



Deliverable 4.1 – Lessons Learned from Case Studies and Co-creation

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List of Abbreviations Used in the Document

ELSA: Ethical, Legal and Societal Aspects

R&I: Research and Innovation

RRI: Responsible Research and Innovation

STI: Science, Technology and Innovation

STS: Science and Technology Studies

1. Executive Summary

In this report, we share lessons learned in the IANUS WP4 case study and co-creation activities. An introduction outlines the WP4 programme and summarises our methodology. In Chapter 1, we present a variety of case study and co-creation activities, in particular lessons learned about discourses on such topics as vaccination, virology, genome editing, neurotechnology, quantum technology, information and communication technology with a focus on disinformation and AI, and ecological challenges such as climate change. Chapter 2 describes the activities of the IANUS Media Panel concerning the role played by journalism for trust in science. The final chapter provides some overarching conclusions and an outlook.

2. Introduction and Methodological Approach

In this report, we provide information on **IANUS co-creation activities and research on a number of discourses on science, technology, medicine or innovation** that have been carried out in the fourth work package (WP) of the IANUS project in close cooperation with other IANUS WPs. These case studies included major societal controversies as well as, more generally, discourses on fields of research and innovation (R&I), science, technology and innovation (STI) or grand challenges of our time such as climate change.

The following **discourses** served as our cases:

- **Bio / biomedical**, with a focus on vaccines and gene editing (see **Section 1.1**),
- **From nano to neuro** (see **Section 1.2**), with a focus on neuro and quantum technologies,
- **ICT (information and communication technologies)**, including AI and with a focus on the topic of (dis)information (see **Section 1.3**), and
- **Ecological challenges**, with a focus on climate change (see **Section 1.4**).

Overlaps between the four cases and between various topics within the cases were deliberately accepted, in particular in some of the co-creation activities. This decision was mainly taken because of technological, discursive or other overlaps existing in reality. Additionally, these overlaps helped to deepen the interaction within the IANUS consortium and with and between members of the project's external networks. WP4 included contributions by all IANUS partners.

We focused on the above-mentioned discourses for two reasons: they all entail potentially intense interventions in citizens' lives, while in all these technology areas significant science-based leaps have been made or are currently being made, which increases the likelihood of disrupting existing social practices and creating new ones.

The **overarching objectives** of our research in IANUS WP4 were to

- develop new and in-depth knowledge of confidence and trust in STI, using real-world examples,
- consolidate this knowledge with societal lab approaches, and
- reflect on and further consolidate this knowledge through expert and stakeholder engagement.

For each of the four cases, at least one written case study was produced, in close cooperation with IANUS WP2 (for some results from earlier in the project's running time, see the IANUS "[Deliverable 2.1 – Comprehensive Analysis of the Research and Policy](#)

Landscape”). In these **written case studies**, approaches were taken that focused on **historical trajectories** (“careers”) of fields and topics. Besides desktop research, we relied for these studies also on expert opinions gathered for example in workshops (for more methodological information, see below in this introduction.) With these written case studies, we achieved our goal to comparatively analyse “past, current and future areas of science-based innovation”, as announced in the IANUS project proposal.

As well in line with the accepted proposal, we worked in IANUS WP4 intensively and in a wide variety of ways with existing **societal co-creation labs**, defined as “any **transdisciplinary co-working settings deliberating on STI**”. The cooperation with them directly contributed to results of the IANUS co-creation activities described below in Sections 1.1.-1.4. Three examples of **co-creation events**, in which we worked in such settings, are described in **Section 1.5**. Results of the case study work and co-creation activities in WP4 were and still are to be fed into policy-oriented activities (in IANUS WP6) and further IANUS work.

Another high-profile co-creation activity of the project was the **IANUS Media Panel**. While somewhat separate from the other activities in IANUS WP4, there were many interconnections in terms of topics, analysed and discussed questions, and stakeholder interactions. Given the paramount relevance of media coverage for public confidence, trust and distrust in STI, we involved in the IANUS Media Panel activities science journalists, other science communication professionals, academics working on science journalism or science communication more generally, and other experts and stakeholders. Some key activities and results of the **IANUS Media Panel activities** are described in **Chapter 2** of this report.

In **Chapter 3**, we present **some conclusions** of our research **and an outlook**.

