2. Scientific literacy in a digital world

ROAR STOKKEN
Volda University College

TOM BØRSEN
Aalborg University

ABSTRACT Social media have increased the need for a critical approach to the information at hand. Since scientific literacy is important when fake is to be separated from fact, it is our responsibility as researchers to assist in fostering this ability among the citizens. Due to the schism between the scientific world and the lifeworld of the citizens, this is a daunting task. Through the concept of responsible research and innovation, and in particular the governance-pillar, an approach that benefits both the public at large and science can be established.

SAMANDRAG Sosiale medier har auka behovet for ei kritisk tilnærming til informasjonen vi får. Sidan vitskapleg forståing er viktig når ein skal skilje sant og usant, bør vi som forskarar bidra til bygging av vitskapleg forståing i befolkninga. Grunna skiljet mellom den vitskaplege verda og livsverda til innbyggjarane, er dette ei utfordrande oppgåve. Gjennom konseptet ansvarleg forsking og innovasjon, og særlig governance-pillaren, kan ein utvikle ei tilnærming som både tener innbyggjarane og vitskapen.

KEYWORDS digitalization | EuroScitizen | governance | RRI – responsible research and innovation

Our internet-connected devices can bring information from the whole world into the palms of our hands in an instant. The very same gadgets can also spread our, and thereby anyone else’s, thoughts to the world with similar ease. This has made social media important in mobilizing grassroots movements like the anti-government movement “Arab spring”, especially due to the lack of government-loyal editors stopping information considered to be unfavourable to the government. On
the other hand, the same mechanisms that are important to grassroots movements can also be used as a means of spreading fake information.

In November 2017, “The Shed of Dulwich” became the top-ranked restaurant in London on Trip Advisor (Butler, 2017). It did not take long before companies started sending the owner Oobah Butler free samples, the city council suggested relocation to a new site under development, and a production company suggested a short documentary film in an airline’s inflight videos. The only catch was that not one single meal had ever been served at the restaurant, nor had there been a single customer. It was all completely fake. Even the food in the pictures was fake; made mainly from non-edible stuff like shaving foam, paint and sponges.

A fake restaurant in London does little harm to either individuals or society, but its very occurrence demonstrates the potential of social media manipulation. It clearly shows how vulnerable algorithms, automation, and Big Data are to man’s creative approaches. At work in other areas, social media manipulation can even pose a threat to democratic society as we know it. The key to avoiding such a situation is that citizens possess the necessary skills to distinguish between fake and fact. As researchers, we should care about this. In addition, fostering scientific knowledge and scientific literacy among the population might not only contribute to a better society but also offers the possibility to foster better science.

FAKE INFORMATION AND DEMOCRACY

There is no doubt that our Internet-connected devices provide our society with a knowledge development capacity far beyond any earlier society in the history of man. Still, the limited trust we ought to have in the information in the palm of our hands makes it important that citizens are able to interpret, understand and judge the information critically. If fake is understood as fact, and becomes integrated in the knowledge base we use to appraise information, we might in the end see a society where fake facts gain the upper hand. We already see traces of this, when traditional media to some extent build their news coverage on profiles designed to influence public opinion.

In essence, ‘democracy’ expresses the idea of a society where those affected by decisions, hold the power to decide who will be making these decisions. By manipulating the information received by the citizens, the supreme power vested in the people that exercise it by means of elections, can be threatened. Bradshaw and Howard (2019) have found evidence of organised social media manipulation campaigns in 70 countries in 2019, up from 48 countries in 2018 and 28 in 2017. Globally, there is, as such, a growing interest in manipulating
the information the citizens get in their hands and thereby influencing the functioning of democracies.

*An Agenda for Europe* (European Commission, 2014) highlights the lack of digital literacy and skills in Europe, and claims that society is suffering from a growing digital literacy deficit. The skills needed include the ability to assess relevance and distinguish the real from the virtual and to become aware of issues concerning validity and reliability. Such skills are important, since a democratic society relies upon the wise and knowledgeable citizen voting wise and knowledgeable politicians into positions where they can use their power to develop and maintain a society that is, in the words of Abraham Lincoln, ‘of the people, by the people, and for the people’.

