technology. For decades, science fiction films and books have conjured futuristic scenarios of



robots and other intelligent machines killing humans or running amok. So, these events of 2016 came as a shock to many casual observers accustomed to associating intelligent machines with fiction. For those who have been following the dizzying pace of developing AI robots and machines intelligence, however, things are less surprising. For everyone, the fact that intelligent machines have now begun to play a role in human death opens a new chapter in the history of relations between humans and machines. It exposes the fragility of common assumptions about moral agency. And it implies that the domain of religion and ethics will have to be theorized anew in an age of intelligent machines.¹

Intervention and Plan for Paper

This paper presentation will focus on the human impact of existing and near-future applications of machine learning/AI and human enhancement with special attention the consequences in three domains: race governance, militarism, and legal subjecthood. The central aim of this presentation is to foreground the urgent need for populations of color to engage with emerging technologies within the realm of AI. Although communities of color are severely underrepresented in the research and development of AI and human enhancement, they will be impacted directly as this technology advances. In addition, this paper presentation will advance a set of specific claims pertaining to the future AI and human enhancement in the aforementioned domains. I draw on the theoretical frameworks of Achille Mbembe, Sylvia Wynter, and Benjamin Bratton to explain how the problem of the human as a political category has a troubling history grounded in race governance. I also explain how emerging technologies are set to iterate the historical challenges of human ontology in disturbing ways.

The paper examines three case studies: the robotic killing of Michah Johnson, the federal government's 2016 decision to recognize autonomous vehicles as drivers proper, and the Pentagon's ambitions for combining humans with machines for medical therapy and enhanced militarism. I interpret each of these three cases to render the fundamental challenges each poses for conventional conceptions of race, militarism, and legal personhood. Drawing on my own work to develop a humanistic AI system, I propose likely outcomes that will emerge from the deployment of these technologies within the next decade. And I proffer specific strategies for enhancing the engagement with these issues in underrepresented populations with a view to influencing the nature and impact of these emerging technologies in a corrective fashion.²

1 Rachel Abrams and Annalyn Kurtz, "Joshua Brown, Who Died in Self-Driving Accident, Tested Limits of His Tesla," *The New York Times*, July 1, 2016, <http://www.nytimes.com/2016/07/02/business/joshua-brown-technology-enthusiast-tested-the-limits-of-his-tesla.html>, accessed 9/14/2016. Kevin Sullivan, Tom Jackman and Brian Fung, "Dallas Police Used a Robot to Kill. What Does That Mean for the Future of Police Robots?"

2 *The Washington Post*, July 21, 2016. <https://www.washingtonpost.com/national/dallas-police-used-a-robot-to-kill-what->

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Session E-4

From theories, policies and practices to pedagogy — Exploring Responsible Research and Innovation in the Classroom

Special format session: Workshop

Rider W. Foley, Beverley Gibbs

University of Virginia, University of Sheffield

Notions of responsibility for research and innovation are being theorized and policies born from those frameworks are taking shape. Alongside the theories and policies is a growing body of scholarship on how responsible research and innovation (RRI) is taken up and performed in practice. In UK Universities, Sarah Hartley and colleagues have developed and class tested a 2-hour teaching tool aimed at enabling STEM academics to introduce principles of RRI to STEM postgraduate students. The Horizon 2020 RRI Tools project, for example, is working to collate a collection of teaching materials that consider varying dimensions of RRI, a collection that can be promoted and made available as open education resources (OERs) for class testing, development and adoption by what we might conceptualize as a nascent community of practice. Others, such as Jeroen van den Hoven at Technical University-Delft created a massive open online course (MOOC) that primes learners about key topics and their intersection with RRI. What these approaches have in common is that they attempt to integrate the theories, policies, and practices of RRI into educational materials, often focused on introducing RRI concepts to the next generation of STEM practitioners. This workshop aims to draw together interested persons at the 2017 S.NET conference to explore the multitude of ways that this community is developing pedagogical approaches for RRI. This workshop has the potential to be an important opportunity for people investigating the emergence of scientific and technological knowledge to consider how they can transform their intellectual contributions into educational lessons. The aspirations for RRI extend far beyond critique, so if science-technology-society relationships are going to shift, there is a clear need for curricular changes that support the professional development of research and innovation stakeholders. The structure of the workshop will follow the activity-based, shared learning model employed by Gibbs and Foley at Sheffield University in 2016. The resulting information and insights that arise will be shared with the wider community of persons interested in the intersection of teaching and RRI in the form of a report or other publication.

Session F-1

Exploring and Enacting Responsibilities II

Three coins in the fountain: anticipation, hope and responsibility in the pursuit of science

Heidrun Åm, Gisle Solbu, Knut H. Sørensen

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This paper critically discusses present-day ideas about science governance, like 'Responsible Research and Innovation (RRI)' and 'Anticipatory governance' based on interviews with 37 scientists working in the fields of biomedicine and nanotechnology. In the analysis, we have particularly been looking at how they reason with respect to governance and governability of basic science. The old but still existing controversy between Bernal and Polanyi about the extent to which science should be governed resonates with some of the interviewees. While they hope to be responsible and useful to society, they find it difficult to promise how their research will contribute to the development of society and to join in with policy-makers' anticipations about concrete benefits. The scientists struggle with balancing policy requirements with the actual doing of science in a world in flux. Uncertainties with respect to results of scientific work are highlighted with reference to the importance of tinkering and the search for surprising outcomes that are required through policymakers' push for scientific excellence. In this way, the interviewed scientists suggest what we call material regress – a set of arguments that point to their research objects as important sources of surprise. The idea of material regress needs to be considered in further debates about science governance to balance the respective roles of anticipation, hope and responsibility in different ways.

Digitalize or Die – Analyzing Responsible Innovation of ICT-based Health Care in the Dutch region Twente

Verena Schulze Greiving, Kornelia Konrad, Paul Benneworth, Stefan Kuhlmann

Science, Technology and Policy Studies (STePS), University of Twente

Information and communication technologies are increasingly utilized to support health care practices. These so-called eHealth innovations embrace complex communication platforms which facilitate the interaction between patients and various actors in the field of health care, or sensor environments that support healthy ageing and independent living of elderly or people with chronic diseases. These emerging

innovations promise to increase the access, quality, and efficiency of health care while reducing its cost. On the other hand, eHealth is expected to change existing roles and responsibilities between patients, their family members, doctors, health care providers and care personnel. Additionally, it is not straight forward to match these new innovations with the needs of envisioned users: the culture for developing digital technology is, for example, often dominated by young male engineers. Gender stereotypes are thus reproduced in medical apps and communication platforms which often do not fit the routines of, for example, elderly women.

In our study we take a look at two eHealth innovations related to the Dutch region Twente. We focus on the actor constellations, and analyze modes of innovations, new collaborations and shifting roles of actors. In particular, we study if and how aspects of Responsible Research and Innovation are addressed in the innovation process and how this relates to regional characteristics.