In line with our initial project vision for WP4, we employed a deliberately heterogeneous and adaptive methodological repertoire, responsive to the situated complexities of our research contexts. The Horizon Europe call we responded to ([HORIZON-WIDERA-2021-ERA-01-44](#)) explicitly called for project(s) that should contribute to a better understanding of the nature and scale of the sources and consequences of mistrust of society in science and the challenges of science-society co-creation by means of “a series of expert workshops, small-scale studies and participatory research actions”. To meet this objective, we designed and iteratively refined a matrix of formats, ranging from expert workshops and ethnographically informed case studies to performative co-creation events and participatory research interventions. This multiplicity was not a secondary feature but an epistemological stance: we recognised early on that rebuilding trust in

science must emerge through context-sensitive, dialogical engagements across social, disciplinary, and affective boundaries.

In our proposal we had announced that for the **overall analysis of the discourses** that we had selected as case studies in IANUS (see above), we will use a combination of the **critical incident technique**, tailored to our needs (identifying and analysing key events, debates, regulatory interventions and citizen mobilisations around the discourses), with **hermeneutic technology assessment** that also deals with historical trajectories, cultural aspects and visions of the future expressed in the discourses. These studies were in fact rather small-scale but dealt with rather broad topics, and the two methods were used within broader **ELSA** or responsible research and innovation (**RRI**) approaches. Besides desktop research we also used expert workshops and in general included expert and stakeholder perspectives in a variety of ways. In the **co-creation activities** we also used **expert workshops and**, in a **wide variety of participatory research actions**, art-science interfaces and combinations of physical co-creation activities with virtual online interactive mechanisms (such as bot detection tools, AI-driven tools, explainable and transparent AI features, data exploration, and visualisation of algorithmic processes). As announced in our project plan, we will also add to our IANUS mixed-tool approach participatory action research and role-play methods (planned for April 2025). Further methodological information is provided in Sections 1.1-1.5 and in Chapter 2.

3. Case Studies and Co-Creation Activities

3.1. Bio / Biomedical

In the following, we will describe lessons learned in IANUS research on discourses about (A) gene editing and (B) virology and vaccination.

3.1.1. (A) Gene Editing

One of the historical case studies (see Introduction), carried out in work for IANUS WPs 2 and 4, focused on public discourse about **genome manipulation and genome editing**. Against a background of over three decades of genome editing (and a longer one of genetic modification), in which the narratives of biotechnology critics have changed very little and are still based on such concepts as ‘tinkering with nature’, ‘playing God’, ‘Frankenstein-like research’, and ‘unnaturalness’ – which are often analysed with hermeneutic approaches –, we focused on how the public image of the field has developed in these decades.

Overall, our findings suggest that scientific and technological advances in the field of genome editing have not been accompanied by corresponding shifts in public perception. Where changes in opinion are observable, they appear to follow generational lines rather than being directly triggered by new developments in science or innovation.

To analyse this dynamic in depth, we applied a tailored version of the critical incident approach, which in our context involved identifying and examining key moments – scientific breakthroughs, regulatory interventions, media debates, and public controversies – that significantly shaped how genome editing has been perceived over time. This approach allowed us to trace how specific events became symbolic turning points or reinforced existing narratives of mistrust.

A central insight from our analysis is that science, as an institution, appears to have limited capacity to shift entrenched public attitudes. Deep-seated doubts and cultural fears tend to persist—and often resurface – regardless of how thoroughly they have been addressed or debunked through evidence. In this light, public opposition is rarely about specific facts but more often about perceived risks to moral, social or natural orders.

One could therefore argue that the history that genome editing has in older gene technology is turning to a disadvantage, in that the original reasons to oppose the idea of DNA changes are so deeply rooted in the public opinion that they cannot be overcome through logical arguments and evidence. Pushing this concept further, it seems that the very **nature of the scientific process** (i.e. hypothesis – experiment –

confirmation/disproving of the hypothesis) that strengthens the scientific process, has a **negative effect on the public opinion** of this process.

To us, this appears to be further evidence that more efforts should be made **to improve the public's understanding of the 'scientific method'**, which is distinct from detailed information on specific STI fields.