As part of a publicly funded and knowledgeable sector destined to educate and create new knowledge, academics and academic institutions are in essence obliged to help people to live “good” lives in a sound society. On the basis of the challenges posed by the digital world, as academics we are virtually destined to help citizens adopt a critical approach to the information at their fingertips. The question is how we can increase the citizens’ – and thereby society’s – ability to discriminate between fake and fact in the digital world. Before we look into this, we ought to take a closer look at the nature of the digital world.

**THE DIGITAL WORLD**

More than anything, what characterises humans as a species is our ability to develop and use tools to make our existence easier. In line with the wheel and the printing press, Internet has become an integral part of our daily lives in many ways. Parents stalk their kids by means of GPS and social media, employers demand electronic job applications and we consult Trip Advisor when we want to dine in unknown territory. The use of these digital tools can be understood as a means to an end, but that is too simple an approach. Computers are not merely mediators of our actions. They are also actors in the social networks we are engaged in, and thereby they shape our thoughts.

A simple, but pertinent example of the way computers influence our thoughts is the “Facebook feed”, calculated on the basis of our own and our friends’ online activities. Inspired by Foucault, Bucher (Bucher, 2018) argues that algorithms are technologies of government by virtue of the way they shape our knowledge of society. We have thereby delegated (Latour, 1992) the formation of the information feed to the technology instead of to the editor of the newspaper. Since we now receive the same information as those like us, rather than something that an editor
finds important. On the other hand, it also poses challenges, since the formation is done by an algorithm and not by human beings.

When we delegate to a human editor, he or she uses knowledge, mind and wisdom to decide what we receive. When we delegate the same task to a computer, it implies that someone has inscribed (Akrich, 1992) rules, on the basis of a scenario, into the system in terms of a computer code. This code regulates our feed of information, and thereby enjoys a role that determines the way the system works.

When the persons behind Trip Advisor wrote the code that decides which restaurant becomes top ranked, they probably did not imagine that someone would register a fake restaurant for the sole purpose of tricking the algorithm. The inscription was based upon a scenario, which became translated (Callon, 1986) into code; which did not include Oobah Butler and his wish to create a fake restaurant. This highlights the challenges related to the code; human creativity can find ways to manipulate it. Thus, whoever has the skills to manipulate the factors that influence the computer’s decision-making, also possesses the power to manipulate the information we receive at our fingertips. One simple example of such manipulation is that if a human knows that an autonomous car will not hit a human being, they can stop all traffic simply by standing in the middle of the road.

In the digital world, where much, and important, information stems from our electronic devices, both the one controlling the code and the one with the capacity to manipulate the information the code works upon, thereby control the information brought to the palms of our hands. The consequence is that these actors possess the power to shape our knowledge, whether it is about restaurants, politicians or the functioning of the world. The way we relate to the information in the digital arena must thus be somewhat different than in other arenas. This calls for critical thinking and a different type of literacy than in earlier times.

LITERACY

Traditionally, literacy has been defined as the ability to read and write. There is now a general consensus that the concept not only reflects the technicalities of reading and writing, but also the capacity to understand the content on the basis of the social and cultural references (Beach, Green, Kamil, & Shanahan, 2005).

When the ‘Digital agenda’ (European Commission, 2014) states that “individuals should be able to use Information Society Technologies (IST) to support critical thinking, creativity, and innovation”, it means that the citizens also must have a critical and reflective attitude towards available information. To be able to take on this task, which the emergence of social media has made more daunting than
ever before, the ability to judge whether the information at hand is plausible, whether it is fake or fact, is absolutely crucial. To a great extent, this capability relies upon scientific literacy.

