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ROLE CONCEPTS OF TECHNOLOGY ASSESSMENT BETWEEN POSTULATES OF NEUTRALITY AND THE DEMAND FOR CREATING IMPACT

ABSTRACT
Technology assessment (TA) has been evolving as a research-based and anticipatory field of scientific policy-advice for more than fifty years. Its position at the interface between science and policy-making has caused several debates on its adequate roles. Proposals reach from the position of a neutral and distant observer of ongoing developments up to taking an active role in transformation processes fueled by the technological advance, e.g. in favor of sustainable development. In this paper, several role concepts of TA will be discussed against the background of a new framework concept on technology assessment. It will be shown, that TA usually has to take the role of an *Honest Broker* in assessing new technologies as an umbrella role concept. The specific manifestations of this umbrella role, however, can vary from context to context. The role concept of the Honest Broker serves as an orientation to determine the more specific roles in the tension between assumed neutrality and the obligation to create impact.

KEYWORDS
technology assessment, neutrality, impact, honest broker, issue advocate, transformation

1. Introduction: Technology Assessment in Practice and Theory

Since the 1960s adverse effects of scientific and technical innovations became more obvious. Some of them even showed dramatic proportions: threats to the natural environment (e.g., air and water pollution, ozone hole, climate change, loss of biodiversity), negative health effects as in the asbestos case, heavy accidents in technical facilities (Chernobyl, Bhopal), social and cultural side effects (e.g., labour market problems due to automation) and the intentional abuse of technology (e.g. by terrorists). The experience with unintended, unexpected and often serious impacts of technology calling for new orientation has been at the core of TA's motivation (Grunwald 2019a). New motivations entered the field of TA over the past decades: the experience of technology conflicts motivated TA to think about a more socially compatible technology (Renn et al. 1995); the imperative of sustainable development inspired TA to engage in shaping technologies in favour of this imperative (Weaver et al. 2000); the

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emergence of techno-visionary sciences and technologies challenged established TA concepts and methods and motivated developing and applying new approaches (Grunwald 2013).

Technology assessment now constitutes an interdisciplinary field of research and advice. It aims at providing knowledge and orientation for better-informed and well-reflected decisions concerning development, use and disposal of new technologies. Three focal branches of TA practices can be distinguished which address different targets and different actors in the overall technology governance (Grunwald 2019a):

(1) TA has initially been conceptualised as *policy advice* (Bimber 1996). Still many TA activities are located in this field (Michalek et al. 2014). The objective is to support policymakers in addressing the above-mentioned challenges by implementing political measures such as adequate regulation, sensible research funding and strategies towards sustainable development and responsible innovation. In this mode of operation TA does not *directly* address technology but considers the *boundary conditions* of technology development and use.

(2) During the past decades citizens, consumers and users, actors of civil society, stakeholders, the media and the public increasingly postulate to be engaged in technology governance, e.g. for siting processes of waste disposal facilities, for shaping energy infrastructures, and for prioritizing the public research agenda. Participatory TA developed approaches to involve these groups in different roles at different stages in technology governance (e.g. Joss/Bellucci 2002, Abels/Bora 2016).

(3) A third branch of TA is related directly to technology development and engineering. Departing from analyses of the genesis of technology made in the framework of social constructivism (Bijker et al. 1987) the idea of *shaping technology* due to social expectations and values motivated the development of approaches such as Constructive TA (CTA, Schot 1992) aiming at facilitating "better technology in a better society" (Rip et al. 1995). The latter approach is among the roots of the current RRI movement (Owen et al. 2013, van den Hoven et al 2014).

This categorization shows a broad variety of obviously heterogeneous TA practices covering different actor constellations, involving different role concepts for TA, and responding to different expectations by applying different concepts and methods. In order to identify a common TA framework for subsuming the many and various TA activities the crucial step is determining the overall *cognitive interest* of technology assessment. Based on a broad consideration of the fields of TA practice the cognitive interest of TA was shown to consist of:

> supporting, strengthening and enhancing reflexivity in all epistemic and social fields of reasoning and decision-making on shaping the scientific and technological advance, on the usage of its outcomes and on dealing with the consequences to present and future society (Grunwald 2019a: 88).

