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Back to the Future? Why TA May Become More Relevant – Again

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Abstract

Technology Assessment (TA) has sometimes been criticised for adhering to an outdated and technicistic view on the relationship between science, technology and society, which may even convey the impression that it has fallen out of time. Has it?

Following different conceptualisations of rationality, inclusiveness and neutrality (as foundational myths of TA) through three historical phases ever since the implementation of TA, this article traces different roles of TA in the respective contexts. Against this background, TA's relevance for solving problems related to science, technology and society in today's world of the "post-factual" is assessed and some requirements for TA's remaining relevant in the future are sketched out. It turns out that actively addressing normative questions may be key in maintaining relevance when knowledge claims are being challenged; two alternative ways to do so are sketched out.

The article concludes that TA does not need to appear having fallen out of time provided it takes on the normative challenge.

Keywords: Technology assessment, rationality, inclusiveness, neutrality, normativity

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1 Introduction

Technology development and implementation may have consequences other than those intended. This simple insight became a politically relevant issue in the USA around 1970. Over the following decades, Technology Assessment (TA) gained a substantial but hard to define role in the political and public deliberations about the governance of technoscientific endeavours in the Western world. TA aimed at a practical advisory function to politics in the role as an 'honest broker' (Pielke 2007), informed by both social scientific approaches as well as the natural sciences and engineering. Although the mother of all parliamentary TA, the US Congress' Office of Technology Assessment had to close after two decades (as well as some European offices), a considerable number of other institutions stepped in and keep doing TA to this day – either connected to the national parliaments, to scientific academies or as independent entities.[1]

At about the same time, from the 1970s on, the relation between science, technology and society had become a prominent subject of interdisciplinary social scientific research. Under the name of Science and Technology Studies (STS), this resulted in a new understanding beyond the dominant simplistic stage model emerging from concepts such as Vannevar Bush's famous "endless frontier" (Bush 1945). Among many other findings, the insights that technology is socially constructed (Pinch and Bijker 1984), that separating nature and culture is precarious (Latour 1993), that scientific facts are established by researchers and that uncertainty entails conflicts (Nowotny and Gibbons 2001) became mainstream – all relevant findings for TA. While TA had met scepticism mostly from engineering and market-oriented politics, criticism from the social sciences focussed on shortcomings in the conceptual understanding of the very subject of TA.

To this day, critics have not fallen silent. For example, van Lente et al. (2017) have found fault with TA as being normatively blind and following an alleged but impossible neutrality as well as an old-fashioned notion of technology as a thing separate from society. This hinders TA from adequately coping with today's problems from conceptual reasons. As an

1. Examples include the German TAB, the French OPECST, the Dutch Rathenau Instituut, the British POST, TASwiss, the Austrian ITA, the Danish DBT, the Norwegian NBT, the Catalan FCRI or STOA at the European Parliament (see PACITA, http://www.pacitaproject.eu/).

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alternative, they advocated Responsible Research and Innovation (RRI) for assessing and mediating the societal consequences of technology in a more inclusive way. Furthermore, a constructivist background would prevent technological determinism and do away with the claim for an impossible neutrality. In their reply (Nentwich 2017), TA practitioners rejected this view, emphasising that neutrality can be upheld and that indeed, TA sees technology as belonging to society. Van Lente's criticism, accordingly, was due to a restricted perception of the many and diverse forms TA had developed ever since the OTA had been set up in 1972. In fact, TA had amalgamated much of the respective zeitgeist, adopting new methods, institutional settings and different agendas. While the reply pointed at a somewhat distorted image of TA among critical scholars, some of their criticism cannot be so easily dismissed. TA is afflicted with a couple of problems, for example:

• In contrast to a genuinely social scientific approach, which looks upon technology from outside and has its own concepts and perspectives, TA as an inter-disciplinary field depended also on the expertise of natural scientists and engineers and therefore has had to reconcile concepts of the social, the natural and engineering sciences. Yet, especially during the implementation phase at national parliaments, scientists and engineers often criticised TA for prioritizing abstract societal concerns over, in their perspective, more topical issues like security or product convenience. In their view, TA appeared as a hindrance to industrial development, slowing down the speed of innovation (Haberland 2016).

