Reframing Reflexivity in Scientific Inquiry

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ABSTRACT

The value of reflexivity has repeatedly been mobilised in claims for Social Sciences and Humanities (SSH) involvement in Science, Technology, Engineering and Mathematics (STEM) research. In short (if not in caricature), the policy narrative goes like this: Scientists, scientific practices, the governance of science and indeed modern society should become more reflective/reflexive. This can be achieved by involving SSH, which are inherently reflexive.

In this paper, I will follow this narrative from the "Ethical, Legal and Social Implications" (ELSI)/ "Ethical, Legal and Social Aspects of bio-, neuro-, and nanotechnology (ELSA) policies and practices of the 1990s and 2000s, to the concept of "Responsible Research and Innovation" (RRI) and the *"need to integrate"* SSH with STEM to address societal challenges in Horizon 2020. Drawing upon my experience as an SSH practitioner in ELSA, RRI and societal challenges-focused interdisciplinary collaborations, I shall propose two lessons learnt. One key lesson is the need to go beyond the simple policy narrative *"SSH makes science more reflexive"* and the many disappointments that it invariably produces. The other key lesson is the need to go beyond simple dichotomies between SSH research and scholarship on one hand and non-SSH research on the other in order to look for meaningful collaborations.

INTRODUCTION: THE REFLEXIVITY POLICY NARRATIVE

This paper discusses the role and value of the social sciences and the humanities (hereafter abbreviated as SSH) in research endeavours primarily driven by the natural "Science, Technology/Technoscience, Engineering and Mathematics" (hereafter abbreviated as STEM). To the concept of STEM we may also include the main part of medical science, which in its methods and orientation is quite similar to natural sciences. In the abstract of this paper, I claimed the existence of a policy narrative that can be summarised as follows: STEM scientists, scientific practices, the governance of science and indeed the modern, knowledge-based society should become more reflective/reflexive. This can be achieved by involving SSH, which is inherently reflexive.

The narrative is never expressed exactly as such, or with such bluntness, in the European Union R&I policy documents, which have to balance the argument for SSH with the appropriate tokens of respect for STEM. In a small country such as my own (Norway), however, one can find more direct expressions. The following quote states the mission of the (second) "ELSA funding programme" of the Research Council of Norway (2008-2014; ELSA = Ethical, Legal and Social Aspects of bio-, neuro- and nanotechnology):

"An important aim of ELSA is creating societally robust bio-, nano- and neurotechnologies. The programme will work to explore central challenges for governance, risk, regulation, culture, and values connected to these technologies. The programme should contribute to increase reflexivity and promote learning among ELSA researchers as well as scientists."

Likewise, a frequently stated goal for responsible innovation/responsible research and innovation (RRI), is that R&I processes become reflexive/reflective – such as in the "R" of the British "AREA" framework: "Anticipate, Reflect, Engage and Act"[i]. While there is no consensus at all on the overall goal and purpose of RRI in the EU – for some, the goal is reflexive practice and governance of science and technology; for others it is *"better alignment" between civil society and the R&I sector – it is interesting to reflect upon the origin of the RRI concept. Except for sporadic and quite unrelated mentions, the term was introduced by philosopher and European Commission (EC) Directorate-General (DG) Research and Innovation (RTD) policy officer René von Schomberg in 2011. Interestingly, he did so with explicit reference to the potential of technology to have negative ethical and social implications:*

"[…] we are confronted with the Collingridge dilemma, implying that ethical issues could be easily addressed early on during technology design and development whereas in this initial stage the development of the technology is difficult to predict. Once the social and ethical consequences become clearer, the development of technology is often far advanced and its trajectory is difficult to change."

In this regard the so-called Collingridge dilemma is taken to stand for the following: Technologies (created by research and innovation) have negative side-effects (such as risks and hazards), but by the time the side-effects are identified and understood, the technologies have become entrenched in society and infrastructure or otherwise difficult to remove. Neither existing modes of technology assessment, ethics procedures, risk assessment nor market mechanisms have been able to solve this problem. R&I practice and governance accordingly should become more anticipatory – better able to anticipate and avoid R&I trajectories that instantiate the dilemma.