As a term, scientific literacy reflects the knowledge and understanding of concepts and processes that are required in order to draw conclusions and make decisions in accordance with what science considers as “right”. It thereby encompasses both scientific ways of knowing and the process of thinking critically about the world (Maienschein, 1998).

According to the OECD PISA Framework (OECD, 2017), scientific literacy is the foundation for the ability to engage with science-related issues, and with the ideas of science, as a reflective citizen. This means that a scientifically literate person can ask, find, or determine answers to questions about everyday experiences, has the ability to describe, explain, and predict natural phenomena, the capacity to pose and evaluate arguments based on evidence and to draw appropriate conclusions (National Academy of Sciences, 1996).

Scientific literacy thereby reflects both the ability and the willingness to use scientific knowledge and methodology to reach conclusions (European Commission, 2014). This spans the whole register from the basic principles of the natural world, via fundamental scientific concepts to the impact of science. It should, as such, aid understanding of advances, limitations and risks of science for both individuals and society at large. In essence, scientific literacy is therefore the foundation for judging how well a statement is aligned with what is considered as a “truth” within the science in question. It is thereby the key to distinguishing fake from fact.

When it comes to how knowledge is created, assessed and judged, there are big differences between e.g. the morphology of spiders and the philosophy of religion. Nevertheless, they have some important features in common, related to both critical thinking and respect for the way we develop knowledge in our contemporary society. Thus, by fostering scientific literacy, we can contribute to citizens’ ability to make sound decisions.

Several initiatives aiming to foster scientific literacy are currently in progress in Europe. One example of such a pan-European initiative is EuroScitizen, an EU-funded COST Action which aims to raise levels of scientific literacy in Europe. To discuss how scientific literacy can be fostered, we will use this COST-action as an example.

In the action’s ‘memorandum of understanding’ (MoU), scientific literacy is considered to be ‘vital for responsible citizenship’ due to its being ‘a prerequisite for generating a knowledge-based society and for allowing citizens to make informed decisions.’ (EuroScitizen, 2018). Since scientific literacy is founded upon
knowledge, we therefore must take a closer look at the concept of knowledge before we look at how scientific literacy can be fostered.

**KNOWLEDGE AND THE WORLD**

Traditionally, knowledge and learning have been understood as behavioural and/or cognitive processes. This way of thinking is based upon an understanding that change in the cognitive process will ensure the desired outcome. During recent decades this view has been broadened. Illeris (2004) claims that a coherent overall theory of learning involves changes in three dimensions: (1) cognitive change, in terms of understanding or skills, (2) emotional change, in terms of emotions and motivation and (3) social change, in terms of social practice.

Illeris’ approach indicates two important issues relating to our matter: 1) cognitive, emotional and social change is in a dialectic relationship, and 2) some knowledge is stored in the head and some is stored in social practices. The first issue denotes that we gain cognitive and emotional changes from the social practices we engage in, and the second that knowledge is only relevant if it affects the social practices we are involved in.

In the case of EuroScitizen, where scientific literacy is seen as a prerequisite for citizens to make informed decisions, the learning of scientific literacy ought to encompass cognition, emotions/motivation and social practice. Furthermore, since the scientific community should take an active role in developing scientific literacy among the citizens, it is important to be aware of the difference between the social practices the experts are involved in, and those the public are involved in. To illustrate the diversity, we use the works of the philosopher and sociologist Jürgen Habermas (1984).

The experts’ domain is ruled by scientific knowledge and practices where we carry out a task to achieve something; e.g. follow a protocol to ensure quality or publish a paper to demonstrate knowledge-building. According to Habermas, this means that the domain is ruled by strategic actions that serve the interests of institutions and organizations. The ruling logic is as such to optimize the outcome through rational actions according to a means-end rationality. This is what Habermas labels as systems: The professional and administrative sphere in which we work and interact with institutional authority.