• TA often emphasized that technological innovation may be a contribution to economic growth but that it is neither a panacea nor an end in itself. This attitude changed somewhat when environmental activists promoting sustainability argued for rapid innovation, for example to produce renewable energy or to introduce more adequate forms of mobility (e.g. Manifesto 2015). In such cases, TA tends to be less critical of innovation. So why did TA consider innovation desirable in some contexts and ambivalent in others? Without a clear normative framework, such a discrimination appeared inconsistent.

• Furthermore, the quest for the "best available knowledge" initially put that of scientific experts centre stage, which attracted criticism early on (Wynne 1975). This preoccupation became even more suspect when situated and lay knowledge, to be retrieved through participatory procedures organised by TA, gained in importance. Consequently, it was by no means clear which form of knowledge would be "better" in the sense of more suitable to

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solve societally relevant problems. Yet with participatory activities two practical problems arose: firstly, how to activate situated knowledge without inoculating lay people with the experts' explanations, and secondly, whom to include, especially if participants were difficult to find or reluctant to engage (Bogner 2012).

The lack of binding standards, the oscillation between normative tenets and neutrality, an inconsistent use of different forms of knowledge and tricky issues around participation may have contributed to the image of TA of having fallen out of time. Many scholars seem to have their doubts whether there is a future for TA as it builds on seemingly old-fashioned ideas.

Has TA indeed fallen out of time? Is it a concept of the past, when technology development was considered to be separate from society? Should it be replaced by RRI or another approach informed by social constructivism? Or does it still have its merits and should occupy a place in technology governance? Is its way of processing knowledge, its effort to stay neutral, its aim at being inclusive and its sober yet often lacklustre form of policy advice still topical?

The article tries to shed some light on this question. Since many of TA's problems relate to rationality, inclusiveness and neutrality, these three foundational concepts, if not to say myths, of TA (Torgersen 2019) will be briefly addressed as they have acquired different meanings over time. To emphasise TA's diversity, and to provide a background for lessons to draw and inspirations to derive, three historical phases of TA development will then be looked at to identify main differences in a variety of parameters.

After discussing some more recent problems of TA, its relation to normativity will be discussed before sketching out its potential future role with reference to the above foundational myths in the conclusion.

2 Foundational Myths

When in the late 1960s, TA was established at the US Congress as a political instrument to empower the legislative vis-à-vis the executive branch, the basic ideas included neutrality, rationality and inclusiveness (Grunwald 2018); properties that were quite rare in (or even at odds with) the political life at Congress.

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As a kind of unique selling proposition, they became essential for TA, but in practice they were difficult to reconcile with the political reality. Without claiming comprehensiveness, these foundational myths of TA may briefly be sketched out as follows (Torgersen 2019):

Rationality refers to the way factual knowledge is applied. Rather than relying on hearsay, TA is committed to use, in an unbiased way, the best available knowledge, often understood to be scientific evidence. Yet in some cases, other forms such as situated and lay knowledge derived from trustworthy sources may be equally or more relevant. Where evidence is shaky or unavailable, such as with new and emerging technologies, convincing arguments e.g. derived from analogies and supported by empirical findings may be applied. If issues are contested, different bodies of knowledge linked to opposing interests may compete against each other. Therefore, the input, the way the information is processed and the results must be kept entirely transparent.

Inclusiveness manifests in considering all relevant sources of information, not favouring a particular interpretation or stake. Apart from scientific evidence, situated or lay knowledge should be considered. All relevant stakeholders should be heard; if not, the exclusion needs to be argued. Results must be openly disseminated so that experts, stakeholders, politicians and members of the public can understand them.

Neutrality means that TA must not take a stand but remain distant to all parties, interests and worldviews. This implies an open-ended investigation of an issue and a non-biased choice of information, way of deliberation and drawing of conclusions as well as results that are comprehensive and relevant. Options proposed should be feasible, oriented at the public good rather than at particular interests and described in a neutral way.

These concepts aka foundational myths are interrelated in many ways. For example, the body of knowledge taken to be relevant influences the form of rationality the assessment process will follow. Who to include determines to some degree what knowledge is available. And whether or not to include a particular stakeholder depends on the respective understanding of neutrality. In other words, these concepts (or myths) mutually influence each other while they together shape the form and understanding of the TA process.