This narrative, as well as the accompanying idea that SSH knowledge and practice can contribute in the strive for reflexivity, builds on extensive scholarship – some would say back to Vico (Rommetveit et al. 2013), others to Heidegger and the Frankfurter School, and yet others would make a more easily documented claim that it builds on latter decades' "Science and Technology Studies" (STS), history, philosophy and sociology of science and technology, and related strands of scholarship. Indeed, since the late 1960s, there have been various maxims of critical science, radical science, the science and society movement, technology assessment, post-normal science, socially robust knowledge and finally responsible research and innovation that had similar content (see Sardar and van Loon 2012 for an introduction to the history of this development). At times, the call was simply for an awakening of the political and ethical sensibilities of (natural) scientists – get out of the lab and engage in society! – while often this was not seen as enough: There was an implicit diagnosis of political ignorance and social, ethical and epistemological naivety within STEM research cultures that SSH involvement presumptively would correct. Indeed, this resembled a "deficit model", this time the scientists being the empty vessels that should be filled with knowledge from SSH in order to become reflexive. It also followed what would be the most relevant knowledge from SSH: Above all history, philosophy and sociology of science, STS, *Wissenschaftstheorie* (in the Germanic language area), ethics and philosophy of technology etc – that is, the various strands of scholarship that have science and technology as their object of study.

I write as if I have ironic distance to this narrative. I should immediately admit that I am among its many narrators. For instance, I was among those who strongly argued for the mandatory presence of ELSA in bio- and nanotechnology as the Norwegian government revised its research policies in the late 2000s; and the government agreed. The strive for reflexive science also underpinned my and others' efforts to give content to RRI in the EU context, although the efforts rarely bore the desired fruit (Rip 2016). And I have kept publishing claims to that inverted deficit model, even with a paper entitled "Naivety in the Molecular Life Sciences" (Strand 2000). The need to historicise these claims does not void them of truth value. We should note, however, the speculative nature of the claim for SSH as a means to make STEM practice and governance reflexive. To the extent that the policy narrative has been used to legitimise a space for SSH in funding programmes, it should be admitted that it was not, and could not be, evidence-based. Rather, to apply our own concepts, it was more of an imagined future of a desirable social, scientific and technological order in which the Collingridge dilemma would be solved. In this sense, that is, in the sense of Jasanoff and Kim (2009), our policy narrative of how SSH would be conducive to reflexive science constitutes a sociotechnical imaginary.

OPPORTUNITIES AND DISAPPOINTMENTS

The many published self-reflection essays from SSH scholars confirm the personal experience of my colleagues and I who have taken part in the various generations of ELSI/ELSA[ii] and RRI-labelled interdisciplinary collaborations over the latter two decades: While results have been achieved and lessons have been learnt, there are also quite frequent expressions of disappointment.

It is useful to distinguish between two phases of ELSI/ELSA research each with their phases of disappointment. The typical disappointment of first ELSI/ELSA involvements was the lack of impact, which was diagnosed as a lack of true interaction and true interdisciplinarity (Nydal et al. 2011), as well as the lack of critical mass and proper organisation (Kaye et al. 2012). The sociologists, ethicists and philosophers were funded to do ELSI/ELSA research within a larger STEM (typically biotechnology) project but they had too much distance. For instance, at the Research Council of Norway, this diagnosis was explicitly endorsed, and from the mid-2000s ELSA funding was directed towards "integrated ELSA" and "integrated projects" with real and intense interaction between SSH scholars and STEM researchers. Similar developments took place elsewhere, drawing on longer traditions of scholarship of constructive technology assessment (Schot and Rip 1997) and innovative combinations of ethics and ethnographic work (e.g. "Socio-Technical Integration Research", see Fisher and Schuurbiers 2013).