Regarding TA practices (Michalek et al. 2914, Scherz et al. 2015) and looking into the motivations and activities applied (Grunwald 2019a, Chap. 3) there is no doubt that technology assessment in all of its practical manifestations is about enhancing reflexivity on scientific and technological progress and the use of its outcomes. However, the notion of enhancing reflexivity is rather abstract. It means, briefly speaking, considering possible consequences of technology in a broader spectrum, thinking more carefully about alternative options at hand or to be developed, to involve values and perspectives also beyond those of decision-makers and experts, and to take care of any decision on relevance to be made, e.g. by determining boundaries of the system under consideration. In order to make the notion of 'enhancing reflexivity' more tangible, three conceptual dimensions of enhancing reflexivity have been identified (Grunwald 2019a):

- *anticipation* (e.g. Guston 2014) addresses the dimension of time for enhancing reflexivity *over time* (Bechthold et al. 2017)
- *inclusion* addresses the dimension of different perspectives to be involved for enhancing reflexivity *across perspectives* (e.g. Renn et al. 1995, Joss/Bellucci 2002, Abels/Bora 2016)
- *complexity management* addresses the dimension of judgments on relevance *for* enhancing reflexivity *over relevance*

These dimensions open up a wide field for developing and practicing concepts and methods in different disciplines and fields of research to contribute to the overall cognitive interest of TA. The Fig. 1 provides an overall picture of TA (cp. Grunwald 2019a for a more detailed explanation and foundation). At the top the societal needs and demands for orientation are mentioned. Technology assessment, working in the dotted box according to the framework described, produces outcomes as responses to those needs and demands (at the bottom). These shall have an impact in the real world and may change the initial situation). In this way, TA is regarded as research-based part of societal learning processes (Wynne 1995) how to deal with the technological advance and its outcomes in a reflexive manner. The background of these directions of enhancing reflexivity consists of the experiences with the ambivalence of technology and the occurrence of unintended effects mentioned above. In this sense, TA fits well into the framework of a reflexive modernization (Beck et al. 1994) and of an alternative modernity (Feenberg 1995).

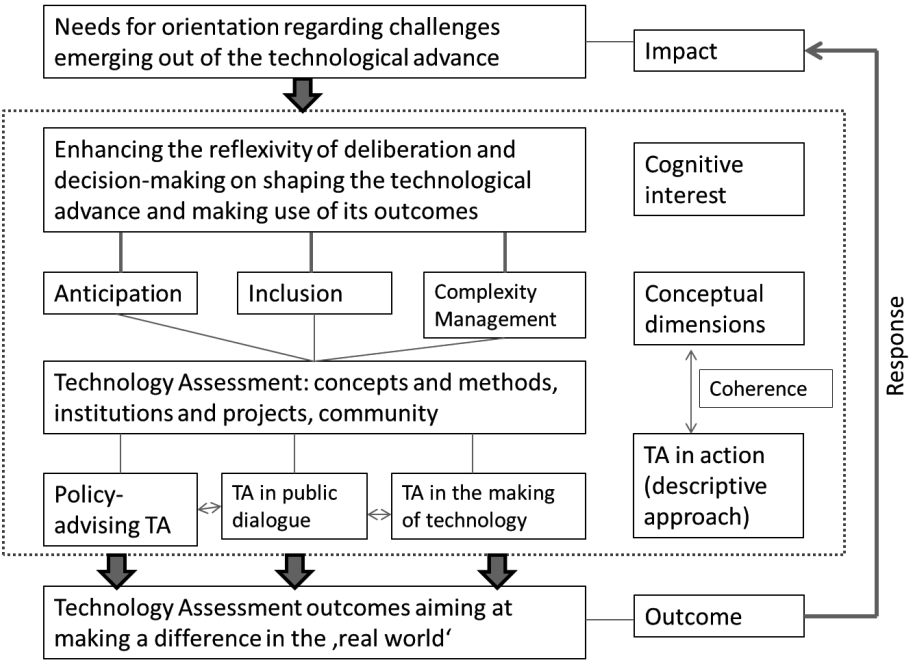

Fig. 1 Framework of TA (source: Grunwald 2019a: 89).