NewHoRRizon: shaping the future of responsible research and innovation, year 1

Michael J. Bernstein, Fern Wickson

GenØk - Centre for Biosafety

In this session, we open a discussion around a new project, funded by the European Union's Horizon 2020 programme, entitled: "Excellence in science and innovation for Europe by adopting the concept of Responsible Research and Innovation." With the short title NewHoRRizon, this project seeks to advance the practice of responsible research and innovation (RRI) across all of the European research funding programmes. NewHoRRizon will foster multi-stakeholder communities of RRI practice through a method termed "Social Labs," where interventions will be co-created for pilot implementation, evaluation and cross-sector learning. A total of 18 Social Labs will pilot some 45 actions to advance different dimensions of RRI within research funding programmes, projects and industry.

Since it is still at an early stage, the project invites a variety of theoretical, methodological, and practical questions. While the European Commission's "keys" (Public Engagement, Gender Equality, Science Literacy and Science Education, Open Access, Ethics, and Governance) will be employed for a baseline definition of RRI, the definition remains open to amendment through the project. Additionally, ongoing interpretive flexibility around practices, processes, and normative outcomes of RRI may complicate the design of cross-comparable actions. The project seeks to raise awareness around and show benefits of RRI, raising questions of how to maintain credibility and legitimacy while also holding an active normative position. We will initiate a critical, constructive dialogue to learn from the SNET community's knowledge and experience with implementing RRI in practice—a conversation we hope to revisit over the course of



this four-year endeavor.

Re -Framing Responsible Innovation: The Relevance of Institutional Context

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Industrialized countries and governments such as the European Union (EU) have increasingly promoted “Responsible Innovation” (RI) policies during the last three decades in order to achieve a better fit between science and engineering developments and socio-ethical goals and concerns. Also RI has started triggering more recently the attention of non-Western research policies as well, such as China, claiming the importance of Responsible Innovation in the 13th Five-Year National Science and Technology Innovation Program of China in 2016. However, the application of RI in non-Western countries like China for instance cannot be automated guided by RI framework of Europe due to the context heterogeneity. This paper will argue that the meaning and scope of RI depends on contextual factors such as national core values, institutionalization logic, and goals of innovation, on the basis of comparison between EU and China.

Keywords: Responsible Innovation (RI); Institutional Context; National Core Values; Institutionalization Logic; Goals of Innovation

Session F-2

Mapping Socio-Technical Change in National Contexts

Session removed due to speaker cancellations.

Session F-3

Science, Technology and Tarot

Special format session: Interactive Panel and Demonstration

Lauren Withycombe Keeler, Denisa Kera, Paul Millea, John P. Nelson

Arizona State University

This two part panel and demonstration will explore issues in science and technology through the lens of Tarot. By invoking Tarot we embrace and make transparent the hubris in human efforts to understand the world and predict the future. That hubris, when intersected with the contemporary realities of scientific knowledge production, creates uncertainties that fuel scientific skepticism and undermine the ability of science and technology to improve human and environmental health and wellbeing. Our panelists will discuss the history, philosophy, epistemology, and pedagogic potential of Tarot and Tarot- inspired card manipulation. Following the discussion, session attendees will be invited to experiment with several different Tarot decks and, through play, learn more about the application and potential of Tarot in scientific and educational contexts.

Session F-4

NSF Workshop: Publication Strategies for Junior Researchers

Presenters: Diana Bowman and Erik Fisher

Arizona State University

This workshop will provide practical advice and field specific questions on how to write a research article that will be attractive to editors and reviewers, how to decide on submission venues and how to network with more senior researchers for pre-publication feedback and post-publication dissemination of scholarship.

Reception

Poster session

Technology won't save us all: On democracy, progress and clean energy transitions

Carlo Altamirano-Allende

Arizona State University

Sustainable energy access is one of the key drivers for global equity, justice, and human development.



However, it has been demonstrated that the use of renewable technologies to address energy poverty is not necessarily linked to improved living conditions and a reduction of inequalities for communities.

This paper explores the geographies of energy and democracy in Mexico. What do contesting visions of the future reveal about values and shared understandings on clean energy transitions? How do deliberations about these futures shape existing material configurations, power relations, and perceived avenues for action and policy decision-making?

Mexico's Isthmus of Tehuantepec wind energy corridor is booming: production has dramatically increased from 84.9MW in 2008 to 1.3GW in 2013; an increase of 1,467%. By 2026, it is stipulated that 35% of the country's energy production must come from renewables. Different schemes further complicate this map, and at the top level these are portrayed as win-win-win for the government, developers, and industry. However, several local groups see it as forced and little-compensated takeover of common and agricultural land, and resistance to these developments is currently growing. Protests by the locals have escalated in massive unrest and confrontations with the authorities at all levels.

Scholars in STS have long demonstrated that science, technology, innovation, and politics are closely intertwined in the design of sociotechnical systems. Here I argue that projects of this nature have proved to be a critical referendum on the possibilities for renewable energy, but are not singular nor will their be unique as renewable energy projects continue to expand in Latin America and around the world. It is a lesson, however, in how disjointed development and failed attempts at sustainability mirror other projects that have similarly taken market-based models as the only possible solution to the threats of the Anthropocene.

MIND THE GAP: DISCONNECTS BETWEEN PERCEPTION AND PRACTICE IN THE VALUE OF A STEM PHD

Elizabeth Garbee

Arizona State University

The quality and quantity of talented members of the US STEM workforce has been a subject of great interest to policy and decision makers for the past 40 years. Recent research indicates that while there exist specific shortages in specific disciplines and areas of expertise in the private sector and the federal government, there is no noticeable shortage in any STEM academic discipline, but rather a surplus of PhDs vying for increasingly scarce tenure track positions. Despite the seeming availability of industry and private sector jobs, recent PhDs still struggle to find employment in those areas. I argue that the decades old narrative suggesting a shortage of STEM PhDs in the US poses a threat to the value of the natural science PhD, and that this narrative contributes significantly to why so many PhDs struggle to find career employment in their fields. This study aims to answer the following question: What is the current nature

of the relationship between the system that funds and trains STEM PhDs, the popular perceptions of the value of such degrees, and the organizations that employ those individuals with such degrees? I propose to preview the results of a critical literature review, a survey of STEM PhD students across five graduate schools at ASU, and targeted industry interviews, analysis of which will help indicate ways to increase the value of a STEM PhD for all stakeholders involved.

The role of institutions in sociotechnical infrastructure resilience

Changdeok Gim

Arizona State University

Critical infrastructure, such as water and energy systems, is tightly coupled. These interdependent systems are vulnerable to disturbances in either system, such as power outages or water shortages. In this context, the engineering resilience perspective focuses on how to robustly retain or quickly recover the functionality of physical infrastructure when exposed to a variety of stressors. The engineering perspective posits a quasi-static equilibrium to which a system should return. However, the function of physical infrastructures is not purely technological and material, nor fully deterministic, and will not therefore return to an identical state after a disruption. Rather, the function is an outcome of human behaviors and institutional dynamics. Critical infrastructure is a sociotechnical system and, thus, infrastructure resilience is dependent on human behaviors and organizational responses expressed through institutional dynamics. This sociotechnical perspective necessitates an investigation of social and institutional arrangements, which is a sine-qua-non, to understand infrastructure resilience. This paper proposes a framework for institutional dimensions of infrastructure to analyze the role of institutions in infrastructure resilience. This paper applies the framework to the case of water and energy systems in the Phoenix Metropolitan Area. This analysis demonstrates a new sociotechnical approach to infrastructure resilience to help us understand the critical role of institutions for the resilience of critical infrastructure as a sociotechnical system. Also, this work can help policy makers anticipate what institutional challenges sociotechnical water and energy systems face in response to climate change.