Again, disappointments are well documented, ironically by the socalled post-ELSI manifesto by Balmer et al. (in a British context), later to be elaborated as lessons learnt (Balmer et al. 2016). Also in my own country, self-reflection and self-analysis by these integrated ELSA researchers has had a relatively pessimistic tone (Forsberg 2014, Nydal et al. 2016). Taking one step back from the more immediate concerns raised in these papers, the disappointment appeared to be related to the adjusted role as "integrated" ELSA/SSH scholars on their way into the STEM laboratories. In integrated ELSA, distance was reduced sufficiently for, as it were, CP Snow's famous "Two Cultures" (1959) to clash, that is, between the natural sciences on one hand and the social sciences and the humanities on the other. SSH scholars experienced that they were not taken seriously qua researchers, were perhaps not even welcome, were neither advancing their own careers nor having an impact on society, or generally uncomfortable with finding their role in co-producing the science and technology that they by virtue of their own expertise could not really vouch for in terms of its ethical and social desirability. The scientists, on their side, had problems coming to terms with what exactly they had let into the lab – a sort of spies? Saboteurs? Or just an irrelevant expense, forced onto them by the grant conditions? A number of lessons were drawn, most of them quite commonsensical, such as being reflexive and open to dialogue about our own facts and values; seek out the meaningful collaborative relationships with scientists rather than forcing ELSA down their throats; etc.

In Europe in 2011-2012, ELSA gradually ceded to the new EU policy concept of RRI (Owen et al. 2012). The European Commission (EC) concept was interpreted differently across

Europe, and notably also within the European Commission, with the orthodox DG RTD bureaucracy insisting on the five or six "keys" (ethics, gender equality, public engagement, open access, science education (sic!) and sometimes "governance") at the same time as the original von Schomberg definition was implicitly endorsed by most SSH scholars who acted for and interacted with the European Commission. In the UK, the alternative "AREA" framework for Responsible Innovation proved influential well beyond the British Isles. RRI functioned as an umbrella not only for ELSA but also a number of other communities of practice and scholarship, notably those of technology assessment and public engagement. Still, RRI actions and projects recruited quite a few of the same SSH scholars who surfed the ELSA waves. For some of us, RRI gave new promise and new enthusiasm, perhaps primarily because RRI was seen less as an inherent negative response to STEM (in spite of its origin in the governance of the Collingridge dilemma) and also as an opportunity to "promote the good" by steering science and technology towards the common good and a better society. Again, the presumption was that such steering is not only possible but also that SSH scholars hold the expertise that enables us to engage in this steering and identify its goals, this time in active dialogue with civil society. Again, there were lessons and disappointments, often related to RRI practices appearing less than meaningful both to SSH scholars and STEM researchers. To quote a biotech PhD student in one of our RRI courses: *"I am still waiting for the moment when you say that we have to engage the citizens in our laboratory research and we tell you that it won't work."* Indeed, in my own subjective experience, I have witnessed how debates among RRI scholars/practitioners in 201618 appeared quite similar to the ELSA debates 5-10 years ago, even with and without overlap in the actual people taking part. For instance, at the 2018 international conference of S.Net (the Society for the Study of New and Emerging Technologies) in Maastricht, the difficult convergence worker role of SSH scholars hired to "do RRI" in STEM projects was discussed in several of the sessions.

Let us recall for a moment the policy narrative that I claimed to underlie ELSA, RRI and other attempts at integrating SSH into STEM:

STEM scientists, scientific practices, the governance of science and indeed the modern, knowledge-based society should become more reflective/reflexive. This can be achieved by involving SSH, which are inherently reflexive.

Above I have described some experiences of disappointment as ELSI/ELSA and RRI efforts often seemed to have little impact and sometimes were perceived as downright meaningless. Since reflexivity is what we as SSH scholars by assumption are supposed to purport, it seems timely to ask reflexive questions about the disappointment. How may we understand our own role as participants in the strive for reflexive science?

The policy narrative of reflexive science can be seen as a sociotechnical imaginary, that is, a collective vision of good and attainable future science, technology and society. It will be useful to pursue that analytical lens somewhat further in the case of RRI. "Science" means two things in this regard. At the distal pole of the imaginary, it is a vision of coproduced good (i.e., reflexive) STEM science, good (i.e., ethically, socially and environmentally desirable) STEM-based technology and a good society that can benefit from this ethically and socially good STEM science and technology. The programme of action corresponding to this vision, is simply the successful deployment of SSH-informed and SSH-driven RRI practices. However, these RRI practices are also themselves imagined; they are in no way present as off-the-shelf technologies. So at the proximal pole of the imaginary we have the vision of co-produced "science" as SSH-based knowledge on RRI, "technology" as the RRI practices, tools and methods to be applied onto STEM research, and "society" as the research and innovation sector that no longer will give rise to Collingridge dilemmas or otherwise create problems in the world. Programmes of action corresponding to this version of the imaginary include RRI frameworks and funding schemes, such as the Horizon 2020 SwafS (Sciencewith-and-for-Science) programme.