2. The Tension between Being Neutral and Creating Impact

According to its normative ground in pragmatist and deliberative views on democracy (Grunwald 2019ab, Saretzki, 2015) TA can give advice to decision-makers (including society) but must not decide itself. The distinction between TA as an advisor and its advisees (policy-makers, societal groups, engineers, managers, etc.) as well as the separation of advice and action is crucial. This observation is common to all of the fields of TA's practice in its trinity (see above). Looking to TA's history, however, demonstrates a certain tension between two expectations:

(1) On the one hand, the demand for neutrality has been part of the history of TA since its origin in the foundation of the Office of Technology Assessment (OTA) at the United States' Congress. TA shall restrict itself to the role of an advisor and remain distant and neutral:

> When legislators established OTA many inside and outside Congress hoped that the new agency would provide the kind of objective advice that is a common mission of new expert organizations ... OTA was designed to emphasize both the appearance and reality of non-partisan, neutral competence (Bimber 1996: 50).

Policy-advising TA must be *neutral* and *independent*, according to its institutional setting, and therefore has to be demarcated from partisan forms of

policy advice, particularly from advice to individual political parties or groups. In the semantic field of neutrality and independence, there are terms among which there is more or less overlap of meaning, such as openness with respect to results, value-neutrality, rationality, objectivity, impartiality, or equity. Three main concepts are openness, independence and equity (Grunwald 2019a):

Openness of the results is an essential property of policy-advising TA. The results of a TA study must not be determined in advance. If the result of a TA study were already clear from the outset, the study would obviously be a courtesy expertise for the retroactive procurement of legitimacy, or for supporting partisan political positions. The openness of scientific research as well as of discursive deliberation and assessment, however, imply that the result will be elaborated only during the process..

Independence: Independence from external interests is obviously to be expected from the respective TA institute and project team, following the conceptual framework presented above. TA must not become the accomplice of interest groups: political parties, ministries, public administrations, other representatives of the executive, or societal groups and those representing their interests such as unions, or employers, federations and non-governmental organizations. This prescription – which follows directly from the conceptual dimension of inclusion introduced above – also concerns science and research institutions, which are naturally representatives of their own interests. Securing the autonomy of TA institutions by means of institutional precautions is of decisive importance (cp. Bimber 1996 on the OTA; Grunwald 2006 on Germany's Office of Technology Assessment TAB).

Equity: The demand for equity means that in TA studies or institutions, no preference must be given to certain value standpoints. Value positions represented in society which are relevant for the respective topic should be taken into consideration equally. Partisanship in fields of societal conflict has to be avoided. Equity applies to all of the steps in TA projects in which, implicitly or explicitly, evaluations are made, e.g. for determining topics and the research design but also for the participation of societal groups in participatory TA.

This position corresponds to the classical view of STS which has been characterised as follows (Grunwald 2013a):

> The sociology of science is often accused of sitting on an epistemological fence (...). Although fence-sitting is still an honourable epistemic tradition, many in the field today enjoy camping out, not on fences, but on "boundaries" (Webster 2007: 458)

This view values 'fence-sitting' as an 'honourable tradition' because the scientific observation of social issues in research often requires a detached and not involved observer. However, as we will see later on, this position seems to be necessary but not sufficient.

(2) On the other hand, TA is confronted with the expectations to create impact, to respond to external expectations (see above), and to exert transformative

power. TA by necessity aims at *creating impact* and *making a difference*. This impact may be a contribution to transformation towards sustainable development, a piece of policy advice orientating a political debate or raising public awareness, amongst other dimensions of impact (Decker/Ladikas 2004).

