ASSW 2017- Session 24:

Meaningful multi-disciplinarity and the governance of evolving global dynamics in the Arctic: Towards a more materialistic study of world politics

This session discusses inter-disciplinary coordination and multi-stakeholder cooperation in the Arctic through the notion of boundary object from Science Technology Studies (STS). It consists of two parts. The first part takes the form of a roundtable-session (Thursday 6.4. at 14.-15.30 in the Virgo Room). The second part is an early-career workshop (Thursday 6.4. at 16-17.30 in the Virgo Room). This information package consists of an outline of the two sessions, a copy of the presentation abstracts and biographies of the presenters in the first part, and a summary of the boundary object - literature in STS with a glossary of some of the key concepts.

Part I:
Multi-stakeholder cooperation and coordination in the Arctic

Thursday 6.4. at 14.-15.30 in the Virgo Room

The first part of the session is a roundtable-session with presentations from three early-career and three senior-scientists about their experiences in participating and organizing multi-disciplinary or multi-stakeholder workshops or projects that have, in one way or another, used specific material entities to facilitate communication and cooperation between participants from different social worlds. The session begins with a short overview of the boundary object –concept and how it has been used in the structuring of the session. It continues with six 5-minute-talks. After their talks the presenters discuss how these kinds of innovations in multi-stakeholder engagement contribute to a more comprehensive understanding of the challenges and opportunities for human activity in the future Arctic how their approaches compare with each other. The session ends in each of the presenters explaining how they would change their presentation if the audience consisted of: a) scientists of different natural sciences b) journalists c) governmental working group preparing an Arctic agenda d) industry.

Introduction, Justiina Dahl, KTH Royal Technical Institute, Stockholm: "Challenges and opportunities for inter-disciplinary coordination and multi-stakeholder cooperation in the Arctic"

Presentations:

- **Sandy Starkweather**, The US Interagency Arctic Research Policy Committee: "Collaborations – Collaborative Infrastructure as an Engineered Boundary Object"

- **Aslı Tepecik Diş**, KTH Royal Technical Institute, Stockholm: "The Fulbright Arctic Initiative Program Interdisciplinary Cooperation for a Sustainable Arctic Region"

- **Ingrid Medby**, University College London: "A Map's Lines of Connection: Representation Beyond and Across Represented Boundaries"

- **Susanna Gartler**, University of Vienna: "The interactive map of the 'Old Village' in Mayo, Yukon Territory: Can this collaborative, multi-stakeholder endeavor be seen as a 'boundary object'?"

- **Kathrin Keil**, Institute for Advanced Sustainability Studies (IASS), Potsdam, Germany: "Developing an Arctic inter- and transdisciplinary research project involving the concept of boundary object"

- **Nadezhda Kharlampieva**, The Arctic and Antarctic Research Institute, Department of Hydrology and Water resources of the Russian Arctic: "Interdisciplinary cooperation between Russian and Chinese universities on Arctic governance"

Part II:
Using the notion of 'boundary objects' as a passage point in cooperation and coordination between different social worlds

Thursday 6.4. at 16-17.30 in the Virgo Room

The second part of the session follows a standard workshop format. It starts with a more in-depth presentation of the kind of work the boundary object notion has been applied to in STS. It continues with a set of individual and group exercises in communicating one's own work, interests and goals to different audiences and social worlds by using the insights of this notion.

Introduction: "The notion of 'boundary objects' as a passage point to meaningful communication and cooperation between different social worlds in the Arctic" (Justiina Dahl)

Exercises:

Tutors: Ingrid Medby, Nadezhda Kharlampieva and Justiina Dahl

- Exercise: Mapping different social worlds present at or connected to your work site(s)

- Group discussion: What actors/actants are possibly missing from the standpoint of other participants and disciplines? What kind of consequences, challenges and possibilities their inclusion would have to the research design might pose for your work?

- Exercise: How to present to and communicate with audiences of a) scientists of different natural sciences b) journalist c) governmental working group preparing an Arctic agenda d) industry.

- Group discussion: Importance and added value of being aware of the normative, ontological assumptions of different actors working with science, technology, environment and society that contribute to the development of governance of evolving global dynamics in the Arctic.