To use or not to use?: Reducing Goodyear's Outdoor Water Consumption

Jessica Givens

Arizona State University

Goodyear, Arizona is a rapidly growing city in the Southwest United States with a population of 79,000 residents as of 2015 and a 21.1% increase since 2010. In the arid climate of the southwest, water availability is exceptionally stressed and requires close planning and attention to accommodate



the predicted population trends. While Goodyear's city planning documents strategize to increase their water portfolio, this report aims to provide recommendations which will reduce the City's 60% outdoor water use by 5% over five years. This report provides three recommendations based off of a review of Goodyear's current city plans, three comparable cities' best practices, and expert interview analysis. These recommendations were presented to the City of Goodyear's Water Conservation Committee during their monthly meeting in April 2017. The recommendations were to install Automatic Meter Infrastructure, create a Homeowner's Association Coalition to share best practices, and conduct a behavioral change science survey to test water reduction strategies.

Interdisciplinary Translation and Integration Sciences Initiative

Amanda Hess

Arizona State University

Responsible research innovation “entails a continuous commitment to be anticipatory, reflective, inclusively deliberative, and responsive.”¹ Interdisciplinary team science is thought to address some of these commitments by including of a wide variety of disciplinary perspectives. Funding agencies promote interdisciplinary projects because many assume that the inclusion of such perspectives produces outcomes that address complex social issues.² In fact, those who undertake such research cite the desire to make a contribution and solve complex societal problems, for which multiple perspectives are necessary.³ Unfortunately, many such attempts fall short of achieving meaningful interdisciplinary integration.⁴ Studies regarding the costs and benefits of interdisciplinary research have shown that participation in collaborative disciplinary-spanning projects is high-risk and high-reward.⁵ Such projects can be extremely costly, both in time and in resources. Interdisciplinary projects also face hurdles related to placement, both for procuring funding and for placing publications,⁶ partially due to the perception that interdisciplinary products are of lower quality than those produced from disciplinary training and expertise.⁷

When properly executed, interdisciplinary research does produce innovative outcomes for which payoffs can be extraordinary. The Interdisciplinary Translation and Integration Sciences Initiative supports interdisciplinary research teams through the use of “Interdisciplinary Translators.” The use of translators mediates the high risk of interdisciplinary projects and assists teams in bridging disciplinary boundaries and producing increased interdisciplinary integration and more effective outcomes.

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Thought experiments on problematizing solar energy transitions

Joshua Loughman

Arizona State University

In response to the global challenge of climate change the path to mitigation is through transforming the ways in which the world gets its energy. The energy transition away from fossil fuels toward renewable energy sources holds both great promise and risk. There isn't one energy transition rather it can be conceptualized as a complex of pathways that lead to different futures. Not all transitions are the same and they will result in a different set of outcomes.

In this paper, I explore the results of data gathered through scenario analysis methods and system dynamics modeling approaches to chart the pathways through the design-space of energy transition futures. Because of the current trajectories of renewable energy technologies, the data for this research is composed of mainly solar-dominated renewable energy transitions. Drawing on this data, thought experiments were generated to accomplish three interlocking goals. First, the thought experiments are used to identify transition challenges at the intersection of the social, environmental, technological, and economic dimensions. By doing this, the thought experiments highlight the importance of consideration at this intersection. The second is to identify gaps in existing framings for addressing transitions. The third goal is to formulate plausible narratives that can be used to construct new models that can capture the social, environmental, technological, and economic dimensions of this challenge.

The broader objective for these cases is to illuminate how an analysis of energy transitions that includes multidimensional considerations can help to make wiser decisions as these pathways are navigated.

Passing the Test: Perceptions of Disability in Prenatal Genetic Counseling Guidance and Practice

Rebecca Monteleone

Arizona State University

Prenatal genetic screening and selective abortion have become ubiquitous in obstetrics care in the



United States. Emerging alongside these technologies are ethical entanglements between disability activists, researchers, and practitioners regarding who decides – and by what measure – “who should and should not inhabit the world” (Hubbard, 2013, p. 81). Embedded within these debates are contestations of problem-framing, credibility challenges, and asymmetrical power distributions. The nature of disability itself serves as a central tension, with the language deployed to endorse or critique screenings, their use in clinical settings, and design of the technologies themselves revealing conflicting orientations toward disability. Out of classifications dictated by genetic screening stems a suite of social and civic responses, including differential treatment under the law. This poster will describe the first phase of a larger project that seeks to untangle the relationship between perception of disability and use, governance, and critiques of prenatal screening technologies. This phase seeks to understand how and to what extent genetic counselors, both at the institutional level and in individual practice, shape and perpetuate certain constructions of congenital disability. Despite the crucial role genetic counselors play in framing congenital disabilities the apparatus of genetic counseling has been a relatively underexamined site in both critical Disability Studies (DS) (Kafer, 2013) and Science and Technology Studies (STS). Further, a broader, more accurate, and less invasive suite of screening technologies is emerging, and it is vital to interrogate the relationship between disability and technology as it pertains to escalating controversies seeking to redefine disability. These factors – the rising controversies surrounding prenatal genetic screening, the unexamined social and political implications of medical classification emerging from such screenings, and the anticipated introduction of safer, more accurate forms of screening – create a landscape in which the study of framing and construction of disability among genetic counselors becomes critical.

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Solar Home resale market: Perceived risks and rewards

Jason O’Leary

Arizona State University

There were approximately 1,000 residential real estate transactions in the Phoenix, Arizona metropolitan region for the year 2014 that included solar photovoltaic (PV) systems. Media reports have featured stories of homeowners who had trouble selling their homes because of complications with their third-party (TPO) lease arrangements. While potential solar adopters may consider many factors in their decision-making process, little empirical research has been done on the added value or risk of existing solar PV

installations in real estate transactions. This paper presents rich description and empirical results from a mixed-methods study that examines the phenomenon of “leased” vs. “owned” solar in the housing market. These research results may help decision-makers determine some of the hidden costs and benefits of leasing vs. purchasing solar PV. Such costs could be important for policymakers to consider when crafting financing schemes and policies that enable or regulate solar PV (eg. PACE financing). Currently, approximately 80% of solar PV residential installations in Arizona are being financed via TPO lease arrangements. While leasing arrangements greatly lower the risks of investing in solar PV – compared to outright purchased systems – they also lower the direct financial benefits to the homeowners. Further, there is some evidence to suggest that TPO lease arrangements may also add some uncommon complications and risks to family mobility when it comes time to sell or lease their home. Thus, the dynamics of leasing vs. purchase models could impact home values in certain neighborhoods more heavily than in others.