This expectation corresponds nicely to an ambivalence of the ideal of 'fence-sitting' STS diagnosed by Webster (2007, see above). The epistemological position of 'fence-sitting', despite being necessary, may not be sufficient to satisfy many current expectations. Therefore, Webster states that STS should go beyond and show more practical engagement:

> The STS analyst can (and does) play an enabling role in such initiatives [projects that are designed to develop new forms of public inclusivity, A.G.]. My argument is that the three entry points [the characterization and anticipation of emerging technoscience fields; the exploitation of (future) technoscience; the context in which technoscience applications are used, A.G.] bring our focus down from the meta-level to more meso and tractable forms of engagement and critique *within the policy room itself*. (Webster 2007: 472)

TA has arrived at a clear conclusion concerning its own position in this debate in accordance with the conceptual framework introduced above: TA is to have impact and must therefore make a difference – and that means that TA admits to taking responsibility for intervening in ongoing processes of opinion-forming and decision-making (Decker/Ladikas 2004). Otherwise, TA wouldn't be needed at all. Combining being inclusive and neutral, on the one hand, and making a difference in practical issues, on the other, however, sounds contradictory in itself. Anyway, it needs creativity with respect to purposive role concepts allowing for resolving the tension.

The main task of this paper is to analyze the tension between the obligation to neutrality, on the one hand, and the expectation to create impact, on the other, more in-depth. The understanding what TA is and does at the interface between science, technology, and society shall be deepened at the occasion of role concepts taken by TA. In the remainder of the paper, role concepts of TA will be explored and discussed which shall enable a constructive way for dealing with this tension.

3. Role Concepts of Technology Assessment

In daily practice working for parliaments, ministries, civic society organizations, or in engineering, feasible ways have to be determined how to deal with the tension mentioned above while observing the general requirements of the theoretical TA framework. The focus in this section is to address this item at two levels: (1) the level of roles to be taken by TA in performing particular tasks, and (2) the level of generalizing role *concepts* as bridges between practice and theory. The following consideration, therefore, address the level of practice (3.1) and theory (3.2) as well.

3.1 Role Concept in TA's Fields Of Practice

In each TA exercise the respective roles of TA, of the TA practitioners involved, and of TA institutions in the respective setting must be clearly determined in order to prepare for a transparent assessment process. The diversity of TA practice fields (see above) and the heterogeneity of different contexts and settings TA implies that a broad variety of role concepts have to be applied, tailor-made to the respective challenge and context. They all demarcate different ways to position TA at the interface between policy-making and scientific research, between more being more observatory and neutral and intervention, between close neighborhood and clear distance to its advisees.

So far, only little effort was spent to clarify role concepts and to create a map of different roles to be taken by TA according to different contextual circumstances and requirements. The focus of the conceptual TA debates was more on the *overall role of TA* at the interface between science and society while its more specific roles were rarely an issue. Petermann (1992) proposed an illustrative comparison by comparing technology governance to a soccer or football match, following the arena-model of social science. In an arena, two parties, e.g. proponents and opponents of a new technology, conduct a match in order to determine the winner. The parties form teams, which conduct the match following not football rules but rules of technology governance. These rules could include powerplay issues, regulatory regimes, elements of deliberative democracy, or others. The match is observed by an audience (e.g. civic society) sitting around, the parties have been coached by trainers, they have to observe the rules, and there must be a referee taking care of keeping the rules. If we apply this model for debates around new technology, TA could take very different roles, without claiming completeness (Grunwald 2019a) and

- observe and analyze the match afterwards and give advice to the coach for the next match
- give advice to the coach before or during the match, based upon the analysis of the preceding stages of the match
- act as a sports journalist commenting on the match over broadcast or TV channels to the broader public,
- sit in the fan-clubs and motivate the players on the field,
- be an active member of one of the teams and struggle for its victory,
- take the role of a coach for one of the competing teams (or even for both),
- act as referee taking care that the rules are observed by all parties
- be member of a committee or jury developing further the rules of the game
- .....

This is, however, only a nice illustration, which may fit to some TA configurations but by far not to all of them. Referring more closely to possible TA positions in fulfilling its mission at the interface between science and society,

its relation with the sociology of science and the STS field (science and technology studies) could be worth to be considered more in-depth. A broad variety of role concepts between the extremes and antipodes of mere observation, on the one hand, and explicit intervention, on the other, should be explored.