PART I

Presenter biographies

Sandy Starkweather (PhD) is the Executive Director of the newly established US Arctic Observing Network (US AON) initiative. Her work focuses on improving the coordination, harmonization and utilization of Arctic observations, as well as improving interdisciplinary and transdisciplinary knowledge exchange. She has served as a research scientists through the CIRES cooperative institute at NOAA since 2010 and recently served a detail with NOAA's Arctic Research Program. Sandy has a blended background in engineering, climate science and science policy. She has a strong interest in improving the effectiveness of the Arctic research enterprise, particularly in situ observational research, through building stronger collaborations among all parties (stakeholders) who benefit from sustained Arctic observing. She specializes in developing and supporting collaborative vehicles like the Interagency Arctic Research Policy Committee (IARPC) and the International Arctic System of Observing the Atmosphere (IASOA).

Aslı Tepecik Diş (M.Sc.), is a Research Fellow at Nordregio and a PhD Candidate at the Royal Institute of Technology in Stockholm, Sweden. Her background is in the broad field of sustainable development and climate change within the context of urban and regional development in a Nordic-Baltic European perspective. She holds two Masters Degrees in European Spatial Planning and Geological Engineering from Blekinge Institute of Technology and Ankara University respectively. She has worked on several applied research projects focusing on the interactions between spatial planning, climate change and gender, such as "Another Climate" funded by FORMAS (the Swedish Research Council for Environment, Agricultural Sciences and Spatial Planning), as well as on ESPON (European Spatial Planning Observation Network) projects. Her recent research interest focuses on the changing economic, social and cultural circumstances of the Arctic Region in the phase of climate change.

Dr. Ingrid A. Medby is a Teaching Fellow of Political Geography at University College London (UCL) in the UK. Her research focuses on how narratives and identity discourses may condition political practice in the Arctic. She completed her PhD at Durham University in 2016, where she looked at how state officials in Norway, Iceland, and Canada articulate Arctic identity. Prior to this, she researched Arctic identity among youth in Norway. Additionally, Ingrid is involved in projects relating to e.g. sustainability discourses in Arctic politics, infrastructure/materialities of mobility, and Arctic Council-dynamics post-Kiruna. Ingrid holds an MSc International Relations from the University of Edinburgh and a BA International Studies from RMIT University in Melbourne, Australia. In addition to her academic background, Ingrid has some experience of Arctic policy-work from the North Norway European Office in Brussels, Belgium, and has been involved with Arctic policy-related events, including the Arctic Frontiers Conference in Tromsø, Norway.

Mag. Susanna Gartler is a PhD candidate at the department of social and cultural anthropology at the University of Vienna. She is the student collaborator in the ReSDA project "LACE – Labour Mobility and Community Participation in the Extractive Industry, Case Study in the Canadian North", which is funded by SSHRC (Social Sciences and Humanities Research Council Canada). Over the last three years she has gained extensive knowledge in the field of FIFO (Fly-in/fly-out) and rotational shift work as well as community and mining industry relations. She has further started investigating for her doctoral thesis in the field of cultural revitalisation against the backdrop of

extractivism and colonialization. She has established since 2014 a strong relation to the First Nation of Na-Cho Nyäk Dun in Mayo, Yukon Territory. Susanna is a member of the Austrian Polar Research Institute, as well as APECS Austria and the Arctic and Subarctic Working Group in Vienna. She has participated in organizing the Young Scholars Forum of the German Association of Canadian Studies in 2016. Further she is co-organizer of the first Graduate Forum of the Institute for Cultural and Social Anthropology at the University of Vienna.

Dr. Kathrin Keil is a Scientific Project Leader at the Institute for Advanced Sustainability Studies (IASS) in Potsdam, Germany, where she leads the Arctic research project GloCAST (Global Change and Arctic Sustainable Transformations). GloCAST uses the Arctic as a prominent case to illustrate interrelations between global and regional change processes and between stakeholders from within and outside the Arctic who are affecting and are affected by developments in Arctic resource and transport sectors. Kathrin is also co-leading a Work Package on Climate Services in the Horizon 2020 Blue-Action project. Kathrin received her Ph.D. in Political Science from the Freie Universität Berlin in 2013. In her dissertation she researched the international politics of the Arctic, with a focus on international regimes and institutions in the areas of energy, shipping and fishing. She is also the Europe Director of The Arctic Institute – Center for Circumpolar Security Studies where she regularly writes about and comments on current Arctic developments. Further, Kathrin is part of the official German observer delegation to the Sustainable Development Working Group (SDWG) of the Arctic Council.