3.1.2.(B) Science and Suspicion: Virology as a Case Study

In our case study on **virology and vaccination**, we made, as announced in our project proposal, use of earlier work in EC-funded and other projects in the biomedical field. We analysed virology as a research area and vaccination as its concomitant societal practice. The rationale for focusing on this area is that it entails potentially intense interventions in citizens' lives, while research-based knowledge production continues to evolve at a high pace. Geographically we focused here on the Netherlands.

Contrary to widespread assumptions, levels of trust in science remain relatively high among Dutch citizens – higher, in fact, than in most other public institutions such as governments, the judiciary, media, or corporations. This assessment is supported by several national surveys conducted over the past decade, which consistently rank science as one of the most trusted domains in the Netherlands. Our starting point in this case study was therefore a context in which science continues to enjoy a strong reputation for trustworthiness.

At the same time, however, the COVID-19 pandemic has revealed a parallel trend: a rise in vocal and visible public distrust, particularly in online spaces. Virology experts involved in public debates frequently report an intensification of polarisation, and social media platforms have emerged as key arenas for distrustful, accusatory, and highly emotional forms of communication. This coexistence of trust and distrust points to a complex and dynamic landscape, in which credibility is increasingly negotiated in real-time and across fragmented publics.

We conceptualise this as “**suspicion**”, a term which echoes the word of the three “masters of suspicion” (Marx, Nietzsche, Freud) who held that, in order to come to terms with discontent also in science, we should be sensitive to those aspects of discourse that are less visible, less audible, focusing on what is silenced and omitted, particularly when its content is uncomfortable or unflattering.

Our question thus was: **what is the moment of truth in discontent and suspicion vis-à-vis virology?** In our attempt to provide an answer to this question, we paid

attention to genres of the imagination (novels, plays) where silenced voices are given the floor and less audible and tangible aspects of discontent are acted out. Building on these analyses, we explored how public trust in science can be strengthened or restored.

Our **research** was also **informed by practice**, however. For more than a decade, some of us were involved in a number of virology projects – and experiences gained by participating in those projects helped to sharpen the lessons learned in IANUS desktop research and co-creation activities. Our participation in these projects as well as our work on virology and vaccination in IANUS itself was guided by the **ELSA approach**, which in our understanding has four key characteristics (cf. Zwart H., A. Nelis, What is ELSA genomics? Science and Society Series on convergence research. *EMBO Reports* 10/6, 2009; Chadwick R., H. Zwart, Editorial: From ELSA to responsible research and Promisomics. *Life Sciences, Society and Policy* 9:3, 2013): 1) proximity (philosophical reflection via mutual learning and critical dialogue, transforming bioethics and philosophy of science into philosophy in science; 2) interdisciplinarity (e.g., interaction between science and the humanities); 3) anticipation (exploring the future of current developments with the help of imagination), and 4) interactivity (offering societal stakeholders a role in co-constructing research agendas).

Table 1: Overview of EUR (Erasmus School of Philosophy) involvement in biomedical collaborative projects

Involvement in virology projects			
Project title	Project lead	Duration	Full title – our role
EMPERIE	Lead: Ab Osterhaus ErasmusMC	2011-2014	European Management Platform for Emerging and Re-emerging Infectious disease Entities. Our role: ethics advisory board
ANTIGONE	Lead: Ab Osterhaus ErasmusMC	2012-2016	Anticipating the Global Onset of Novel Epidemics. Our role: ethics advisory board
ASKLEPIOS	Lead: Ab Osterhaus ErasmusMC	2013-2017	Advanced Studies towards Knowledge on Lyssavirus Encephalitis Pathogenesis Improving Options for Survival. Our role: ethics advisory board
From molecular pathogene	ID 91213058 (ZonMW)	2014-2018	A systems biology approach to the use of next generation sequencing for emerging viral diseases