The preliminary following list may be regarded as a first step and as an invitation for improvement (building on and extending Grunwald 2019a). This list briefly describes role models widely used or conceptually proposed for TA between these poles. The description is orientated to the *functions* the specific role models shall fulfill and to the *intentions* followed. Hence, the descriptions mirror the self-understanding either of the respective TA actors or of conceptual assignments, which are not strictly separated but may overlap in daily practice.

(1) TA as scientific observer and analyst: In this role, TA understands itself - similarly to the self-understanding of large parts of the STS community (see above) – as a more distant observer of the field. TA in this role would be about researching the actor and power constellation, ongoing discourses, communication issues, and so forth, with the aim of creating better understanding of social processes involving new technology, or ideas and visions of new technology. This is the traditional position of social science trying to avoid any intervention.

(2) TA as irritation: In sociological systems theory (Luhmann 1990) the societal subsystems are characterized by their own language codes. These hinder simply transferring knowledge from one to another subsystem, e.g. from science to politics. According to this theory, transgressing systems boundaries would only be possible by *irritating* the target subsystem. There only could some hope for the emergence of some intended resonance there. In this role concept, TA could irritate engineering processes by pointing to their blind spots, or irritate parliamentary bodies by opening up unexpected alternatives.

(3) TA as Cassandra: Regarding the significance of non-intended effects and the ambivalence of technology (see above), TA frequently was expected to take the role of an early warning mechanism against possible risks possibly related to new technology (Paschen/Petermann 1991, cp. also the watchdog issue mentioned in Smits/van Leyten 1991).

(4) TA as tracker: In this role concept (Smits/van Leyten 1991) TA is expected to act as the twin of Cassandra in the opposite direction. TA shall be a scout searching for opportunities related to new technology, think about feasible innovation paths at early stages of development already, and support innovation strategies by foresight processes and strategic intelligence.

(5) TA as an agenda-setter: TA can assume a role for bringing new issues onto the political and engineering agenda. It also can contribute to the public agenda by extending the scope of expert-oriented technology debates to broader audiences and to creating social awareness with respect to possible future developments.

(6) TA as a coordinator with technology governance: In this role, TA regards itself as a process manager, as designer and conductor of processes regarding the governance of technology. The processes to be coordinated may be deliberative and communicative processes around technology as well as processes

of shaping technology by engineering. The role of a coordinator could, in a strong understanding, even be understood as taking responsibility over the entire process of designing technology and aiming at dominion in this respect. In particular, it could aim at influencing the engineering process in order to achieve the 'right impacts' to be determined in public debate and political decision-making processes (von Schomberg 2013).

(7) TA as an activist: TA here understands itself, simply speaking, as a movement struggling e.g. for sustainable development, or more general, for "better technology in a better society" (Rip et al. 1995). Under this doctrine, interventions into ongoing processes in public debate or political decision-making shall not be avoided but are, in the contrary, part of TA's mission, according to this role concept. Here TA assumes an explicit transformative function far away from traditional self-understanding of science.

(8) TA as referee: In order to achieve the 'right impacts' or 'better technology in better society' TA could go beyond a moderator's and coordinator's role by itself determining what is a 'right impact' and 'better technology'. As a result, TA could come up with substantial recommendations and postulates concerning measures to be taken. Thereby, TA would apply the 'science knows best' approach of traditional academic policy advice to its own mission. This variant of technocracy could be named 'TA knows best', society: please follow!'

According to the heterogeneity and variety of contexts TA operates in, there is no opportunity to determine one or some of these role models as better *per se* than others. The reason simply is that the criteria of 'better' will be case- and context-dependent. However, taking over these roles in specific exercises must strictly observe TA's cognitive interest of enhancing reflexivity (see above). This requirement results in the call for an umbrella role concept of TA. It should orientate the processes of determining the context- and case-depending roles and their exertion in a reflexive and transparent manner.

3.2 The Honest Broker as an Umbrella Concept

Pielke (2007) considered the field of scientific policy advice according to different role concepts of scientific advisors in relation to different types of knowledge to be transferred. He proposed differentiating between the following concepts (Pielke 2010, 2):

> The Pure Scientist – seeks to focus only on facts and has no interaction with the decision-maker ...
>
> The Science Arbiter – answers specific factual questions posed by the decision maker ...
>
> The Issue Advocate – seeks to reduce the scope of choice available to the decision maker ...
>
> The Honest Broker of Policy Options – seeks to expand, or at least clarify, the scope of choice available to the decision-maker ....