Dr. Nadezhda Kharlampieva, is an associate professor of World Politics Department at St. Petersburg State University and a Senior Researcher Fellow at the Russian Arctic and Antarctic Research Institute. She has recently been involved in a research project about the role and place of Russia in shaping international and transnational regimes of the future Arctic. Dr. Kharlampieva has been involved in a multitude of research projects on social and human health in the Russian Arctic. Next to her extensive teaching responsibilities Nadezhda is involved in a Russian Scientific Foundation supported project about Policy of Demography and Migrations in the Russian Arctic.

Presentation abstracts

Sandy Starkweather (National Oceanic & Atmospheric Administration (NOAA) – Arctic Research Program Cooperative Institute for Research in Environmental Science (CIRES))

- **The US Interagency Arctic Research Policy Committee (IARPC) Collaborations – Collaborative Infrastructure as an Engineered Boundary Object**

The US Interagency Arctic Research Policy Committee (IARPC) was created by Congress in 1984 (Arctic Research and Policy Act as amended 1990, ARPA) with a joint mandate to create greater coherence across 14 government agencies engaged in Arctic research and to develop collaborations with outside partners. The law directed IARPC to create a plan every five years to guide agencies; the current plan is Arctic Research Plan FY2017-2021. In 2014, to most effectively fulfil its mandate towards working with outside partners, IARPC created IARPC Collaborations – a completely open collaboration infrastructure that consists of open teams, regular virtual meetings and a user content-driven web platform (iarpccollaborations.org). IARPC Collaborations was created from the recognition that Arctic research is diverse and requires cooperation between multiple types of participants. It could be viewed as an "engineered boundary object" (Bowker and Star, 1999) that was designed to bridge the gap between Federal funders, members of the research community, and other stakeholders.

IAPRC's collaborative infrastructure supports low friction engagement and seeks to democratize the process of advancing Arctic research. In the two years since the website launched, more than 1000 member have joined and contributed more than 2600 pieces of content (documents, updates or events), generating more than 350 comments. It has been observed that engineered boundary objects can fail to engage and bridge diverse groups if they lack plasticity or "ambiguity" (Stoytcheva, 2013). IARPC Collaborations (virtual meetings and website) bears many similarities to learning networks; it also supports self-organized sub-networks. In these aspects it supports plasticity and evolves organically. Yet a comprehensive assessment of its value to diverse stakeholders has not been undertaken. While IARPC Collaborations is still a young and evolving infrastructure, viewing it as an engineered boundary object presents a valuable framework to evaluate its effectiveness at bridging diverse communities moving forward.

Aslı Tepecik Diş (KTH Royal Technical Institute, Stockholm)

- **The Fulbright Arctic Initiative Program Interdisciplinary Cooperation for a Sustainable Arctic Region**

This presentation draws on the group work of Fulbright Arctic initiative (FAI) alumni from the 2015-16 cohort (http://www.cies.org/fulbright-arctic-initiative/scholars). The Fulbright Arctic Initiative, an innovative model for policy relevant research and public outreach, is a new multidisciplinary, multinational team research program designed around specific applied research challenges in the areas of water, energy, health and infrastructure. The Initiative is designed to have an immediate impact on our understanding of these Arctic issues within the timeframe of the U.S. Chairmanship of the Arctic Council (2015-2017).

The FAI brought together leading scholars, policy makers, government officials, indigenous peoples and other stakeholders to identify critical Arctic issues, conduct policy-relevant research, and widely share findings and policy recommendations. Research activities involved disciplines of environmental sciences, political sciences, anthropology, law, public health, biology, engineering and urban planning. This interdisciplinary collaborative work created an opportunity to learn from different disciplines and explore shared challenges relating to sustainable energy sources, community wellness, climate change and water. Three working groups were established; Energy, Water and Health&Infrastructure. As the Health & Infrastructure (H&I) working group, we worked with the goal of exploring how multidisciplinary approaches could enhance the understanding of community wellness and quality of life in the Arctic. Our research indicated that community wellness in the Arctic is a concept that is strived for and discussed by many who live and work in the Arctic regions. While holistic and multi-sectoral approaches are seen to be beneficial to community wellness, there is lack of interdisciplinary models for research collaboration across sectors and an interdisciplinary research platform for policy formulation. The H&I group has been working to develop such a holistic model for wellbeing in the Arctic that is more inclusive and responsive to the challenges and opportunities that characterize northern regions.