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In the phase of implementation at various parliaments, neutrality, rationality and inclusiveness were prerequisites for success. Over time, procedural and substantial neutrality served to defend TA against the allegation of partisanship. Remarkably, majority factions at parliaments often tried to prevent TA because they suspected that the opposition would benefit more (Petermann/Grunwald 2005). TA used to be a foreign object in the daily political business, bringing in and promoting forms of knowledge, expertise and solutions more suited for solving controversies by factual arguing than by partisan bargaining (Bogner 2010).

Over time, other institutions and actors in society became important addressees as well, which changed the role of TA and in part, its rationale. With the benefit of hindsight, several phases can be identified, each with a different perspective, respectively, on the relation between science, technology and society (Bogner/Torgersen 2019). They emerged, flourished and partly lost their salience again without disappearing for good. Their following description may appear rough or even a bit exaggerated, but this is necessary to spot the differences in understanding and conceptualising major issues across the different phases. In reality, things were less clear-cut and more ambivalent, but assuming three phases can be discerned, let us see what can be learned.

3 Tasks and rationales of TA

3.1 Expert orientation for multiplying options (from 1970)

Initially, the task of TA at the US Congress was to provide more and better options for decisions on technological issues. So far, pertaining political decisions had mostly been taken by the Government on the basis of information from selected experts and/or lobbyists. Now, “better knowledge” backed by scientific expertise that included all relevant positions should also enable the legislative branch to develop a better understanding of the issue at stake without having to rely on information prejudiced by partisan interests or Government’s intentions. It was hoped that more options would emerge beyond those that powerful political actors would suggest to Congress. This hope was rooted in the confidence that analysis-based planning on the basis of objective knowledge would promote the common good (Bimber 1996). In today’s terms, policy development should become more evidence-based without determining the outcome in someone’s favour. From a normative point of view, this program followed mostly US Democratic (in Europe:

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social democratic) thinking that was influential in many political institutions during the 1970s, the age of systems analysis and rational planning. In this spirit, Emilio Daddario, one of the founders of the OTA, referred to TA as a method of analysis that systematically appraises the nature, significance, status, and merit of a technological program (Braun 1984).

At that time, the pace of technology development not only appeared as a huge source of benefits but also as a potential socio-political problem. In the long run, it was feared, technology would determine society while securing economic progress and material well-being. Accordingly, technology would impose a single option to every choice: the technological one (proposed by industry and government), and so democracy would suffer. According to Ellul's de-humanized "technological society" (Ellul 1964), public life would be determined by rationality, efficiency and control. The remedy proposed by the OTA was better-founded scientific expertise from more varied sources, as well as a re-alignment of technology development at the interests of the common good rather than that of particular (industry) stakeholders.

TA saw one of its main tasks in advising political actors on decisions over big and costly technological projects. A famous example was the SST project to develop a supersonic civil airplane in the US, or the Sänger project to construct a space shuttle in Germany. Both were eventually abandoned because there was no acceptable return on investment economically, scientifically or in terms of common good benefits. In retrospect, this was well-founded (Petermann/Grunwald 2005).

Regarding the three foundational myths, rationality in this phase can be understood as following the best available scientific knowledge to arrive at robust decisions. Inclusiveness refers to taking on board different scientific disciplines as well as the interests of all relevant institutional stakeholders. Neutrality meant not taking sides with partisan interests but to promote solutions in the interest of the common good.

3.2 Participation to extend inclusiveness (from 1985)

During the late 1970s and 1980s, certain technological developments gained an image as a hazard not only to democracy but to sheer physical existence. Deep controversies over nuclear arms were subsequently extended to technological risks from atomic energy and, later, from biotechnology. While stakeholders promoted the technologies and their

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applications and the state was interested in economic growth through innovation, civil society organisations protested against the deployment of a number of contested technologies. Controversies often ended up in violent protests. As a side effect, the perspectives of “those affected” became acknowledged as those of legitimate stakeholders. Initially, the affected consisted of the neighbours of a plant to be erected; later, virtually everybody was included as the technologies were said to pose risks to society at large. Hearing non-experts turned the focus from top-down planning to more distributed decision-making and triggered the development of participative methods; new forms of TA made available new forms of knowledge and delivered alternative values for novel options. Elaborate procedures generated alternatives to the official experts’ discourses that were intended to make decisions more socially robust (Nowotny et al. 2001). From this perspective, TA understood itself as a hinge, or translator, between science, stakeholders, politics and the public.