sis studies to evaluation of control measures	Lead: Marion Koopmans ErasmusMC		Our role: WP lead to incorporate societal knowledge to address knowledge deficits in current research via co-creation.
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As indicated in **the table above** we have been involved in virology projects in numerous ways, either as project partner or via the ethics advisory board, collaborating with the **viroscience department of Erasmus Medical Centre (ErasmusMC)**, an expert centre of international prominence chaired by Marion Koopmans and combining world-leading research with (national and international) policy advice and a strong media presence. We invited Koopmans to join the first panel of our IANUS kick-off conference on June 13, 2022 (entitled “The corona experience: virology, pharmaceutical companies and trust in science”), as a prominent expert in global viral research who also reflected on her experiences in an autobiographical retrospect (*Viroloog in een veranderende wereld*. Amsterdam: De Bezige Bij, 2022). Her work focuses on emerging viral diseases, and she serves on the scientific advisory group of the World Health Organisation (WHO). Koopmans is a member of the Royal Netherlands Academy for Arts and Sciences and was awarded a substantial NWO grant (2019) to establish a consortium, the Versatile Emerging Infectious Disease Observatory (VEO), to study how changes in environment and travel will impact the risk of infectious diseases. On 2 December 2020, Koopmans was appointed as member of the WHO team to investigate a highly controversial topic: the origins of COVID-19. In 2020 she received the Machiavelli Prize for their efforts in the field of public communication to make the science on the coronavirus accessible to a wide audience.

Closely connected to the question how to foster trust and trustworthiness in science, another question emerged in the aftermath of the COVID-19 experience as well, namely whether scientists can still trust public debate? We noticed **scepticism among scientists whether a safe and respectful exchange of views is still possible in the public sphere and whether scientific expertise and validated knowledge are still sufficiently valued**. We encountered this experience when we invited Koopmans for a follow-up debate. She is a scientist who deliberately seeks dialogue with sceptics and opponents of the policy, as well as with broader audiences, via media presence (television) as well as social media presence. Notwithstanding or perhaps because of prominence, Koopmans had to face a plethora of threats, notably via social media, accusing her of crimes against humanity, of being on the payroll of either pharmaceutical companies or the Communist Party of China, or both. As a result, she

became increasingly reluctant to join meetings and debates on the coronavirus, if only because of safety issues.

For virologists, this is not without precedent. On Tuesday morning, May 28, 2013, in a conference room at the Hilton Hotel in Rotterdam, Ab Osterhaus, former head of the virology department (with a strong media presence as well), opened the ethics session of a European virology project meeting by introducing his colleague Ron Fouchier, professor of virology at ErasmusMC, as keynote speaker with the following quote, displayed on a power-point slide, inviting participants to guess its source:

“Just recently, two very respected virologists – Fouchier and Kawaoka – had created a highly pathogenic mutant H5N1 virus. Despite the researchers’ purely academic intent, their new creation possessed certain capabilities that had alarmed biosecurity specialists and had created a firestorm of controversy online...”

This quote was taken from **Dan Brown’s novel *Inferno*** (2013) which had been released just two weeks before the meeting (on May 14, 2013). Brown’s novel explicitly referred to Fouchier’s work with the avian flu H5N1 virus. During a personal conversation which I had with Fouchier later at the same conference, he indicated that serious drawbacks were involved in figuring in a Brown novel as a virologist working with dangerous viruses. Since the novel had been published, he had become the target of threatening hate mails from all around the globe. The objective of Fouchier’s work was to contribute to preparedness. There is an intriguing paradox at work here. In order to foster preparedness, expert virologists work with lethal viruses in their laboratories. During one of my visits to the virology department at ErasmusMC in the context of one of our projects, a virologist pointed to a refrigerator in the room, indicating that it contained test tubes filled with dangerous pathogens that could cause tremendous harm if it were to fall into the wrong hands. Although biosafety protocols and biosecurity protocols are in place, research with potentially lethal pathogens remains a source of public concern. To be prepared for viral threats, to be able to control viral pathogens, we have to deepen our knowledge of them, but precisely this knowledge may become a threat in its own right (the paradox of dual use). From an ethical point of view, Dan Brown’s decision to refer to existing and traceable scientists in a best-selling novel instead of anonymising them (and doing so without their consent) is **morally unacceptable**.

This same tension came to the fore in the discussion concerning **the origin of COVID-19**. On February 19, 2020, the biomedical journal *The Lancet* published an editorial