Ingrid Medby (University College London)

- **A Map's Lines of Connection: Representation Beyond and Across Represented Boundaries**

The Arctic region's territorial indeterminacy – melting, thawing, shifting, and moving 'homelands' – is prompting seemingly contradictory processes of re-asserted state sovereignty and re-imagined post-sovereign space. As such, the Arctic challenges traditional practices of politics, and in so doing, is inviting new modes of relating both socially and politically. This presentation focuses on one specific object – something as mundane as a map – and how this came to stand in for these shifting geographical imaginaries: representational lines, fixed on paper, which most of all bore testimony to their own inadequacy. Tracing the map through a series of connected events, I argue that it took on both shared and contrasting meanings for those who engaged with it; and, indeed, through their encounters therewith new meaning and understanding were generated. The first encounter was an interview, where latitudes traced by a finger came to signify shared identities across vast oceans, generations, and professions as interviewer and interviewee. Second, the story of the map and the encounter within which it came to intervene provided a point of departure for subsequent inter-disciplinary discussion; here, once more, the depiction of the same map engendered new stories and new relational meanings. Finally, the map was written into a research project, fixed on paper, symbolising something wholly new: an educational journey. In the end, my argument is less about what the map is intended to represent in and of itself – space, borders, territory – and more about the meanings with which any object with seemingly known attributes can become imbued when it enters a field of social interaction. With multiple but not exclusive meanings, such a familiar object thereby allows us to explore co-extant understandings of the Arctic and beyond, traversing disciplinary and professional (not to mention, geographical and generational) boundaries.

Susanna Gartler (University of Vienna)

- **The interactive map of the 'Old Village' in Mayo, Yukon Territory: Can this collaborative, multi-stakeholder endeavor be seen as a 'boundary object'?**

During the course of my fieldwork in Mayo, Yukon Territory, in summer 2016, I was collaborating with the First Nation of Na-Cho Nyäk Dun's (FN NND) heritage department on various heritage-related subjects. One on-going heritage project was the development of a heritage site called Old Village. Together with various stakeholders we created an inventory as well as an interactive 'map' of the former dwelling place of the FN NND. This experience was not only a cross-stakeholder experience involving administrative staff, a researcher, members of community, Youth and Elders but a multi-disciplinary one at the same time, being located at the intersection of geography, map-making, anthropology and heritage. During my first visit I given a tour by restoration/clean-up project members explaining the specifics of the site. An Elder told me stories related to the dwelling history of the place and provided general information in regards to the current use. Later on I revisited the site to take an inventory with a young local woman taking pictures, and administrative heritage staff as well as myself taking notes. Back in the office of the self-governing First Nation it turned out we had to figure out which cabin on site had belonged to whom, leading to the idea of creating a new map. Eventually a visualization of the Na-Cho Nyäk Dun Old Village was created with the help of a geographical map (MAPS), an Elders mental map and a historic schematic drawing by the Mayo Historical Society, as well as our drawings from the site and the visual data provided by the FN NND Youth operating the camera. In light of this experience I would like to discuss the concept of 'boundary objects' and if it applies to (the creation of) this particular artefact?

Kathrin Keil (Institute for Advanced Sustainability Studies (IASS), Potsdam, Germany)

- **Developing an Arctic inter- and transdisciplinary research project involving the concept of boundary object**

This talk will give a brief outline of the attempt to draft a strong inter- and transdisciplinary project, including expertise from within and across natural and social sciences as well as engagement of stakeholders throughout the research process. The idea behind such a project is that we aim to strengthen the outcomes of science-policy interactions by involving Arctic stake- and rights-holders throughout the research process and by making research results accessible and useful for them. This builds on and augments, but does not replace, traditional basic scientific research and outreach approaches. Further, the project aims to use the concept of boundary object in the form of a set of scenarios for future Arctic development outlining possible developments over different time scales and the possible consequences of potential decisions that could be taken in regards to the Arctic environment and Arctic communities. While the project is still in the planning phase, some advantages and difficulties of such an approach can already be shared.

Nadezhda Kharlampieva, (Saint-Petersburg State University, Department of World Politics Study and the Arctic and Antarctic Research Institute, Department of Hydrology and Water resources of the Russian Arctic)

- **Interdisciplinary cooperation between Russian and Chinese universities on Arctic governance**

In 2012 the Department of World Politics Study of Saint-Petersburg State University started a new private cooperation with the Institute of Law and Policy of China Ocean University (Qingdao). The collaboration bases on the Department of World Politics Study's research on new methods for cooperation between the natural and social sciences in the development of Arctic governance.