All imaginaries are speculative; this is what makes them imaginaries rather than plans or cost-benefit analyses. Change is generated by imagining the non-existent and agreeing on a programme of action that may bring it into existence. This implies, however, that there can be no guarantee of success. Anything can go wrong in the attempts to realise a sociotechnical imaginary, and the failure may have any type of cause: material, social, epistemic, political.

As for the proximal pole of the imaginary, one assumption stands out in its boldness: The belief that STEM practices will produce substantively "better" technologies (in the sense of their ethical, environmental and social desirability) if these practices become reflexive and so can account for their own value-ladenness and their own context of implication. This assumption seems to be shared in all strives for reflexivity, going back to Marxist and feminist critiques, through radical science, post-normal science and the concept of socially robust technology, all the way to the RRI of the 2010s. The exact mechanism of how this is supposed to happen, varies from quite elitist beliefs in the normative expertise of SSH, ethics, "Technology Assessment" experts and the like, to beliefs in the power of deliberation and democratisation. The latter would entail recommendations of bringing in a range of stakeholders, citizens and social actors in upstream engagement exercises to cancel the tunnel vision of STEM practitioners and/or "align" research agendas with society, that is, steer research funding towards STEM that addresses social needs and concerns.

We do not know if this assumption of the effectiveness of reflexivity holds. It is of course always possible to cherry-pick examples that seem to confirm the assumption; hence the industry of projects that document "best practices" of RRI[iii]. In my experience, many STEM researchers can sympathise with the goals of RRI but they also find the working assumption quite naïve. I quoted above the PhD student who said: "I am still waiting for the moment when you say that we have to engage the citizens in our laboratory research and we tell you that it won't work." Indeed, he expressed the expectation that we were making naïve assumptions about the impact of upstream engagement.

The experience of disappointment with RRI as expressed by SSH scholars engaged in RRI projects and efforts has been connected to more than this problematic (but central)

assumption, however. Perhaps above all there has been frustration with practical and organisational issues related to the programmes of action. The RRI frameworks and the SwafS programme have been seen as too superficial and not really embodying the insights of relevant SSH scholarship (see e.g. Rip 2016); research policy-makers don't really understand RRI; even when STEM researchers engage, they might not engage with the level of commitment required; and when research funding organisations require RRI from STEM projects, they may be satisfied with mere tokens and window-dressing, not unlike "Corporate Social Responsibility" at its worst. The pure ideas about reflexive science originating from STS and all the other relevant SSH fields become co-opted, contaminated and perverted.

I suggest that this type of disappointment can be overcome by applying our own scholarship onto our own situation; by an exercise of reflexivity, as it were. Indeed, if our vision was to achieve impact on a large scale, co-producing goodness in STEM and the whole world by first coproducing our own RRI knowledge and technology, then this was a vision of massive upscaling. We know, however, from STS and the history, philosophy and sociology of science and technology, that upscaling processes are open-ended and that they introduce surprise. Above all, other actors who are not trained in SSH have to become enrolled into the programme of action, and they cannot help but make their own sense of these policies and practices. Inside the bureaucracy of the European Commission, for instance, the successful deployment of any policy concept both necessitates and hinges upon the development of numerical indicators and a monitoring system. Otherwise it cannot survive within the institutional logic.

The open-endedness and complexity of such processes also imply that one should not trust one's own assessment and evaluation of the process while it is unfolding. It is a paradox that while we as SSH teachers will instruct our students about the virtues of critical distance to the object of study, ELSA and RRI scholars are to the highest degree both participants and observers at the same time; indeed, we seem to be our own chroniclers. This criticism hits the present author as much as anybody else and it also hits several authors in the reference list of this paper. It is a striking feature of SSH scholars who work with STEM that we write quite a lot about ourselves.