Populist Imaginaries of Flux: Sustainability, Socialism, and the Legitimacy of the EU Project

Tilde Petterson

Linköping University

2016 was a year of change around the globe, upending democratic and social norms in every area of expertise – but especially in science and technology studies (STS). The ever-more-complex socio-technical system we, as academics, find ourselves in poses serious epistemological concerns for reflexive and anticipatory technology assessments going forward. We perceive a pacing problem between “traditional” deliberative democracy / participatory stakeholder frameworks and the rapid rate of flux in post-normal science and associated knowledge production activities. As such, we propose an experiment designed to deconstruct the interpretive framework of public engagement activities in general, and specifically in the Swedish context of the rise of neoliberalism and socialism, combined with the uncertain future of the European Union in the wake of Brexit. In this experiment, we will run a series of three participatory dialogues with students, faculty, and community members, in which they will be presented with identical scenarios concerning Sweden’s role in an evolving European Union. We hope to build on tacit understanding in the community surrounding Linköping University as representative of Swedish citizens in general, as well as innovative engagement activities with community stakeholders, in order to create a set of responsible mapping tools to enable social development. These tools would help build trust among participants, and be useful not only for academics, but also for industry and community managers as they help their constituencies move forward into 2017.



Anticipation and Design: How Architects Know and Visualize the Future

Kaethe Selkirk

Arizona State University

Everyday professionals in a variety of organizations create the cities that we will inhabit tomorrow. In particular, architects, charged with building design and development, make decisions every day that determine how cities will materialize in the near and far term. How do architects do this? How do they decide what futures to create, and in particular, how do certain technologies affect their practice? This research explores how architects— conceptualized as expert designers— use virtual reality to know and anticipate the future. Virtual reality is an emerging tool in architectural design. Unlike previous technologies of representation, virtual reality simulates tomorrow's conditions in an increasingly experiential, immersive, and realistic manner. This research focuses on how virtual reality integrates into and affects architectural design practices, with particular emphasis on how futures are newly anticipated, known, and visualized. The examination draws from interviews with architects at two prominent firms in Portland, Oregon, and from relevant content analysis across Science Technology Studies (STS), Design Studies, and the Sociology of the Future. The implication of this work is not only an expanded understanding of future knowledge production and epistemology within the design and technology fields, but also a greater understanding of how the future is considered by those who are actively engaged in building it.

Why Automate: Understanding Technological Automation as a Power Process

Ilirjan Shehu

Carleton University

As technological automation becomes ubiquitous, our understanding of the transformative effects resulting from it is in need of much research. The question to be asked is: why automate? At first look, it seems as if this question has been answered already. After all, don't we hear economists, experts, and business representatives continuously explain through the media how automation saves costs, increases productivity and improves efficiency, all necessary for successful competition in the market? They also tell us how the public benefits as well in terms of increased safety, improved performance and lower prices. On both the liberal and critical sides of the debate, and despite fundamental differences, it is usually assumed that competition among firms is the push behind innovation and technological automation. Others, like Jacques Ellul, have argued that technological automation has become an autonomous process over which humans have lost the ability to control. The debate centers around questions of the use of technology: is it inherently beneficial to humans or should its application be restricted? More recently

authors and public figures such as Jaron Lanier and Steven Hawking have intervened in the debate by expressing their worries over the ownership of machines and share of profits. These approaches however, miss the crucial point that technological automation is not about control of machines per se. It is about control of information (i.e. data). I use a power perspective where power is defined as the ability to control efficiency and creativity in society, a notion pioneered by Thorstein Veblen (1908) and developed by Nitzan and Bichler (2009). I also borrow from James Beniger the idea of information control. This means, as the computer pioneer John von Newman put it, that there is 'end-directedness' or purpose and purpose is an essential property of control. Thus, we can argue that social organizations that achieve a higher level of information processing and communication also achieve a higher level of control of the social-physical environment and, in terms of economic activity, higher profits. In this sense, we can think of technological automation as control of efficiency through control of information (data) in order to increase power.

The New Democratic Innovators: Young Makers and the Future of User-Centered Innovation

Steven Weiner

Arizona State University

The Maker Movement, as a cultural phenomenon, has been defined and described in a variety of both intersecting and divergent ways (Dougherty, 2012; Hatch, 2013; Lang, 2013). Underlying these narratives is a core set of social interactions centered on the sharing of knowledge and skills pertaining to the construction or modification of physical objects. Through online forums, public festivals, known as Maker Faires, and shared-use workshops, also called makerspaces, self-identified Makers engage in the process of additive innovation (Jordan & Lande, 2016) and, through their collaboration, construct dense learning ecologies (Barron, 2006). It is this educational dimension of the Maker Movement that has garnered the attention of K-12 schools, universities, libraries, and science centers, leading to concrete investments in project-based curricula, robotics and engineering clubs, and even the construction of state-of-the-art makerspaces (Martin, 2015).

In previous research, I explored the formative experiences and factors that led young adults to identify as Makers with the intent of providing educators with insight into their current efforts (Weiner, Lande, & Jordan, Forthcoming). In this poster presentation, I would like to recast my findings in terms of the democratization of technological innovation. In contrast to the agonistic relationship between early 20th-century farmers and the automotive industry (Kline & Pinch, 1996) or the "underground" ethic of computer hackers (Toombs, Bardzell, & Bardzell, 2014), young Makers consider themselves "mainstream" and feel entitled to and empowered by customizable "toolkit"- style technology (Hippel, 2005). Integrating their perspective into historical sociotechnical trends could shed light on the future of user-centered innovation,

illuminate better pathways to institutionalizing Making within educational organizations, and yield potential avenues for future research.

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EXPANDING ENGINEERING TOOLS WITH RESPONSIBLE INNOVATION IN AN INDUSTRIAL SETTING

Shivam Zaveri

Arizona State University

Policies for Responsible Innovation (RI) seek to reflexively align science and engineering choices and activities with societal goals and values. While numerous studies have explored the possibility and utility of RI within academic research settings, few have sought to do so in more economically-driven corporate and industrial settings.

This study will examine the human and social dimensions of the industrial manufacturing system in order to determine whether reflection on these dimensions by management personnel can support RI while simultaneously advancing economic output and productivity. Implementing continuous improvement (CI) programs requires management to plan technical and social functions. I will first explore the CI program, Lean Manufacturing that focuses on waste, success and failure factors. If the failure factors correlate with workforce considerations, the analysis will specify the different decisions and behaviors that correlate with the workforce. To address these decisions and behaviors, the established RI tool of Socio-Technical Integration Research (STIR) will be applied in an industrial setting. After developing a novel approach using STIR and Lean, I will assess RI use by management in terms of its residual impact on the workforce and the CI program.