The disagreement of experts from various disciplines mostly over risks exacerbated conflicts and fired up criticism of science. Achieving the one best solution with the best available knowledge according to the dominant expert appeared unrealistic because a counter expert would immediately question the epistemic foundation of such a solution. While Paul Feyerabend (1978) depicted western rationalism as “ratio-fascism”, an extreme constructivist relativism would consider lay expertise as equivalent to the results of scientific inquiry. Science and technology appeared as irresponsibly and undemocratically inflicting risks to society at large for the material interests of the powerful few. Calls for a more democratic technology development contributed to the preference for governance over top-down ruling, and for assigning the responsibility for decisions to be made to multiple stakeholders.

One of the main occupations of TA under these conditions was to assess risks and to determine whether they would be acceptable. In practice, this often translated into checking the conditions under which the respective technology would find acceptance. In some cases, such as with genetically modified food products, this seemed never to be the case as environmental or health risks were always claimed even if they could not be scientifically demonstrated. Multiple TA exercises established divergent interpretations of risk that were rooted in different scientific disciplines, interests, world-views or cultures (Levidow/Carr 2010).

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The focus on constructivism suggested that there were different forms of rationality, and TA was not in the position to decide which form was more relevant. Inclusiveness meant taking on board all voices, irrespective which ideological stance they represented, what kind of argument they put forward or which form of knowledge they were derived from. Consequently, neutrality was understood as mainly procedural, making sure that all voices would be heard at equal level, with TA in the role of an organiser or moderator of the process.

3.3 Pragmatically promoting innovation (from 2000)

Two major developments brought a preliminary end to the traditional form of open technology conflicts that had been dominant so far: firstly, events such as the assault of 9/11 captured the imagination of politics, the media and the public, shifting the attention to topics other than new technologies. Secondly, the term technology became almost synonymous with computers and in particular with the internet and social media as parts of everyday life. Technology, hence, no longer had the image of a menace but turned into a playful and useful tool enhancing productivity and self-fulfilment (Torgersen/Schmidt 2013). Under similar auspices, the term “converging technologies” transgressed the boundaries of information technologies and described the growing together of various sectors to one all-encompassing technological idea that would inevitably govern our lives in the future, it appeared.

Yet public opposition was still a concern in the minds of technologists, at least when it came to biotechnology or related endeavours (Torgersen/Hampel 2012). Whether a new development would be acceptable should therefore be determined early-on by comprehensively assessing, in a pragmatic way, the ethical, legal and societal implications (ELSI).[1] This program and the term were coined under the debate on the Human Genome Program when it emerged that the consequences for the acceptance of the developments to emerge might be far-reaching when not properly addressed (Cook-Deegan 1994). In contrast, for information technology, the Silicon Valley business and innovation model served as an irresistible blueprint for a successful economy, conveying a libertarian individualist ideology that considered technology as the solution to every problem including

1. in the US; in Europe, “issues/implications” had been replaced by “aspects” (ELSA)

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boredom and individual death. Transhumanism, space exploration, but also geoengineering fired up the phantasies of technologists aka entrepreneurs. Risks were something for the faint-hearted while technological gadgets occupied a growing share of reality. This model eventually led to framing synthetic biology accordingly (Torgersen/ Schmidt 2013).

At the same time, coming to terms with menacing societal challenges demanded the rapid introduction of appropriate technologies. Innovation again appeared without alternative, provided it pursued the right aims: to secure privacy through IT design, to keep the Internet accessible for all, and last but not least, to produce renewable energy or devise emission-free public transport. Scientific advice to politics should ensure that technology is "useful, usable and used", for example in disaster risk reduction and sustainable development (Aitsi-Selmi et al. 2016).