None of these analyses proves that RRI or other strives for reflexive sciences are futile or meaningless. The analysis indicates the trivial conclusion that there can be no recipe for success but also the slightly less trivial insight that success may be different from what was imagined and might be identified in hindsight and perhaps by others than the SSH scholars who were involved in the first place. We are reminded of Hegel: *"The owl of Minerva spreads its wings only with the falling of the dusk."* (Hegel 1972, p. 14)

At the same time, SSH scholars are knowledge workers, and even when consciously involved and engaged in the co-production of society, we are involved with knowledge production. I will end this section by a personal example, taken from my work for the Centre for Digital Life Norway, a national, "virtual" (meaning geographically delocalised) centre for systems biology and biotechnology. The centre and its research projects are funded by the Research Council of Norway, and RRI is a mandatory requirement in all research projects and in the activities of the centre hub[iv]. I participate as one of the RRI coordinators of this hub. In this capacity I see myself and my colleagues as knowledge workers in three respects. First, we teach and disseminate SSH knowledge to STEM scientists, in particular PhD students and postdoc researchers, but also to some extent the "Principal Investigators" who are ultimately responsible for their own implementation of RRI into their respective research projects. Secondly, we make some effort to attend to the core of the assumption of the RRI imaginary, namely to understand the possible relationship between the many methodological choices in the STEM research and its context of implication. In this effort it has made little sense so far to "bring citizens into the lab". Rather, we work to understand the downstream implications of choosing, say, one type of computational or biological model over another. This is a challenge not so much of participatory technology assessment as of *Wissenschaftstheorie*, of being able to penetrate deep into the epistemological questions of STEM science, actually deeper than what is normally required for STEM daily practice, to identify sites of *de facto* politics in the lab. This kind of work depends on combined STEM and SSH knowledge to the extent that it has proven difficult to do without "double competence", that is, persons who are trained in both STEM and SSH.

Finally, we do our own SSH-based research, organised in the recently started Res Publica project, which is led by Dr Heidrun Åm.[v] The Res Publica project will among other issues focus on how the bioeconomy is imagined and attempted to become realised by biotechnology. In other words, the project will not restrict itself to the potential *de facto* politics of minute methodological decisions in the laboratory but also keep an open eye for the *de facto* politics of politics itself, in the conventional sense of public decision-making and political institutions. Again, one could imagine a future ex-post assessment of the RRI endeavours of the 2010s to conclude that they had an STS bias and focused too much on the implicit micro-politics at the expense of attention to political economy. Perhaps future historians would identify this bias as part of a larger SSH trend at the beginning of the 21st century and relate it to increasing differentiation and fragmentation of SSH. Even worse, they might relate the fragmentation of SSH research to how important issues are lost out of sight. They may even connect this to how SSH students and scholars maintained an intersectionalist focus on micro-aggressions in university life in European and North-American countries, while the public sphere in the same countries saw the rise of populism and open threats to democracy. There might be a need for a wake-up call to engage with the big issues and ask what is important.

LESSON 2: GOING FOR WORTHWHILE COLLABORATIONS BEYOND THE INVERTED DEFICIT MODEL

The big issues do not respect disciplinary borders or even the distinction between nature and culture. For SSH to gain impact, it seems that SSH scholars have to learn about issues outside of