These role concepts also reflect different scientific self-understandings. Many scientists would see themselves as pure scientists working in and for the subsystem science (Luhmann 1984) without claiming to be policy-relevant or to give advice to decision-makers. Science arbiters bundle scientific knowledge and give advice, often in commissioned projects responding to specific questions raised by knowledge-seeking decision-makers. Issue advocates close down the field of alternative options under consideration in favor of clear recommendations what should be done, e.g. for transforming the energy system or to prepare for integrating robots into the care system. Honest brokers, in the contrary, elaborate more the set of alternative options and aim at creating better knowledge on their implications, or they even open up more options (Stirling 2008). Often, there is lack of transparency in taking these roles. Sometimes, the claimed objectivity and value-neutrality of the pure scientist collides with interests and stakes: "The notion that scientific advisors can or do limit themselves to addressing purely scientific issues, in particular, seems fundamentally misconceived" (Jasanoff 1990). In the same direction: "There is a tendency for advocates to present an agenda grounded in advocacy in the cloth of science, either as a Science Arbitrator or even as a Pure Scientist, above the fray" (Pielke 2010: 8).

TA obviously cannot be pure science according to its history and motivation (Bimber 1996; Grunwald 2019). Also obviously, TA must not advocate its own issues of which technologies should be introduced, or of how society should develop while adopting particular new technology. Also, TA cannot work towards creating acceptance for particular technologies, e.g. care robotics or GMO products, or towards creating rejection of particular new technologies. Acting as an issue advocate pro or con particular technologies would be in conflict with main elements of its cognitive interest (see above), in particular with the dimension of inclusion which prevents taking a biased or even partisan position.

The role of the science arbiter, however, can play a certain role, e.g. if expert knowledge about facts was required in a decision-making process and a TA study was commissioned to provide that knowledge. However, usually this role will only take a small share of TA's work. Because its cognitive comprises regarding technology as embedded in society and reflecting values and normative criteria in an inclusive manner. There, TA's work will include reflective parts of the advice in by far the most cases far beyond only feeding facts and expert knowledge into the process.

Reflection and inclusion of different and possible contradictory positions and diverging values leads TA to the approach of thinking in alternatives (Dobroc 2018, Grunwald 2019) which clearly corresponds to the role of the honest broker. Due to its cognitive interest in the conceptual dimensions involved and with its fundament in democracy (Grunwald 2019b) technology assessment is obliged to take the role of the honest broker (Sarewitz 1996). Its thinking in alternatives, the commitment to democracy and the rejection of technocracy, the issues of inclusion and enhancing reflexivity prevent TA from taking other roles (Grunwald 2019a).

Recently, a model of scientific policy advice was proposed which fits well to this position of TA and can serve as an illustration (Edenhofer/Kowarsch 2015). It is grounded in the Political Philosophy of John Dewey, which was adapted to the specific field of climate policy with the Intergovernmental Panel on Climate Change (IPCC) as assessment and advisory body. The authors regard scientific advisors as mapmakers while policymakers shall use the presented map as information and orientation in order to deliberate different pathways to the future and to finally determine, where the travel shall go:

> ... researchers, along with stakeholders, act as the "cartographers" of different, viable policy pathways and their practical consequences by acting as the "mapmakers" of the political solution space. They provide a guidebook with alternative options for policymakers (.i.e. the "navigators" and the public). Such maps cannot replace travelling i.e., decision-making nor can they resolve all environmental policy conflicts, yet they can provide an important orientation in otherwise uncharted territory (Edenhofer/Kowarsch 2015: 63).

Analogously, TA practitioners develop 'maps' of introducing new technologies into society together with stakeholders, citizens, or other actors. These maps include alternative pathways and roads into the future and information about their anticipated properties and implications but also uncertainties and pitfalls. They provide several alternative pathways with different properties, which can be used as orientation by society and decision-makers. In this way, the reflexivity will be increased on where to travel in the scientific and technological advance and the use of its outcomes as well as public dialogue and democratic deliberation on new technologies and their meaning for the future of society will be enriched.