Such a "correct" technology would have another advantage: it would open up promising business fields because the respective processes and products would be in demand. With the right incentives, they would find a market, reconciling industry's need for economic viable innovations with the demands from environmentally and socially conscious citizens for more sustainability (von Schomberg 2011).

Responsible Research and Innovation (RRI) was to apply both expert knowledge, as well as the wisdom of the crowd, as useful resources to identify areas where a normative consensus over the aims of new technology could be reached. Targeted research on areas of general concern should deliver new value-generating processes and products addressing pressing problems, like antibiotic resistance or climate change. RRI appeared as a historical compromise between forces oriented at industrial innovation and at sustainability. Criticism of technology might still exist in the form of individual NIMBY protests but no longer as a political ideology.

Many TA projects revolved around issues of sustainability (e.g. the implications of renewable energy production, e.g. Grünwald 2009) or the protection of individual rights (such as privacy in IT, e.g. Friedewald et al. 2017). They often addressed a mission – a clearly defined aim – and sought appropriate ways to reach them by adequate means without causing too many unwanted side effects (Mazzuccato 2017). The label of technoscience indicated that application orientation already guided the early phases in the

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development cycle, so “upstream” participation was considered necessary (Guston/ Sarewitz 2002) to effectively influence technology development. Being future-oriented, TA had to deal with visions (Grin/Grunwald 2000) or even adopt a “hermeneutic” approach (Grunwald 2014).

To find a place within all these requirements, TA took on a predominantly instrumental perspective, often following pre-determined missions. Rather than questioning the missions’ aims, instrumental rationality guided the choice of the best options towards fulfilling the respective mission’s aim, and inclusiveness developed into an epistemic tool to collect situated knowledge, views, interests and options to inform this choice. Neutrality referred to selecting the way how to pursue the mission to the best result (or solutions eliciting little opposition) with least possible input.

3.4 Tasks and Rationales: a Summary

Table 1 summarizes the forms TA adopted in different phases (Bogner/Torgersen 2019). In the left column, the five upper rows show broader societal context characteristics during the phases influencing the respective form of TA. The items in the five lower rows refer directly to TA, the bottom three are the foundational myths. N.B.: The different roles of TA under particular phases emerged gradually through shifts in focus rather than disruptions. Although this summary is necessarily coarse it becomes obvious that TA is, and for a long time has been, a multi-facetted endeavour almost impossible to address as a homogenous entity. Over time, it has become ever more diverse, developing new tasks and skills without giving up previous preoccupations. Around 2010, TA had acquired the status of an umbrella term indicating a manifold assortment of different approaches and practices. What they had in common was an orientation towards novel technologies, broader socio-technological issues and societal problems where technology plays a role, either in evoking them or in potentially mitigating them. From an epistemic point of view, TA remained trans-disciplinary: rather than investigating concepts and practices from an outside perspective (like sociology or STS do), the aim was to include insights from various natural and social sciences as well as situated and lay knowledge. This went along with an integrative approach towards balancing the diverse interests involved in the development and deployment of new or substantially altered technologies.

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Rather than sticking to assessing the consequences of deploying a ready-made technology, as the name suggests, TA saw itself as a player in shaping technologies in a way that would benefit society as a whole while minimising the inevitable downsides. To obtain this, ever more emphasis was placed on public debate, partly as a response to the allegation of being lopsided in favour of scientific insights and consequently, world-views. While this may have been justified sometimes, the accompanying allegation of being more open to certain political and economic interests is not very plausible. Rather, TA always seemed to feel obliged, although seldomly addressing it in an open way, to a somewhat old-fashioned conceptualisation of the public good as a moral compass guiding its choice of topics and its daily practice.

	phase 1 (from 1960)	phase 2 (from 1980)	phase 3 (from 2000)
zeitgeist	faith in planning progress	scepticism on progress	pragmatism
paradigmatic society	technological society (Ellul)	risk society (Beck)	network society (Castells)
image of technology	dominant, jeopardising democratic decisions	threat to existence	problem solver, gadget
governance	top-down	bottom-up	network negotiation
status of science	authority	voice among others	competitive advancement
role of TA	increasing the number of options	widening the range of those included	improving innovation
rationale	return on investment	acceptance	mission fulfilment
rationality	scientific	pluralistic	instrumental
inclusiveness	relevant stakeholders	all voices	potential influencers
neutrality	equidistance to partisan interests	epistemic indifference	instrumental plurality

Table 7: *Perspectives of TA in different phases (Bogner/Torgersen 2019, adapted)*

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4 Back to the future of TA?