In the first leg of the research on how to increase multi-disciplinary collaboration in the development of Arctic governance that has been ongoing at the Saint-Petersburg State University since 1997, we studied the role and place of: a) international organizations, b) federal and local structures on the shaping of arctic policy and participating in arctic affairs in Russia. In second leg, which began in 2010, we first contacted different private and public institutions in East-Asia to see if there were similar interests in the development of Arctic governance and business structures than we had discovered on the Russian side. An important tool in building this leg of collaboration in multi-disciplinary arctic research between Chinese and Russian institutions was a Singapore seminar and conference on Arctic issues organized between 2010 and 2012. Next to building this collaboration we researched the role of states in the shaping of strategical arctic researching planning and in arctic affairs. The third leg of research has included an ongoing cooperation between Dr. Nadezhda Kharlampieva (Department of World Politics Study, Saint-Petersburg State University) and Professor Peiqing Go from Institute of Law and Policy of China Ocean University (Qingdao) on: a) Cycle of interdisciplinary researching "The Arctic Policy in XXI century" (since 2009), and b) Annual Russian-China Science-Practical Interdisciplinary Workshop (since 2011).

The research and practice of multi-disciplinary collaboration between Chinese and Russian institutions on Arctic issues has illustrated innovative possibilities for research that focuses on: 1) economic and ecological international interactions in and of the Arctic 2) transformation of decision making processes on local, regional and global levels, and 3) facilitation of the creation of interdisciplinary dialogs between the natural and social sciences in the governance of evolving Arctic issues.

PART II

The notion of boundary object

History of the term

The boundary object -concept first emerged in the context of **interactionist research**[1] in STS in the late 1980s. This type of social study of science and technology focuses on the social elements in the process of knowledge production as well as its product (Sismondo, 2010, pp. 19–21). It is related to the wider **social constructivist** strand of STS.

Social constructivist STS has used an array of different historical, sociological and anthropological case studies from different natural and technical sciences to illustrate the social nature of all knowledge production. (E.g. Collins 1985; Latour and Woolgar 1979; Lynch 1985) According to Susan Leigh Star (2016, p.26) - one of the creators of the boundary object –approach, the more general aim of this kind of science study is to demonstrate how reports of science that are stripped of production history – accounts discussing the social, technical, and material dimensions associated with knowledge production – overlook the necessary social elements in the organization of what counts as legitimate natural and material knowledge. In short, how the outcomes and content of science, as well as access to it as a profession, are determined by larger social and political structural commitments, positions, and other institutional considerations.

One of the main analytical arguments that has followed from the social constructivist cases studies of science and technology is that the social study of science and technology cannot be separated from the study of professional governments, from medicine, or from any other profession (Star 2016, p. 25). In short, because science and technology cannot exist as somehow separate from society they should not be studied through a primacy of any one viewpoint. Instead, they should be approached through an allegory of **"ecologies of knowledge"** (Star 2016, p. 20). One approach in this kind of science study is the analysis of science as a job and scientists as people who are doing a certain kind of work together (Star 2016, p. 25). Another is the study of the different **social worlds** present in complex institutional scientific and technical settings such as voluntary staff for fieldwork and specimen collection for a museum of zoology, the technology and technical crew maintaining a specific technical unit in a laboratory, the janitor, or imagined users of birth control pills (Bowker and Star 2000, p. 147; Clarke and Star 2008, p. 121; Star and Strauss 1999).

Boundary objects

The first case study of "boundary objects" in STS is Star and James Griesemer's (1989) study of the division of labor between different social groups connected to the Museum of Vertebrate Zoology at the University of California, Berkeley between 1907 and 1939. Their analysis of the cooperation between the different social worlds in this arena focused on the nature of relations and action across the arrays of people and things that encountered and confronted each other in this specific scientific institutional space. In other words, the concept was used as an analytic entrée for the

[1] At the end of the information package, there is a glossary of all the terms that are marked in bold.

descriptive study of the different negotiations and other work occurring in the museum space (Clarke and Star 2008, p. 118).

Boundary objects in Star and Griesemer's (1989, p. 392-393) study are those scientific objects that both inhabit several intersecting **social worlds** *and* satisfy the informational requirements of each of them. Examples of these kinds of objects in the context of the Museum of Vertebrate Zoology include the terrain of the state of California, the habitats of collected animal species and physical factors in California's environment such as temperature, rainfall and humidity. These scientific objects qualify as boundary objects because they are "objects which are both plastic enough to adapt to local needs and the constraints of the several parties employing them, yet robust enough to maintain a common identity across sites." (Star and Griesemer 1989, p. 393) In other words, the basic social process of **translation** allows these objects to be (re)constructed to meet the specific needs or demands placed on them by the different social worlds (Clarke and Star 2008, p. 121).