Explicit or implicit expressions of the role of the honest broker can be found in many examples from TA fields of practice. For example, the Office of Technology Assessment of the German *Bundestag* (TAB) does not deliver recommendations to the parliament but alternative options. More generally speaking: because TA as policy advice has to realize political neutrality, and because in TA in public dialogue must ensure legitimacy and include different values and interests (Section 3.1), the umbrella role of the Honest Broker must be taken for determining the more specific roles and positions for particular TA exercises. This role concept serves as a kind of orientation and guidance how to design and organize TA studies and projects.

4. Creating Impacts as an Honest Broker?

At this point of the analysis it is time to recall the tension mentioned in Section 2 above. TA is to have impact and shall make a difference in real-world issues. Making a difference means intervening in ongoing debates and decision-making processes (Decker/Ladikas 2004). The role model of the Honest Broker, however, seems to be incompatible with making a difference and

having impact in the 'real world'. Interventions into the 'real world' should be left to the advisees and not be done by TA as the advisor:

> One way for science advisors to closely engage with the needs of policymakers but avoid recreating themselves as special interest groups is to work to clarify and, if possible, expand the scope of choice available in decision making. ... the Honest Broker of Policy Options seeks to explicitly integrate scientific knowledge with stakeholder concerns in the form of alternative possible courses of action (Pielke 2010: 17)

How can any claim of technology assessment to make a difference in order to "achieve a better technology in a better society" (Rip et al. 1995) or to contribute to sustainable development be compatible with thinking in alternatives as an Honest Broker? How can TA be simultaneously neutral and transformative? In the remainder of this Section, three arguments will be given how to resolve this tension: (1) agenda-setting as an intervention, (2) developing alternative options as an intervention, and (3) developing arguments as intervention.

(1) *Agenda-setting as an intervention*: The determination of items and themes for TA exercises can act as an intervention and may create impact without urging actors into a particular direction like an Issue Advocate would act. Putting new themes on the agenda of parliamentary TA offices, for example, often raises public attention and can contribute to public awareness. This holds in particular for issues, which had not been discussed intensely so far. In Germany, the possibility of a large-scale blackout of electricity supply was not an issue in public debate until Germany's Office of Technology Assessment (TAB) was commissioned to conduct a study on the possible consequences (Petermann et al. 2011). Public attention and great perception in mass media accompanied this project during its runtime and contributed to societal awareness. This clearly was an intervention into ongoing debates on the current status and the futures of society without having stakes with respect to better technology or other measures how to respond. The agenda-setting *as such* created impact. Agenda-setting was already reported in the TAMI project (Technology Assessment: Method and Impact, cp. Decker/Ladikas 2004) as an important means for creating impact by technology assessment bodies or institutes.

(*2) Developing alternative options as an intervention*: Developing alternative options only provides the *potential* for making a difference. Whether and how this opportunity really will be taken, depends on many contextual factors and the engagement of actors, in particular on the advisees, and on the course of deliberation and decision-making processes – in accordance with the role concept of the Honest Broker (Pielke 2007). Nevertheless, developing options *as such* also can have an intervening force. As soon as the alternative options are on the table of societal and political debate, they can unfold their transformative potential and power. The mere existence of alternative options can motivate and fuel the transformation of real-world issues because the previous options on the table will look differently in the presence of new options (Grunwald 2019a). New comparisons become possible between the established

and the new options. The alternative options provided by TA can be catalysts of opinion-forming and decision-making as soon as they will be taken up by societal actors, by stakeholders and citizens, by politicians and policy-makers in order to draw conclusions for transformative action. The case of the German blackout study (Petermann et al. 2011) serves a good illustration. The study showed in a merely analytical manner that the consequences of a prolonged and widespread power outage could amount to a particularly serious hazardous situation with the risk of a collapse of all of society (Petermann et al. 2011). This analysis was done by TAB in the role of the honest broker without advocating own issues. As soon as these analytical results were published, they immediately made a difference and led to a review and reformation of the civil protection system in Germany in order to become better prepared.