their usual scope, which is an excellent motivation for research. This has been a key point from actor-network theory for decades: The development of science and technology (and accordingly its governance) depends on many nonhuman actors: the genetically modified organisms, the nanoparticles, the CRISPR-Cas systems, the plastic in the Pacific Ocean – such things that STEM researchers know much better than us. Here there is a research challenge, not just a challenge to educate STEM researchers and policy-makers with our perfect SSH understanding, and it is a research challenge that is profoundly Mode 2 in the sense that it demands contributions from radically different types of disciplines but also that they leave their comfort zones. I will end this paper with another personal example, not from an RRI project but from the "Horizon 2020 Societal Challenge" project called MAGIC (making GRADE the irresistible choice)[vi]. In MAGIC, we study the science-policy interface for the governance of the water-energy-food nexus with a combination of ecological economics, energetics, biosemiotics, sociology and STS, because this is called for to understand the interactions between the human, social and natural agencies involved, including our own role as change agents. Whereas it is possible to classify the researchers in the project as "mainly STEM" and "mainly SSH", the practice is more usefully described in Germanic languages that have less dualistic concepts for the "Two Cultures": We are all *Wissenschaftler*. There may be occasions when researchers from one culture, say SSH, have to fill in knowledge gaps left open by STEM and vice versa. However, the interaction goes beyond seeing the others as empty vessels whose knowledge deficit has to be corrected. I interpret the richness of interaction in part as a result of the scope and complexity of the research topic, namely the water-energy-food nexus. In order to understand the biophysical system of, say, a river and the surrounding agriculture, one needs to understand the human, social, cultural and political dimensions of this system. Conversely, in order to understand and interpret the intricacies of policy-making in the field of water governance, one also needs to understand what is at stake in the policy debates, in biophysical terms. What we learn in the MAGIC project, is that SSH methods and theories are not void of implicit assumptions about the nature that humans try to govern, and that STEM methods and theories also hold implicit assumptions about governance and society. Part of the

research challenge is to discover these implicit layers, explicate them and challenge them. This is quite different from filling deficits.

There is nothing unique in this particular example; there are whole journals that identify features and approaches conducive to meaningful inter- and transdisciplinary work between SSH and STEM. When I invoke the example of MAGIC, it is to make a specific point by contrasting it with features of ELSA and RRI interactions that have created disappointment. I have launched above the idea of going for "big" and "worthwhile" issues; however, with further comment this idea is nothing more than two fine words. Above it was noted how STS may have introduced a bias towards the *de facto* micro-politics of the STEM laboratory. In some instances this "bias" may be terribly important and exactly what one should focus on; and it was a great achievement of STS to discover the micro-politics through thorough empirical research from the 1970s and onwards. Still, one potential disappointment of the ELSA or RRI convergence worker is created from the realisation that the actual micro-politics of a particular STEM research project may be quite unimportant or uninteresting, or that it may be important but that there is no willingness, neither in the practice or the governance of the science, to change anything. This is partly why the Res Publica project also will return to the "politics of politics proper", to find other and promising sites for the co-production of the good future. If a STEM project has the express and unshakeable goal of producing a cybernetic soldier or a genetically modified salmon, there may be little use in spending years in the lab to do RRI as a kind of activist ethnographic action researcher. The contrast with the MAGIC project is striking. Although its main part is quantitative biophysical science, its goal is to rethink and help change the science-policy interface in the governance of the nexus. It addresses a "big" issue not by trying to device a technical solution but by creating knowledge that may induce institutional change.

The openness of the MAGIC project to theoretical and institutional change fits SSH really well and in particular the H for Humanities. SSH rarely sits well in collaborations in which it is relegated to a technical role, defined by STEM; this is seen well in the disappointments described above. Indeed, before the split of the "Two Cultures", the laboratory had to be invented for natural philosophy to become able to solve technical problems. In the example of the MAGIC project, we accordingly see a marker of a worthwhile collaboration: The willingness of all participants to go beyond the technical challenges and engage with theoretical as well as practical-political challenges. However, this marker – indeed a marker of reflexive science already present – is sufficient but not necessary. One could still strive for reflexive science, not necessarily to solve the Collingridge dilemma but to arrive to the point at which the SSH-STEM collaboration becomes meaningful because a shared interest in theoretical and practical-political challenges has been cultivated. Perhaps what has been learned through the successes and failures of ELSA and RRI endeavours is that SSH cannot provide a technical fix to the lack of reflexivity. Rather, it brings a repertoire and knowledge reservoir that may or may not be relevant in the context at hand. Mechanical and mindless deployment of that repertoire may end in disappointment because it tries do what especially the humanities are not at all equipped to do, namely reduce the other human subject (the STEM researcher) to an object. For worthwhile collaborations towards reflexive science to develop, it seems a better strategy to cultivate common intellectual curiosity and engagement towards the big issues across the STEM-SSH divide. Part of that strategy will be to identify contexts in which such commonalities are likely to be possible. This insight reflects back on the policy narrative of reflexive science, however: It might mean that RRI or other SSH interactions with STEM will never come off-the-shelf (Delgado and Åm 2018).

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