4.1 Contemporary problems

Today, many problems have become extremely pressing, like climate change, micro-plastic pollution, loss of biodiversity, antibiotic resistance etc. More than ever, TA is called to support the societal transformation towards more social, ecological and economic sustainability in a mission-oriented way. Expertise through TA from the sciences, from stakeholders and from citizens on social and technological innovation is highly welcome, provided the relevant actors, especially from the political sector, consider it trustworthy, relevant and significant. Therefore, options and recommendations have to be knowledge-based, balanced, comprehensible and transparent. There is a consensus in western-style liberal democracies that the only way to meet these requirements is through a "rational" debate, highlighting more or less accepted "facts".

However, there are indications that things have changed over the second decennium, so rather, one should say that a consensus was reached. Scholars have bemoaned that our liberal democratic societies are at risk of deteriorating as implicit social and behavioural rules erode (Levitsky/Ziblatt 2018). Accordingly, the accepted habit of using factual arguments and acknowledging opposing positions have given way to hate speech, minority-bashing and blunt lies. Trumpeting against a so-called elite being detached from the views and interests of ordinary people goes hand in hand with scepticism against any specialised expertise (Nichols 2017). In such an anti-rational environment, accordingly, it has become increasingly difficult to cling to sober facts, no matter what their factuality is built on.

This diagnosis is not unfounded. For example, scientific dissent over man-made climate change has been disavowed as a lack of facts, and experts claiming the existence of facts have been accused of being corrupt and pursuing elite interests only. The scientists' consensus over substantive indications but not yet fully conclusive evidence yet (Oreskes 2004) did not manage to sway those in doubt; rather, it confirmed those already convinced, deepening the split in society.

If there was a justified allegation against TA of not having identified a new technology's unintended side effects it must have been its epic failure to foresee the multiplication of the ranting at the pub's bar to the filter bubbles of social media. Originally, the possibility to

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freely upload any opinion was praised as a contribution to a lively democracy. In effect, it promoted the erosion of the public space. The pattern of “belief trumping evidence” fuelled technology conflicts that were said to have waned, with issues from climate change to vaccination, the refusal of the latter having developed into a global threat simply for social reasons (Larson/Schulz 2019).

TA and similar exercises are caught between the demand for transforming society along the lines of better knowledge and an increasingly anti-rationalist critique of experts that denies the mere basis for such an endeavour. Apart from splitting society over the conflict issues of the day, this division allows for an increasingly authoritarian politics to focus on power and mission control. TA might shy away from considering such a form of policy-making to be a proper addressee for its advice.

The obvious question is what an appropriate strategy could be for TA. Should it meet the critics half-way in an attempt at staying neutral? After all, the TA philosophy would demand to deal with the relevant dissenting views in a serious way in order to develop a consensual position. But what does relevant and serious mean here? Which dissenting view can be considered as being grounded in a relevant form of knowledge so that it can be taken seriously? What about pathetically staged arguments built on fake news, intended to raise emotions in social media – should they be included? Would transparency regarding sources and methods and a comprehensive reference to dissenting minority views be the solution, as the TA cooking book would suggest? Or would it be futile to rely on rational arguments anyway, because the critics’ business model is built on exactly the opposite?

4.2 Rationality, inclusiveness and neutrality in a post-factual world

The expert oriented, the participatory and the pragmatic phase emerged from a particular societal setting in the relation of science, technology and society, entailing different conceptualisations of rationality, inclusiveness and neutrality, respectively. The legitimacy of TA has always been predicated on it being a rational endeavour. It also related to the demand of being inclusive, which played out in the form of neutrality. Today, there is a new and different societal situation, with new technologies and new challenges, in particular a problematic public space, which may demand a new interpretation of the three foundational myths rather than giving them up altogether. However, simply rejuvenating

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the past and digging out old solutions does not seem appropriate. This said, past experiences may nevertheless serve as inspirations.