On the contrary, our daily lives are in what Habermas labels the ‘lifeworld’. He explains that the lifeworld carries the shared common understandings that develop through human interaction over time in social groups. These are not ruled by means-end rationality, but by communicative action in which commitment and
influence hold the upper hand. Thus, while it is the best argument that wins supremacy in science, it is what is in accordance with our lifeworld that rules the day among the public. Since we as researchers are destined to bridge the gap between citizens and scientists, it is pertinent to look into this difference and how it affects the question of what is fake and what is fact when we appraise the feed of information in the palms of our hands.

FAKE AND/OR FACT?

Elements of the lifeworld can be communicated and scrutinized and thereby become a part of the systems (Scambler, 2001). This is the very meaning of science. EuroScitizen not only appeals for such a process; it also calls for knowledge from the system to be relevant to the lifeworld of the citizens since the very result of the increased literacy should be citizens able to make informed decisions on important societal issues (EuroScitizen, 2018). This can be demanding, since a system is always parasitic on the lifeworld, due to its being dependent upon supporting the lifeworld to achieve legitimacy. A system acquires its legitimacy from blending into the lifeworld, and if it does not, we see that it does not support the background and horizon of our lives. This is what happens when ‘facts’ in science are understood as ‘fake’ by the general public. Thus, we also must examine the roots of this schism before we move on.

While the majority of us are convinced that the earth is a sphere, there also is a group of citizens that seems convinced that the earth is flat. This group argues for and explains their view in both mainstream media and more narrow channels on the Internet. Due to the code embedded in the social media platforms, these statements therefore turn up in our feed of information, more or less, on equal terms with statements from acknowledged scientists. An important reason is that the information feed is tailored to our interests, on the basis of the actions of those similar to us on the Internet. This means that flat-earth-approaches can be even more visible than scientific facts. Thanks to scientific literacy, it is, however, quite easy to establish which of these groups that is right about their assumption and thus hold a “true” view about the earth. But there is more to this issue than a skewed feed.

As we see, despite the “flat or spherical earth question” being simple to answer within the framework of science, the conclusions are not given among those who do not adhere to the way of thinking prescribed by science. On the other hand, as long you are not flying an airliner between continents, calculating the trajectory of long-distance missiles, or engaging in satellite positioning, it might not be of
importance at all. To the vast majority of us, whether we are welding ship hulls, caring for patients, analysing the interaction among politicians in the UN or playing hide and seek with the kids, the shape of the earth simply does not matter. The shape of the earth is thereby not relevant in the lifeworld. The first obstacle to overcome when fostering scientific literacy is therefore to demonstrate how and why a scientific approach to knowledge really matters.

In other cases, the question of whether something is ‘fake’ or ‘fact’ is more complicated. The statement “Trump is the best American president, ever!” might be both fake and fact, dependent upon how ‘best’ is defined. The key to this answer depends therefore on how the presidency is measured, judged and appraised. Thus, the answer is not to be found in Trump himself or his actions, but in the parameters that define his success. By assessing and communicating the parameters behind the appraisal of whether Trump is the best American president ever, it is possible for the reader to judge whether the statement is fact or fake. On the other hand, if what matters in a scientific context is something other than that which matters in the lifeworld of the citizens, scientific knowledge is of no consequence. The second obstacle to overcome when fostering scientific literacy is therefore to align the scientific approach to that which matters to the citizens.

The discussion of, and distinction between, fake and fact, is thriving and important, but in some cases, something can be both fake and fact at the same time, dependent upon the eyes of the beholder. In addition to the cases above, there are therefore situations where what to consider as ‘fake’ or ‘fact’ is not necessarily a matter of either/or. Both can actually be true, dependent upon perspective, or ‘paradigm’, as we label it within science. A striking example is placebo. ‘The gold standard of medical research’ is the placebo-controlled study. This means that all good medical studies in principle also create evidence of the existence of the placebo-effect. Thus, there is probably no single phenomenon for which there is stronger evidence within medicine than placebo, even though there is research that contests the effect.