Star (2010, p. 602-603) has later clarified how the focus in the study of boundary objects is on how a single object can be used for different purposes for different groups that wish to cooperate without sharing a paradigm. In relation to the concept itself she describes how the first part, 'boundary', refers to the stuff of action and the second part, object, to something that people act towards and within. Otherwise put, the materiality of these objects derives from action, not from a prefabricated stuff or "thing"-ness. In transferring these basic analytical insights of the boundary object -concept to a more materially focused discussion of the evolving global dynamics in the Arctic, the exercises in the workshop imply Charlotte Lee's (2007, p. 308) summary of this kind of study as one that empirically illustrates how a single object can be used for different purposes for different people. Star (2010, p. 602) conceptualizes this as the **interpretive flexibility** of (boundary) objects.

Towards a "more material" study of evolving global dynamics in the Arctic

The "more material" in the topic of the session refers to the way studies of boundary objects approach the study of the relationship between the material and the social worlds in the context of complex institutional settings.

In more traditional social and political studies, material entities come secondary to existing disciplinary paradigms associated with concepts such as power, social status, identity, structure, and system. In the study of boundary objects the material universe, the spaces, sciences, materials, infrastructures and technologies that enable different actors to work together, are, in contrast, the starting point in the mapping of these more traditional social aspects of scientific practice.

The talks in the first part of the session give concrete examples of different ways in which actors inhabiting different social worlds have come together in collaborating on Arctic issues. They offer one insight to the importance of empirically studying and illustrating the different – hard to detect – normative and ontological assumptions of different actors working with science, technology, environment and society in the development of Arctic governance. Because of the lack of accumulated experimental knowledge of the materiality of the Earth under anthropomorphic global warming, the identification of these normative and ontological assumptions is especially important in the development of new peaceful forms of Arctic governance in the twenty-first century.

Glossary

Ecologies of knowledge: An approach to science studies that refuses social/natural of social/technical dichotomies. Argues that "nature" is nowhere to be found apart from the web of work an inquiry constituting the relations of science. Seeks to understand the nature of these relations by focusing on the action across the arrays of people and things in specific scientific arenas. Makes inventories of these arenas by studying what are the different communities and activities of which it is composed (human as well as non-human). In other words, actors that encounter and confront each other in specific spaces.

Interactionist research: Sociological study that focuses on the subjective aspects of social life rather than on objective, macro-structural aspects of social systems. In STS inherently connected to the sociology of work that first describes what people *do* as well as what they say they do, and then situates this narratives and discourses to the larger context of careers, materials, techniques, theories, organizations, and professions.

Interpretive flexibility: Refers to how the same object can have different meanings for different actors. In short, how no technology or object has only one potential use. Often used example from the history of technology is the development of the safety bicycle - the basic design of most twentieth- century bicycles - at the intersection of different users of this technological gadget.

Social constructivism (in STS): Study the political and relational aspects of what qualifies as legitimate scientific knowledge. Concerned to show how science is not neutral, but how the outcomes and content of science as well as access to it as a profession are determined by structural commitments, political positions, and other institutional considerations. As a methodology follows more general concerns about reliability and validity of data, robustness of findings, and the meaning of those findings, but aims to not be reductionist. Argues that neither unmediated knowledge of reality nor a single complete set of truths are possible. Social, political, anthropological and historical strands have provided multiple case studies of how scientists and technologists build socially situated knowledges and things.

Social worlds: An analytical term based on the observation on how actors solving scientific problems that come from different social worlds can establish a mutual modus operandi without coming into a consensus. Each of the social worlds present in a scientific site has at least one primary activity, a particular site of operation, and technologies that they use. Once the cooperation between the different social worlds is under way, more formal organizations typically evolve to further one aspect or another of the world's activities. Individual actors compose social worlds, but in arenas they commonly act as representatives of one specific social worlds, preforming their collective identities. Used especially in the identification of social power structures through i**mplicated actors/ actants.**

Implicated actors/ actants: Actors silenced or only discursively present in a specific social setting. In short, human actors and no-human actants constructed by others for their own purposes such as specific social groups that will be affected by the adaptation of specific technologies to new region.

Translation: Because the new objects and methods mean different things in different worlds, actors are faced with the task of reconciling these meanings if they wish to cooperate. One of the focus areas in social studies of science is how people from people from different worlds find common language in which to conduct their joint work. In other words, how scientists and other actors contributing to science translate, negotiate, debate, triangulate and simplify their concerns, methods, work and findings in order to cooperate together.

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