The outcome of the study will showcase if and how RI principles of reflexivity and responsiveness can

enhance alignment with societal values while making sustainable improvements in manufacturing systems. Where the RI principles are effective will vary for industries and by the location in the supply chain. Unlocking the potential from within the system requires a thorough evaluation of where to implement RI.

Hands-on Frankenstein exhibit

Mary Shelley's Frankenstein is a modern myth, a 200-year-old science fiction story with themes that continue to resonate in our current technosocial moment. ASU's Frankenstein Bicentennial Project (<http://frankenstein.asu.edu>) explores the novel's themes of human creativity, social responsibility, and scientific ethics with events, performances, and installations for a variety of public audiences. Hands-On Frankenstein demonstrates how DIY STEM making activities can encourage young people and their families to reflect on some of humanity's most challenging and enduring questions: What is life? What does it mean to be human? Why do we create? Join us to sample some of the Frankensteinian activities we've concocted for use in museums and science centers, and puzzle over the eternal questions through participatory making and play.

Wednesday Sessions

Keynote Address:

Matters of Course

Alfred Nordmann

TU Darmstadt, Department of Philosophy

Since antiquity and to this day, philosophers have been wondering how we can possibly know or understand a world that is in flux. We are good at picturing things, at making representations - but what can these representations tell us what might come next in a world of becoming and decay? As we inhabit the world as a kind of working order of things, we participate in its workings, we learn something about the course of events and the *Lauf der Dinge*, allowing us to grasp the pregnant moment which announces what will happen as a matter of course. That is how a sculpture can tell a dramatic story, what makes us laugh at a slapstick scene, and what allows us to simulate the performance of a complex sociotechnical system. So, of course(!), we can anticipate and know a world that is in flux. However, as we contemplate and seek to anticipate the implications of technological change, we are no longer talking merely about a world where everything flows but upping the ante on the old philosophical predicament - when technology changes the world and, in a sense, seeks to create a new world where things flow differently, can we



know or understand what might happen as a matter of course?

Session G-1

Questioning the Policies and Practices of Nanotechnology

The deliberative turn in nanotechnology policy

Franz Seifert

Australia

There is something special about nanotech policy. Nanotech advocates and critics typically converge in a call for ethical expertise and public deliberation on nanotech. This convergence among disparate actors and national discourses is not a trivial matter. Specifically, it cannot be attributed to some ‘anti-nanotech’ mood in the public/media. Nanotech has hardly ever been topical in the media, and very rarely has it been targeted by activists. So, why has this ‘deliberative turn’ in this technology field come to pass? How did it unfold over time and across countries? The presentation gives an overview of the analytic premises and preliminary results of an ongoing research project. The study focuses on deliberative experimentation in three countries—France, Germany and the UK—over an observation period of 15 years. It combines three aspects—a domestic perspective, transnational diffusion, and policy-oriented learning. Domestic contextual conditions account for the fact that deliberative processes in various countries manifest themselves in characteristic ways. At the same time, the deliberative turn is a transnational phenomenon since deliberative experimentation gained currency in a number of countries at about the same time. This, in turn, can be explained through transnational diffusion—the transfer of policy models between states. The concept of policy-oriented learning describes the deliberative turn as a learning process from past collective experiences such as public controversies. The study crucially draws on the ‘Advocacy Coalition’ approach (Sabatier / Jenkins).

The Klimisch Score as an Example of Disciplinary Imperialism

Frederick C. Klaessig

Pennsylvania Bio Nano Systems, LLC

The Klimisch Score is frequently used by toxicologists in a regulatory context to rank laboratory studies relative to reliability and relevance. The Klimisch score may be characterized as either a rational threshold criterion or as a filter to inconvenient peer reviewed studies. The role of toxicology as a discipline exercising a superordinate influence over other scientific disciplines at the crossroads of science, regulation and innovation is an underdeveloped theme in emerging technology studies. Toxicologists

exercising their professional judgement will be examined through their reliance on the Klimisch Score. Case studies will include Scientific Committee for Consumer Safety opinions on TiO₂ in food & sunscreens and hydroxyapatite (nano) in mouthwashes & toothpastes. The SCCS approach will be considered from the standpoint of regulatory capture extended to include disciplinary capture and Mäki's concept of disciplinary imperialism.

Nanotechnology Policies in Argentina, Brazil and Mexico: a comparative analysis

*Noela Invernizzi **, *Guillermo Foladori***, *Tomás Carrozza****, *Edgar Zayago Lau***,
*Josemari Quevedo**

* Federal University of Paraná, Brazil

** Autonomous University of Zacatecas, México

*** Universidad Nacional de Mar del Plata, Argentina All the authors are members of RELANS (The Latin American Network of Nanotechnology and Society)

This study examines, in a comparative manner, nanotechnology policy design, implementation and outcomes in the three largest Latin American countries, Argentina, Brazil and Mexico, from 2000 to 2016. The dimensions analyzed are partially based on the 2008 OECD Survey on Nanotechnology in order to facilitate broader international comparison. They include: policy design and instruments (national programs; goals and key sectors; main instruments; funding); governance (actors engaged in policy design and implementation; public-private relationships; participation in international fora); ELS (Ethical, Legal and Social) and EHS (Environmental, Health and Safety) issues (programs and actions); and regulation (regulatory initiatives; international regulatory cooperation). Some indicators of scientific performance (publications and patents; high skilled research personnel) and business performance (number of nanotechnology firms; labor force training) were used to assess nanotechnology policy outcomes. Main results showed similar timing, goals and instruments of the policies in the three countries although only Brazil designed a centrally coordinated initiative. The common goal of increasing competitiveness was reflected in more actions towards the productive sector; however they lacked coordination and/or sustainability in all countries. Governance was mostly restricted to government, scientists and, to a less extent, business actors, with restricted spaces for civil society participation. ELS aspects remained largely not addressed, while EHS issues and regulatory discussions emerged recently as increasingly important matters in Brazil and Mexico. Regarding to policy outcomes, the three countries enhanced their scientific capabilities in different areas but had poor patenting performance. Companies in Brazil and Mexico were more dynamic in incorporating nanotechnology to their businesses.

Session G-2

Flying Cars are so Passé; The Future of Ground Transportation

This panel will examine emerging transportation technologies with an eye to considering the policy implications involved with their development and implementation. The first looks at the past – the history of automated vehicles and how policy questions have changed over time. The second explores the current discussions around automated vehicles with an eye to envisioning how differently-abled people could benefit if policies were created with them in mind. And the third looks at a slightly longer range future – a viability and risk assessment of hyperloop technology. We envision this panel as a progression of three papers, but we would be open to adding an additional presenter focused on policy aspects of a transportation technology to the panel if the conference organizers found an appropriate candidate.

Automated Vehicles were always 20 years away

Jameson Wetmore

Arizona State University

While the media and IT companies have generated a significant amount of buzz about automated vehicles in the last few years, they are not a new phenomenon. Designers and engineers have been working on cars that drive themselves since at least the 1930s. This presentation will explore that history including not just the design exercises and stylish prototypes, but the ways in which policy questions have changed. While most contemporary automated vehicle exercises are basically robotic cars, for much of the last 80 years, automated vehicles were designed to work in concert with an intelligent infrastructure. This talk will examine the move to place all the intelligence in the vehicle, the policy implications of that move, and a brief reflection on what is lost.