Despite the evidence in support of placebo, in research, placebo is almost always considered as a ‘fake’ effect of a pill. On the other hand, for the patient the benefit of a placebo drug is ‘fact’. The effect can often even be measured in terms of physiological parameters. This duality is not a problem within a medical trial, since it is the scientific paradigm that defines how to perceive placebo. Nor is it a problem for that patient, since (s)he experiences an effect. The third obstacle to overcome when fostering scientific literacy is therefore to create knowledge that does not exclude what is important to the citizens, simply because it is outside the bounds of what the scientific approach calls for.
As we see, what we consider as being ‘fake’ or ‘fact’, is a question of whether it matters and which paradigm is underpinning a given situation. This does not only apply to research, but also to us as knowledgeable and learning beings. When a ‘flat earther’ sees a picture of the earth as a sphere, it is an anomaly that does not fit the paradigm at work. This makes pictures of the earth as a globe just as irrelevant to the ‘flat earther’ as the placebo-effect is to the researcher testing the effect of a drug.

This makes it more complicated to aid the general public in evaluating and meeting the information they continually receive in the palms of their hands with a healthy scepticism than when interacting with scientists. As our discussion above has indicated, it is clear that in the case of the public at large, this certainly cannot be done within a framework built solely upon the scientific paradigm held by the experts.

By demonstrating how and why scientific knowledge matters, aligning the scientific approach to what is important to the citizens, and creating knowledge with a starting point in what matters for the citizens, is as such the key to providing relevant knowledge for the citizens and thereby paving the way for the development of scientific literacy. However, we ought to have a strategy for such alignment in science and science communication.

**RECIPROCITY**

In the 1980s, the ‘deficit model of science communication and public understanding of science’ was the most common approach to meet the challenges brought about by the general public holding truths contrary to those held by the scientific community (Collins & Evans, 2002). This approach is characterized by a belief whereby public uncertainty and scepticism towards modern science is caused primarily by a lack of knowledge, and that disseminating experts’ knowledge can alleviate this problem. In this model of thinking, the reason for citizens not drawing the “right” conclusions and holding “wrong” beliefs can be rectified by transferring knowledge from experts to the public. In this, so-called, first wave of science studies, the experts are enjoying authority and the public should be educated. However, as we see above, the picture is clearly more complicated than this.

Having experienced the very limited impact that initiatives building upon the ‘deficit model’ have on public understanding of science, we are now in the so-called third wave of science studies (Collins & Evans, 2002), where both the recognized experts and the public at large are considered to possess expertise of importance to the case in question. Along with this third wave, The European
Commission’s funding frameworks Horizon 2020 and COST, as well as several funding schemes administered by national research councils, all require research projects to implement tools for Responsible Research and Innovation (RRI).

RRI is often described by six pillars derived from the policy agendas underpinning it: ethics, gender equality, governance, open access, public engagement and science education. It is as such about involving citizens in science and innovation in an upstream fashion to ensure that outcomes are aligned with the values of society (RRI-tools.eu, 2020). The reason is that even though research and innovation have improved our lives in almost every area that exists, the transformative forces of technology also create new risks and dilemmas. By involving the public in the processes, the idea is that one can reduce the negative “side-effects” of research and innovation.

In a review of RRI-literature, Burget, Bardone and Pedaste (2017) claim that four dimensions are vital to RRI: 1) ‘anticipation’, which is often linked to governance, 2) ‘inclusion’, which encompasses both those involved and the public, 3) ‘responsiveness’, which is often connected to ethics, risks, transparency and accessibility and 4) ‘reflexivity’, where awareness of the limitations of the knowledge at work in a project is at the core. To be able to bring these factors into play, a reciprocal relationship between experts and citizens is needed. This demand for reciprocal relationships is also in line with the current trend in European policy: New Public Governance (NPG), which describes the ideal process as one in which experts and the public use their diverse knowledge to co-produce policy, services and new knowledge (Amdam, 2019; Osborne, 2006; Torfing, 2016). By aligning science and science communication with policy, we can support democratic processes and thereby reduce the threat to democracy induced by the digital world.