To be rational, TA needs the best available knowledge for example on climate change. In many cases, such knowledge still comes from science. Bruno Latour (in an interview, de Vrieze 2017, p. 159) recently claimed that “we will have to regain some of the authority of science” when it comes to combatting climate change denial. However, this was not an argument in favour of “strategic essentialism” presenting science as indisputable from strategic reasons only. Rather, the solution should be the same as in STS: “You need to present science as science in action.” (ibid.) This may be interpreted as critically describing how scientists arrive at a conclusion and which theories and experimental practices guide them. Such a description may be considered more accurate, relevant and therefore convincing than mere gut feeling or general arguments about scientists being corrupt because they are part of the elite. It may even claim to be more neutral.

Hence, one may adopt, from the expert-oriented first phase of TA, a certain prerogative of scientific findings – provided they can be argued not only in disciplinary terms but on a more general level, referring to how science works. This does not away with the significance of situated or lay knowledge as emphasised in the participatory second phase, but its relevance must be critically argued in an analogous way, for example by describing the situation of the respective speaker in relation to the issue at stake. The mere ennoblement of an argument by the ignorance of a lay person should not be enough for its eligibility. Finally, knowledge must be good for something, it must provide a relevant insight that enables action (as in Aitsi-Selmi et al. 2016). Here, inspiration may be found in the third, the pragmatic phase.

The relation between inclusiveness and neutrality is trickier. On the one hand, Grunwald (2018) had argued that the demand for inclusiveness requires neutrality, because otherwise some views might get neglected, curtailing the knowledge base. Rationality, on the other hand, does not allow keeping equidistance to all positions because taking on board views aiming at discrediting (not only scientific but also situated) expertise and replacing it with mere belief would make a consolidated neutral stance of TA non-rational. As a result, it would erode its legitimacy. Neutrality and rationality in a strict sense as prerequisites for TA’s role as an “honest broker” (Pielke 2007) thus seem to exclude each other under some conditions. But is this the only possible role TA can adopt? Traditionally,

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the honest broker is the ideal role that has been assigned to TA. These days, however, scholars like Pierre Delvenne consider it necessary that TA adopts the role of an "issue advocate" actively promoting rationality, neutrality and inclusiveness against an increasingly irrational, lopsided and divisive political climate that jeopardises the very elements of a liberal democracy (Delvenne/Parrotte 2019).

4.3 Normativity and neutrality in TA

The main bone of contention here seems to be the relation of TA to normativity. In the first phase, TA derived its normative orientation – apart from its basic predication on rational decision-making in the interest of the common good – from the relevant experts' and stakeholders' views; in the second phase, it took those of "the affected" on board as well while staying as neutral as possible itself. Today, this neutrality grounded in a sociology-inspired, procedural approach collecting and integrating norms as found in society no longer seems fully adequate. In post-factual times, sticking to a totally detached position would undermine the very basis on which TA operates. Somehow, TA has to re-discover its normative basis.

Recently, Armin Grunwald and Pierre Delvenne proposed two different options, respectively, to deal with the tension between neutrality and normativity (Grunwald/ Delvenne 2019). According to Armin Grunwald, TA should emphasise its epistemic basis in scientific rationality and, at the same time, uphold neutrality to guarantee inclusiveness (see also Grunwald 2018). This does not preclude that TA openly refers to a normative basis, namely to the very general values of enlightenment, including personal autonomy and human rights, as well as to the tenets of a liberal democracy such as the division of powers and personal freedom of speech. It may also refer to the values enshrined in the concept of sustainability, to societal equity, the pursuit of the common good or even to a socially sustainable technology development. René von Schomberg referred to a similar corpus of general norms and treaties when describing the normative basis of RRI (von Schomberg 2011). On the level of the respective technical and societal questions at stake, however, TA would be obliged to uphold an operational neutrality regarding stakeholder interests, the hierarchy of aims or the way they are pursued etc. This partition would enable TA to keep its self-assigned role as an honest broker in policy advice, which conveys political credibility and influence while not falling into the trap of eroding its own basis.