(3) Developing arguments as an intervention: TA not only develops alternative options but also investigates and examines these options with regard to possible, plausible, or probable consequences and implications in its assessment process (Grunwald 2019, Chap. 4.3). By doing this arguments, have to be critically reconstructed with respect to the technologies under consideration but also on already existing technologies in order to make comparisons possible. The assessment itself includes evaluative steps considering the implications and consequences facing normative criteria, e.g. of sustainable development or responsible innovation. As a result of the assessment – which has to observe particular criteria such as inclusiveness and fairness in accordance with TA's conceptual framework (Section 1 at the top of this paper) – arguments will be provided allowing for informed and well-reflected comparison of the options on the table. The third argument is, that these arguments, which have to be developed in accordance with the role concept of the *Honest Broker* can have transformative power. If the new options developed by TA would receive argumentative legitimacy in the assessment process and would be convincing to actors, stakeholders, and advisees, they can lead to a difference and create impact. This impact would then not be the consequence of lobbying actions of an Issue Advocate but be due to argumentative rationality and normative reflexivity, which have to be ensured in TA's assessment process. Developing options (see point 2 above) and carefully scrutinizing arguments pro and con, obviously, belong closely together. Providing society and advisees with options is more than only delivering options: in includes giving differentiated arguments which can unfold transformative power and make a difference.

The separation of TA as an advisor from its advisees making decisions allows combining taking the role of the honest broker in the assessment process and simultaneously exerting transformative power through its results. In particular, it gives substance to the postulate that assessments shall be policy-relevant without being policy-*prescriptive* (Edenhofer/Kowarsch 2015, 56). Alternative options put on the table together with carefully scrutinized arguments makes the results of the assessment process policy-relevant but does not prescribe the specific decisions to be made. This is the characteristic mode of operation of TA as an honest broker simultaneously enabling transformative power (Grunwald 2019a).

5. Concluding Remarks

In this paper, the issue of role concepts of technology assessment was addressed, focussing on the tension between the requirements that TA shall create impacts but simultaneously be neutral and distant. It was demonstrated how this tension can be resolved referring to a theory-based TA framework. It became clear that making a difference and creating impact on this track heavily depend on the quality of the particular TA assessment process, which has to be reflexive in anticipatory, inclusive, and relevance issues.

Coming back to TA's practice (Section 3) the next step of a deepened understanding of TA should consist of going through all the role concepts mentioned. They have to be reflected against the background of the *Honest Broker* model understood as presented above. E.g. the role concepts of TA as Cassandra, TA as tracker or TA as activist have to be considered and scrutinized with respect to their compatibility with the Honest Broker model as an umbrella concept. Such investigation should be accompanied and informed by an empirical consideration of specific TA exercises and institutions. In this way, good and best practices of determining adequate role concepts for TA practitioners in particular contexts could be established. These would support the further development of TA in practice but also in theory.

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Armin Gunvald

Koncepti uloge procene tehnologije između postulata neutralnosti i zahteva za stvaranje uticaja

Apstrakt

Procena tehnologije (TA) razvija se u poslednjih pedest godina sa osnovom u istraživanjima i polju predviđanja naučnih javnih politika. Ta pozicija na razmeđu između nauke i javnih politika je prouzrokovala nekoliko debata o njenim adekvatnim alatkama. Predlozi polaze od pozicije neutralnog i udaljenog posmatrača tekućeg razvitka do zauzimanja aktivne uloge u procesima transformacije potpomognutim tehnološkim napretcima, na primer, u korist održivog razvoja. U ovom radu, nekoliko koncepata uloge iz procene tehnologije će se diskutovati u okviru novog rama koncepta procene tehnologije. Pokazaću da PT često mora da zauzme ulogu *Honest Broker* u proceni tehnologije kao krovni koncept. Specifična pojavnost ove krovne uloge varira od konteksta do konteksta. Koncept *Honest Broker* služi kao orijentacija da se odredi specifičnija uloga u tenziji između takozvane neutralnosti i obaveze da se stvori uticaj.

Ključne reči: procena tehnologije, neutralnost, uticaj, *Honest Broker*, branilac slučaja, transformacija