Prevailing trends call as such for an enhanced focus upon the social responsibility of research, concerning several areas, from sensitivity to research biases to adapting research to changing social values and expectations. RRI also requires making research results accessible to the general public, involving a greater number of stakeholders, engaging the general public in research projects and creating a science-literate and knowledge-based society.

Our example, the EuroScitizen (EuroScitizen, 2018), aims to increase the level of scientific literacy in Europe. In the MoU, it is explicitly stated that the action will be ‘promoting a culture of RRI amongst researchers, by enabling them to collaborate with other stakeholders involved in the Action and ensuring the successful dissemination to society’. In this matter, the RRI-dimensions found by Burget et al. (Burget et al., 2017) indicate that a reciprocal relationship with the target
group must be established. On this basis, we raise our final question: How can we as experts increase the scientific literacy among our citizens by means of reciprocal relationships?

FOSTERING SCIENTIFIC LITERACY

Thus far we have established that there is a democratic challenge due to the new digital world, which scholars and researches more or less are obliged to care about since a lack of scientific literacy is a part of this challenge. In the light of Habermas, we have also seen that there is a schism between the world of the experts and that of the citizens, and that reciprocal relationships with the public might hold the key to a more fruitful approach to fostering scientific literacy than simply disseminating knowledge.

The schism outlined above between the world of the experts and the daily lives of the citizens is of great importance for two reasons, if a reciprocal relationship is to be established. The first is related to the need for differences to be bridged. The other is that the differences are of a fundamental nature. We have earlier pointed out three means that can aid the search for novel approaches: 1) Demonstrating how and why scientific knowledge matters, 2) aligning the scientific approach to that which matters to the citizens, and 3) creating knowledge with a starting point in what matters for the citizens. The underpinning common denominator of all these approaches is reciprocal relationships between experts and citizens.

Reciprocal relationships do not imply that experts and citizens ought to have the same intentions, knowledge and perspectives. Star and her colleagues (Bowker & Star, 1999; Star, 1989; Star & Griesemer, 1989) have developed one of the most influential contributions to understanding interaction this way. In Star and Griesemer’s seminal article about ‘The Berkley’s Museum of Vertebrate Zoology’ (Star & Griesemer, 1989), the museum itself is used to demonstrate how diverse actors shape the museum into various forms simultaneously. On this basis, the concept of boundary objects was coined.

Boundary objects are plastic, and thereby they can have diverse meaning to diverse actors. This allows them to speak differently to different audiences (Bowker & Star, 1999). Their key feature is as such their ability to facilitate communication by reducing the complexity of what is being communicated, which they accomplish through being fuzzy enough to absorb tensions (Mol, 2002) by not connecting perspectives and meanings (Wenger, 1998).

As a boundary object, The Berkley’s Museum connects diverse worlds (Star & Griesemer, 1989). Three of them are 1) the world of the museum’s director Joseph
Grinnell, 2) the world of the main sponsor Annie Montague Alexander, and 3) the world of The University of California. Grinnell’s desire was the elaboration of Darwinian theory, a desire shared with the academic staff, and hence the museum was a way for him to realize this. Rooted in her persistent and tireless interest in collecting these as an amateur, the desire of Alexander was the preservation and conservation of flora and fauna, which also the museum made come true in an excellent way due to collaboration with professionals. A third desire is the University of California’s vision of becoming a legitimate, leading national university, where the museum was also seen as an important means to an end. Even though these three actors attune to the museum to achieve differing outcomes, they still cooperate to make the museum as good as possible, despite overt, covert and latent conflicts.