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In contrast, Delvenne (ibid.) recommended that TA should adopt a more pronounced (or even political) stance in the sense of an actor who deliberately pursues concrete yet democratically legitimised aims (such as sustainability goals, social equality, forms of justice or the common good) that lie behind certain proclaimed missions (Delvenne/Parotte 2019). TA would have to declare its normative stance with respect to those aims very transparently and, in every case, to hierarchically deduce operating instructions from this general normative positioning for all its actions, including detailed questions and the choice of options it would have to promote. This could even entail giving up the role of an honest broker and adopting that of an issue advocate, recommending certain solutions rather than others. It could also imply getting into conflict with stakeholders that do not agree with the positions TA defends.

There is something to be said for and against each alternative, and it is difficult to speak out for one as a general recommendation for TA. Rather, both roles, that as an issue advocate or as an honest broker, may be adopted depending on the context, provided TA indicates openly, as a prerequisite for its credibility, in which role it acts in a particular setting. TA would need to adopt a program of reflexive normativity (Kollek 2019), constantly reflecting on the normative foundations that guide its actions in every stage of an assessment. This should become a daily practice by default rather than an effort carried out only on special occasions.

Conclusion

Has TA really fallen out of time? Certainly not. The demand for an institution that analyses, as far as possible and applying multiple bodies of knowledge, various options for socio-technological ways to proceed in a neutral and rational way, that organises and stimulates the public debate on them and provides, at best, sober policy advice for decisions to be made seems still topical. One may claim that such an institution is even more necessary in an era where the public space is eroding, where anti-rational assaults jeopardize effective policy-making and where it becomes increasingly difficult to sort out conspiracy theories from critical positions, fake news from unexpected facts and staged claims from well-founded arguments. Within the realm of technology governance, few institutions may be in a better position.

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However, to do so successfully TA needs to better adapt to this function. It must learn from experiences without aiming at bringing back the past days of glory. The TA of the future will have to be inclusive, i.e. take on board expertise from multiple scientific disciplines and views, from public involvement and from a variety of stakeholders. In addition, it will have to lay open the form of neutrality it follows as well as the normative tenets it holds, which everybody is free to agree with or not and therefore to criticise TA – and TA will have to tolerate and take up criticism. How exactly such a regime would look like is unclear yet, but some points with regard to neutrality, rationality and inclusiveness might render TA more viable in the future.

Regarding neutrality, TA might secure its institutional basis so to keep major actors at arm's length, which means establishing good relationship e.g. to industry, NGOs, the executive branch or various political forces at different levels. Yet TA should not risk falling into an institutional or financial dependency. This is more difficult than it appears since TA is increasingly dependent on doing project work paid by institutions that have self-interests such as the European Commission, e.g. in mission-oriented research programs. In other words, reducing the dependency of TA on third party funding will be essential but difficult.

Regarding rationality, TA should remain, on the one hand, science-based, i.e. relying on scientific insights but keep in mind that they are only temporarily valid. On the other hand, it should also consider non-scientific forms of knowledge, because they are essential in balancing hidden interests inherent in the scientists' data interpretations. Yet all forms of knowledge must be subject to the same level of scrutiny and double-check, irrespective of their origin, whether they fit a particular view or contribute to reaching an aim proclaimed in a mission. TA should be committed to state what the case is, and not what it should be, unless clearly argued.

However, this is not enough. TA, as all trans-disciplinary fields, needs to develop its own concepts and approaches rather than bouncing between the detached approach of the social sciences (viewing technology from outside) and the risk of being engulfed by the standards of the natural sciences (coming from within technology). This requires more emphasis on, and reception of, theoretical work.

Regarding inclusiveness, certain views and interests suggest themselves; the same goes for particular scientific disciplines. Yet they cannot claim to depict the entire reality, so

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searching for alternative views is necessary but tedious. When it comes to popular views on scientific issues, they often command a certain credibility and should not be entirely dismissed. However, conspiracy theories need to be separated from relevant critical stances. The only possible way to do so is through a rational analysis, the criteria of which need to be made fully transparent.

Such a TA may fulfil a role that is needed in a post-factual society stricken by news whose trustworthiness deteriorates by the hour. TA may become one of the few trusted sources for what remains to be called truth, even if it is not to the taste of those in power – provided the institutional setting allows TA to pursue its task.

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