Designing the Human Body: Federal Policy, Personal Vehicles, and Assumptions about User Bodies

Alecia Radatz

Arizona State University

For about a hundred years, the personal vehicle has largely looked the same, housing a driver who manually operates some part of the vehicle, while passengers sit idly nearby. Despite countless additions and modifications to automobiles, the premise has remained the same: people drive cars. Autonomous vehicles, however, challenge this basic understanding of the interface between humans and vehicles. With the advancement of technology, humans need no longer interact with the vehicle as a driver, and instead,

only as a passenger. Because of this change in the basic human-machine interface, the personal vehicle, as well as its design and related policies, can be revisited. One such way the personal vehicle should be revisited is to see in which ways vehicles can be designed to better accommodate people with different bodies, including those who may have been previously excluded from personal vehicle designs. This paper will explore how body characteristics are implicitly or explicitly designed for through federal regulations, how these designs might change for autonomous vehicles, and how policies could change to open up the opportunity for autonomous vehicles to better accommodate people with different types of bodies.

Hyperloop Viability Report and Risk Assessment

Elizabeth Garbee

Arizona State University

The Hyperloop transportation system, first proposed by Elon Musk and SpaceX in 2012, flew right off the pages of a science fiction novel and into the imagination of entrepreneurs the world over.

Published and explicitly open-sourced by Musk in a white paper entitled Hyperloop Alpha, he describes a solar powered, reduced-pressure tube transit system built on a series of pylons along existing highways. Although both practical and corporate knowledge concerning this particular emergent technology promises to address the potential risks and threats to value represented by the Hyperloop, science and technology alone are insufficient to ensure industry innovation aligned with broader economic and social goals. This risk assessment and viability report embodies that spirit of interdisciplinarity in a critical exploration of the barriers, threats to value, and ways forward in four related domains of impact: technical, economic, legal, and social. In this analysis, “risk” is defined as a situation or event in which something of value is threatened, and the addressing of which involves a systematic way of dealing with both the hazard presented and the human response. I also assert that both the risk assessments and regulations which will both shape and govern the production of hyperloop technology will require equal parts grounding in existing frameworks and true innovation in terms of negotiating their value to various stakeholders. The overall viability of hyperloop technology lies in its technical, economic, legal, and social viabilities and the degree to which those domains of impact effectively cooperate and interact.

Session G-3

Socio-technical Integration Practices in Context



Integrating public values with graduate education in synthetic biology

Brandiff Caron, Ravtosh Bal, Matthew Harsh

Concordia University

Universities play multiple roles in the innovation of emerging technologies, and can act as “ideal centers for reflexivity in innovation” by developing critical thinking in researchers (Valdivia & Guston 2015). However, for the field of synthetic biology, the university lab has been somewhat overlooked as an important site for responsible innovation, especially in Canada. Our paper begins to fill this gap by focusing on a cutting-edge and nationally-renowned synthetic biology lab as a site for integrating societal implications and public engagement with graduate education. Combining perspectives from responsible innovation, anticipatory governance and experience-based learning, we examine how graduate students in synthetic biology think critically about public engagement and about societal and ethical issues related to synthetic biology. Our approach combines in-laboratory reflective activities with face-to-face and online engagement activities which are designed and conducted in collaboration with laboratory ‘scientists-in-the-making.’ Drawing on surveys, interviews and observational data, the paper demonstrates how in-lab experiential learning and early-career public engagement can serve to integrate multi-stakeholder communication into normal scientific practice, thus integrating public values into science and preparing graduate students to be responsible practitioners of synthetic biology.

Midstream Modulation in Post Socialist Countries: Special Features, Challenges and Opportunities

Miklos Lukovics

University of Szeged

While the promise of R&D and innovation for high-level and rapid development is attractive for policy makers in post socialist countries, they also need to be prepared to address the social-ethical dilemmas and risks of unpredictable effects that are strongly connected. Unfortunately, it is not possible to predict these effects, which often do not appear until the later stages of innovation processes, when intervention is often too late and expensive. The notion of responsible research and innovation (RRI) emerged in part as a response to this challenge. RRI tools and techniques seek to enable R&D and innovation actors to reflect upon uncertainty, ignorance and negative side-effects connected to innovation in order that science, research and innovation can be more responsibility-driven with reference to its impacts on society, human beings, and the environment (Guston 2004; Owen et al. 2013; von Schomberg 2013; Fisher and Maricle 2014; Guston 2008; Pavie and Carthy 2014). Although RRI has gained credibility in the world’s scientific thinking over recent years, it is a relatively new concept for the post socialist

countries including a large number of what the European Union designates as “lagging behind regions.” Since most RRI policies and research programs concentrate on developed countries, we thereby only have relatively limited information about the opportunities of the introduction and application of RRI in post socialist countries.

Our previous research discovered special features of the East-European countries in relation to innovation including the role of stakeholders, levels of corruption, political influence on innovation activities, high territorial concentration of innovation activities, the lack of highly-developed R&D infrastructure, and the lack of technology transfer. Research results also raise questions, including how tested and operating good practices work in the innovation environment of developing countries. Accordingly, this paper reports on our efforts to apply the Socio-Technical Integration Research (STIR) approach in an Eastern European setting. The methodology of STIR, which is closely associated with RRI, has been applied in over three-dozen laboratories over the course of a decade of documented research. However, all of these laboratories were located in developed countries. Therefore, it is highly suitable for being appropriately tailor-made to the specific features of post socialist countries on the one hand, and for comparison on the other hand. Most discussions and applications of STIR have been confined to Western Europe and North America, which underserves important regions such as Eastern Europe and their scientific and citizen populations.

The aim of our research was to apply the STIR methodology in 7 Eastern European post socialist countries during which we discover the special features of undeveloped regions and we adapt to them, and at the same time we develop the methodology according to the arising issues. Also, to compare the results with those of the conducted researches in developed countries is a main aim of the research, and to reveal the features of transition countries based on these results. The paper will offer our preliminary results and assessments.

Can a culture of responsibility help overcome the two cultures-divide? The vision of Climate Neutrality as challenge and opportunity

Alexandra Hausstein

Karlsruhe Institute of Technology

This talk addresses the transition in the academic system caused by new science policies emerging in the context of pressing societal challenges. Universities are an essential part of the socio-technological order and should be among the first ones to provide institutional settings and conditions for implementing change in socio-technological systems, towards responsibility and sustainability. However, the cultural, epistemological and institutional structures defining our actual techno-scientific practices are stable and the pace of change is slow. Therefore, a time-lag in response to the urgency of action if not failure has to



be taken into account.

Climate Change and the vision of climate neutrality are a special case, as it is the most pressing crisis right now and there is hardly any time left to debate solutions. A series of interviews have been conducted with scientists, engineers and social science/humanities researchers at the Karlsruhe Institute of Technology on the question of possible contributions in their field to achieve the worldwide climate objectives. The interviews reveal the institutional and epistemological barriers and catalysts in the process from constructing a vision to putting knowledge into practice. It also highlights the difficulties in starting a process of integrating knowledge in order to elaborate a joint institutional contribution.