Turning back to the placebo-example, we see that ‘effect’ serves the purpose of being a boundary object between the experts and the citizens. The patient experiences an effect from the pill, which is measured through physiological and sometimes also through psychological measures. The researchers divide this effect into the effect induced by the medication and that induced by placebo, and the physician knows that the effect of the prescribed drugs has two components. Placebo is as such an important concept on the experts’ side, while it is not on the patients’ side. Still both experts and patients can collaborate flawlessly. A central component of this collaboration is that the concept of placebo is openly communicated to the patients partaking in medical trials. There is no doubt that there is an increasing scepticism towards medical research in the population. On the other hand, this scepticism does not seem to be among those partaking in the trials, but among those decoupled from the medical research practices, like vaccine opponents.

From this, there are three lessons to be learnt: 1) A boundary object that matters to both experts and citizens is used, 2) there is an openness concerning the methodology, and 3) both experts and citizens benefit. Returning to our example of EuroScitizen, which aims to foster scientific literacy among Europeans, we see that an operationalization of these three factors can be much simpler than creating a ‘gold standard’ within a field of research.

Starting at the latter point, concerning reciprocal benefit, the MoU (EuroScitizen, 2018) underpins the goal of increasing scientific literacy by stating that Europeans 1) do not think that scientific knowledge is important in their daily lives, 2) feel less well informed than their level of interest demands, and 3) are not very active in science and technology issues. Thus, constructing some sort of venture where the involved citizens learn about science would be beneficial to the citizens. It would probably also be beneficial to the scientists, since almost whatever role
the citizens are engaged in would thus have higher quality. On the other hand, what is beneficial to the citizens cannot be decided top-down. RRI and governance is about taking note of what comes upstream from the citizens to the experts. This does not mean that a project ought to be dictated by the citizens, but their concerns, wishes and arguments are to be heard and appraised in the same way as a concern, a wish or an argument from an expert. This requires acting in a way whereby the reciprocal relationship with the public includes listening, contributing, involving and interacting with all relevant stakeholders.

Concerning openness with regard to methodology, we must demystify science by explaining what and why research is conducted in a special way; and demonstrate the relevance beyond the scope of the narrow topic we are investigating. Thus, we have to open the back-box of science (Latour, 1987) for the citizens. In this way, the interaction has the potential to increase the scientific literacy of the public, thereby leading to the empowerment of the citizens in distinguishing fake from fact and in making choices that are well informed and in accordance with their values and wishes. Another equally important benefit is that we can align our research to that which matters in the lifeworld of the citizens. This represents democratization in two important senses: 1) we empower citizens, and 2) we make science matter in their lives.

What is a feasible boundary object will vary from venture to venture, and must therefore be coned from what is of mutual benefit, in combination with what is methodologically acceptable for the scientists. This calls for innovative approaches, which cannot be constructed by experts alone. While the experts’ domains might be complicated, they are governed by logic within a given scientific paradigm in the system. In contrast, the lives of the citizens are complex, ruled by the lifeworld that carries our shared common understandings and these are determined by engagement and influence. Our claim is thus that by paying attention to the complexity of the citizens’ lives in the construction of such boundary objects, one can strengthen the relationship between the public and science, and thereby raise the levels of scientific literacy. In this process, it is important to be aware of the distinctions between the experts and the citizens, and not be tempted to meet complexity with complicated solutions that alienate the citizens.

Thus, we argue that the best way to foster scientific literacy among the citizens is almost as far from ‘the deficit model’ as possible. It is not by disseminating knowledge. It is not even through carrying out citizen science projects where the citizens gather data for a researcher’s project. It is through genuine reciprocal ventures together with the citizens.
We started out by voicing a concern regarding the citizens’ ability to discriminate between fake and fact in the feeds of information that turn up on devices in the palms of their hands. We have argued that scientific literacy is at the heart of this ability, and claimed that involving citizens in governance processes concerning science is of vital importance in this matter. The key to fostering the citizens’ ability to evaluate, assess and judge the information at their fingertips is thus embedded in the interaction between the general public and science. Viewed in our perspective, this will increase the scientific literacy – at least as long it is carried out in accordance with the reciprocal relationship between science and the public at large that is at the heart of RRI. Most important in this respect is the pillar of governance in terms of facilitating participation.

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