In the case of Germany, potential barriers that could impede such a transition are a culture of identities and mentalities and their rootedness in the cultural and organizational history of disciplines and institutions; a matrix of rationalities with gridlocked self-images and images of the perceived other; and the latency and stability of social and institutional structures.

The talk will present some empirical findings of this case as well as conceptual considerations on how to put responsible innovation and integrated research into practice at a university level.

Session G-4

NSF Workshop: Creatively Sharing Research with Diverse User-Audiences

Presenters: Michael Bennett and Joseph Eschrich

Arizona State University

During the first half of this workshop, the presenters will describe approaches to expanding the audience for one's work by converting research into modes suitable to non-traditional audiences and user populations. The second part of the workshop will be interactive, and largely devoted to discussion among participants and presenters.

Session H-1

Engaging Shifting Sociotechnical Constitutions

Turning to the Right: New Era of Drug Regulation with the 'Right-to-try' Movement

Sungwoo Ahn

Virginia Tech

As of March 2017, thirty three states have passed similar laws since 2014 that intend to offer terminally ill patients experimental drugs that have not yet been approved by the FDA. The popular support for the so-called 'right-to-try' laws is now pushing a bill at the federal level: the 'right-to-try' bill has been introduced in the Senate and the House, and Vice President Pence backs the bill while President Trump has supported it in a way to criticize the drug regulation system under the safeguard of the FDA. However, the idea of 'right-to-try' and the legislation efforts driven by the Right-to-try movement originated from diverse forces and interests, which range from the patient advocacy activities weaving shared interests of patients and pharmaceutical businesses, to the libertarian activism energizing grass-root sentiments against government regulations in general, and even to the progressive and participatory traditions of politics, especially from the AIDS activism in the 1980s.

In this paper, I show that the Right-to-try movement can be understood in the context of the neoliberal turn of mass movements in the U.S politics in which the agents across the political spectrum support change against the established order, which has been set not only by experts or power groups but also public efforts throughout the troubled times. In this Right-to-try case, the public and political organizations from heterogeneous traditions have aligned to make an exception to the drug regulation system for patients who have no alternative options but unapproved drug. However, the 'right-to-try' movement has a potential to transform the regulatory system in which the FDA controls the fate of drugs with multi-layered screenings including double-blind randomized controlled clinical trials as the gold standard to prove the efficacy of new drugs. Having scrutinized especially the libertarian argument of this movement, this paper also shows that the concerns of STS regarding the role of public participation in democratic technopolitics should extend to the conservative grass-root movement, which has not been studied thoroughly compared to its counterpart from the progressive political traditions that have engaged in environmental and other social movements related to the technoscientific issues.

Evaluating Barriers to the Democratization of AI R&D

Colin Garvey

Rensselaer Polytechnic Institute

What would it mean to take seriously the democratization of artificial intelligence (AI)? Rather than offering developer tools online for free, I argue that addressing governance of the research and development (R&D) process itself is the first step to democratization. Drawing on Woodhouse's framework for democratic decision making through intelligent trial and error (ITE), a design-based approach to the governance of technological R&D that synthesizes the insights of critical technology scholars with democratic political decision theory, I evaluate AI R&D broadly to consider how it could be



governed more democratically.

My initial analysis suggests the existence of considerable barriers to the democratization of AI. To name a few:

(1) Public deliberation is impaired by deterministic framings of AI's developmental trajectory, which prohibits partisan disagreement and restricts discussion to a narrow set of concerns. (2) Importantly, decision making processes are largely opaque, exclude most stakeholders, and allocate authority to technical experts and business executives. (3) The rapid pace of AI R&D and subsequent rush to deploy and monetize applications mitigates against stringent initial precautions and disallows time for governance institutions and other social organizations to learn and respond.

Finally, while several institutions have formed to investigate the ethics and safety of AI, these are primarily staffed by computer scientists and other technical experts, lack social scientific expertise, and have yet to provide substantial advisory assistance for those most likely to be negatively impacted by AI.

Adequately addressing these issues may require significant, unprecedented changes to the R&D process itself— but I would like to believe that the pioneers at the forefront of the field are capable of social innovations in addition to technological breakthroughs.

Five 'Tragic' Cultural Narratives of Science

Phil Macnaghten

Wageningen University

Previous studies aimed at understanding public responses to emerging technologies have given limited attention to the social and cultural processes through which public concerns emerge. When probed, these have tended to be explained either in cognitive social psychological terms, typically in the form of cognitive shortcuts or heuristics or the influence of affective variables, or in social interactionist terms, as a product of the micro dynamics of the social interaction. We argue for an alternative approach that examines how public attitudes are formed in relation to the interplay of wider cultural narratives about science and technology. Using data from recent qualitative research with publics on nanotechnology and other emerging technologies, we develop a typology of five cultural narratives that underpin and structure public talk. The narratives we identify within focus group talk are familiar stories that are deeply embedded in contemporary culture, and which provide cultural resources for navigating the issues posed by emerging technology. Substantively, they inform a 'tragic' mood on the prospects of emerging technology, reflecting the loss of belief in science, when coupled to neo-liberal logics, as guaranteeing social progress. The implications for policy-making are discussed.

Session H-2

Self-Altering Practices of Knowing and Caring

The New Patient of Early Genetic Diagnosis

Vanessa Nurock

Paris 8 University/CNRS/UCLA

This talk aims at analyzing the 'new patient' in Early Genetic diagnosis, which is now widespread especially in the US. My working hypothesis is that the expansion of Early Genetic diagnosis will widen the number of people labeled as 'patients', so that all of us may be soon concerned. For this reason, the classical relationship between 'normal' and 'pathological' can no longer be thought of as an opposition but rather as a continuity. This new patient may be understood by introducing the concept of a 'quasi-chronical' patient. This 'quasi-chronic' patient may be understood not as someone who 'has an illness' but rather than as someone who 'is a patient' engaged in a flux.

I propose to analyze this patient within the framework of the ethics of care. I thus suggest that this 'quasi-chronic' aspect may be better understood by two main characteristics. First, contrary to the traditional and etymological conception, this new patient shall be considered as characterized not by its passivity but rather by its patience. Second, contrary to the bioethical tradition, it shall be considered not as autonomous, but rather as a 'patient in relationship'.

Turning pale in light of the present: how future promises are destabilized by present care practices

Sarah Weingartz

Maastricht University

Promises of emerging technologies are not merely directed towards the future, they also convey a normative message to the present. In light of future promises the present seems improvable, less acceptable and weaknesses are foregrounded to highlight the benefits of the emerging technology. This poverty thesis of the present is often the structure of the promises of emerging technologies. In order to question this dominant assumption this research draws on a case study in cancer care settings in the Netherlands, UK and Germany in which the emerging technology 'iknife' is being aimed to be embedded. Interviews with cancer patients, technology developers and care professionals as well as observations of care practices provided the basis to develop scenarios which challenged the idea that the future may simply be an improved version of the present. Rather it suggests studying the present as a source for



already available competencies that need to be aligned with potential techno-social-moral changes. 'Opening-up' the present care practices by means of scenarios, in turn, allowed to destabilize future promises: which aspects of care work are challenged by the emerging technology, which are deemed valuable to keep and which value-trade-offs would be necessary to keep quality of care while trying to improve aspects of it? By drawing attention to the present in light of future promises, the study highlights mundane, implicit routines of care, those invisible but necessary aspects of care that promote quality.

Collateral effects of technoscientific buzzwords: Lessons from nanotechnology and personalized medicine

Claudia Schwarz-Plaschg

University of Vienna

In recent years, buzzwords have come to play an increasing role in shaping the future of new and emerging technoscientific fields. By stimulating actor networks, activities, and investments, buzzwords are vital performative elements in the creation of hypes. Such hypes are characteristic of the early stages of emerging technoscientific fields, indicating that these fields are gaining currency. At the same time, hypes point to the fluctuating character of that which is hyped, because after a first wave of huge expectations often follows disillusionment. However, already before such disillusionment may set in, buzzwords can entail unintended consequences. While we have seen much attention devoted to the investigation of ethical, social, health, environmental, and safety-related side-effects of new technoscientific developments, we know much less about the concomitant consequences of the widespread strategic use of buzzwords themselves.

The paper explores both the intended, political functions and the unintended, collateral effects of two current global technoscientific buzzwords, nanotechnology and personalized medicine. More specifically, it focuses on their functions and effects in the Austrian national context. It analyses how scientists and other field-relevant actors (e.g., policy makers, industry representatives) describe the aims and impacts of buzzwording activities in qualitative interviews and stakeholder workshops, as well as how members of the public make sense of these buzzwords in dialogue settings. In particular, the paper maps and characterizes collateral effects, and actors' strategies of how to manage them. This analysis will allow to draw more general lessons for the responsible use of buzzwords in the governance of fluctuating technoscientific fields.

Session H-3

Data Practices, Futures and Responsibilities

Awareness and Perceptions about open science from perspective of Colombian researchers

Clara Inés Pardo Martínez, Alexander Cotte Poveda

Colombian Observatory of Science and Technology

Open science is a challenge for researcher that implies diverse possibilities to make collaborative works, to disseminate of adequate form results of research, to generate higher impact in the scientific community, and society to achieve effective and efficiently science. This research seeks to analyse and evaluate trends and perspectives of open science in Colombia using qualitative and quantitative methods that allow to determine current awareness of open science by analysing attitudes and values, information habits, institutionalism and the social appropriation of open science taking into account demographic characteristics. An anonymous online survey of 37 questions was sent to all professors and researchers of the Colombian universities and research institutes. A total of 1042 responses were received with level of confidence of 95% and margin of error of 3%. The majority of respondents have heard about open science especially the related to open science, tools (software, repositories, networks) and open data. The researcher consider that the rise of digital technologies, the search of new collaboration forms, higher availability of open data and information and public demand of better and more effective science are factors that have positioned open science. In contrast, the lack of resources and the limited integration between traditional and open science are the most important barriers for use of open science in the research. These results are important input to build adequate policy on open science in Colombia.

Databases as “Normal Science” without a Paradigm

Frederick C. Klaessig

Pennsylvania Bio Nano Systems, LLC

Increasingly, knowledge organization involves relational databases, whether at the laboratory notebook or in the contexts of regulatory assessment or of research funding. There has been some analysis, such as by Leonelli and Ankeny, of self-governing communities of research that recognize the challenges surrounding database development, with some communities more successful than others, e.g. *Arabidopsis thaliana* compared to *Mus musculus*. The range of database activities is quite broad, including metadata criteria (annotation and minimum characterization information), database curation and gauging data 'quality.' Once within the database, data compilation becomes normal science. There is a taxonomy, but no explicit paradigm or exemplar as per Kuhn, and there is equally no formal connection to 'post-normal science' or to 'repertoires.' These issues will be examined in terms of the on-going Nanoinformatics 2030 Roadmap project and nanotechnology standardization.



Shifting responsibilities for responding to user needs in smart mobility

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Smart mobility innovations are often accompanied with narratives promising that smart mobility will respond to broader societal needs, like environmental sustainability. As traffic innovations are becoming smarter, or more ICT-driven, new user needs like privacy and security are emerging. Furthermore, roles and responsibilities of actors in mobility systems are in flux. Actors from new domains, like computer sciences, are entering the field of traffic management. Governments are increasingly funding innovation experiments to support a transition towards smart mobility. They are outsourcing traffic management roles to private parties. Innovations are increasingly carried out through public private partnerships. Thereby, private parties are expected to share the responsibilities for responding to public needs together with public parties. In this transition, science and technology are developing faster than the actors are grasping their transitioning responsibilities.

This article explores the allocation of responsibilities for responding to user mobility needs in Dutch and German mobility systems. Specifically, it addresses three questions. First, ‘who is responsible for responding to new user mobility needs?’ Second, ‘how are fluxing responsibilities regarding user needs enacted by the various mobility actors?’ Third, ‘what is the new role of knowledge institutions outside the private sectors?’. We research these questions through interviewing policy makers, smart mobility manufacturers, and researchers, as well as through analysing policy documents and smart mobility advertisements.

The electrical grid in flux: Vulnerability of critical infrastructures in times of political volatility

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The electrical power grid is arguably the most critical infrastructure in modern societies, and it is experiencing a rapid transformation. With the recent shift towards renewable energy and ICT- enhanced distribution systems, this infrastructure has become vulnerable to a new host of threats carried out from the digital world. Malicious cyberattacks can severely disrupt or damage large technical systems, as the computer worm “Stuxnet” demonstrated by wrecking Iranian uranium enrichment facilities in 2010. Individual households have become more open to attacks as well, as appliances are about to turn into



communicating agents in the “internet of things.” The academic discussion on energy and society has mostly neglected this downside of today’s ongoing sustainability transitions, which take place in a world marked by increased political volatility.

In my talk, I draw upon analytical tools from STS and cybersecurity to conceptualize the changing relationship between materiality and power, technology and politics, and the unintended consequences of innovation. I am going to argue that cybersecurity inserts a new political dimension into energy policy and green innovation. Securing energy infrastructures is not an issue of engineering or technocratic governance but requires an open discourse on the interdependence between technology and societal vulnerability. With becoming “smarter,” the electrical grid becomes more vulnerable to outside actors who seek to compromise or disrupt it. However, by becoming more exposed, these infrastructural configurations also become more visible. This allows for a political engagement with energy infrastructure beyond the typical supply or demand centered activism. In short, my goal is to explore the vulnerable underbelly of an evolving electrical grid (focusing on the US) and propose conceptual (re)considerations for further empirical research.

Keywords

Electrical grid, critical infrastructures, cybersecurity, internet of things, smart grid, vulnerability.

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