stating: “We stand together to strongly condemn conspiracy theories suggesting that COVID-19 does not have a natural origin and overwhelmingly conclude that this coronavirus originated in wildlife”. The consensus is that the COVID-19 pandemic originated in Wuhan in China, but what is condemned here in *The Lancet* is the hypothesis that COVID-19 originated not on a wet animal market (visited by humans, rodents and cats, where not only fish and shellfish, but also exotic animals were for sale), but in a virology lab located in the same city, working with dangerous viruses at biosafety-level 4. The National Institute of Health and the National Institutes of Allergy and Infectious Diseases funded experiments on coronavirus bats at the Wuhan Institute of Virology (WIC), grafting proteins into the base structure of SARS-CoV to observe pathogenic effects in humanised mice and to augment contagiousness. Yet, after on-site investigations, a WHO experts’ team (including Marion Koopmans) concluded that the theory of a laboratory leak at WIC to explain COVID-19 is highly improbable. The official view now is that COVID-19 originated at the wet animal market. For the authors of an anonymous manifesto published in 2022 (*The Conspiracist Manifesto*. Paris: Éditions du Seuil), however, it cannot be a coincidence that a virology institute was located in the same city, formally cleared to conduct research that is considered too risky to conduct in the West. The authors even take this a step further. Rather than arguing that the Corona virus was leaked by accident (an accident which subsequently was covered up), they contend that the virus was leaked on purpose, as a means to retake governmental control over revolting populations, from the revolt against authoritarian Arab regimes known as the Arab Spring up to populist protests in the West, such as the Yellow Vests in France. COVID-19 emerged to intensify the hold on populations and flatten a “historical crescendo of revolt” via lockdowns, surveillance and other policy measures, these authors argue.

The **purpose of the IANUS project** was not to position ourselves in these debates, but rather to **ask the question whether a meaningful deliberation about these issues is still possible**. On the one hand we recognise that trust in science is never a given. In fact, “healthy scepticism” is crucial, not only as an intrinsic dimension of research methodologies themselves, but also in the context of public debate. One of the purposes of public debate is to determine whether and when public trust in science is warranted.

This raises a deeper question: to what extent does a **public sphere** – in the classical Habermasian sense of a shared arena for rational-critical debate – still exist in today’s fragmented media landscape? **The COVID-19 experience highlighted that scientists are not only concerned with *being trusted*, but increasingly ask themselves whether they can *trust public discourse* in return**. Many report a

growing sense of unease: established formats for public engagement appear less effective in contexts where dialogue is replaced by confrontation, and where scientific authority is often met with suspicion or outright hostility. We notice scepticism among scientists whether a safe and respectful exchange of views is still possible in the public sphere and whether scientific expertise and validated knowledge are still sufficiently valued.

Rather than simply lamenting this shift, our co-creation activities in WP4 suggest a need to rethink what counts as “public” and how deliberative processes can be made more resilient. This includes exploring formats that acknowledge affect, disagreement, and unequal access to epistemic authority – not as threats to science, but as realities to be navigated. **The challenge is no longer just to communicate facts, but to co-create conditions under which mutual trust and dialogical openness can emerge at all.**

The term ‘science’ may refer to a broad spectrum of perspectives, moreover, where **many disciplines and paradigms** are involved, at times endorsing diverging perspectives and resulting in diverging views concerning policy and decision-making. Involving multiple disciplinary perspectives is an important requirement for **developing a comprehensive approach**, for instance in the case of the COVID-19 crisis, which was not only about viruses and vaccines, but also about cultures, values, governance and behaviour. Yet, **the spectacle of a plethora of contradictory positions may challenge public trust** in academic knowledge (e.g., the claim that, for any possible position, a (self-proclaimed) expert can be found who supports it. Concerned citizens often do not know how to determine whether an expert is trustworthy. Here we have to deal with a thorny problem in the relation of science and science communication.

Again, like in the case of discourse on genome editing, we would like to emphasise, now in light of our research results on virology and vaccination, that more efforts should be made **to improve the public's understanding of the ‘scientific method’** – or less traditionally said: methods – one of the challenges here being that there are **multiple methodological differences, both within and between fields**, which may give rise to different insights and results. We thus believe it is also necessary to **improve public understanding of interdisciplinarity and** of what can be called **the political economy of science**. This may improve the chances that concerned citizens can raise their partly fact-based concerns without demonising individual researchers and that conspiracy thinking can be criticised in a co-creative, mutually respectful way. At the same time, we learned that in particular due to the societal debates and changes in the science-society relationship in the course of the Covid-19 pandemic, there is also a **crisis of trust among many scientists with respect to parts of society and public debate**.

3.2. From Nano to Neuro

Following earlier waves of public controversy around green biotechnology and genome research, nanotechnology emerged in the late 1990s as a new focal point of both scientific promise and societal anxiety. What distinguished this field was not only its potential for disruptive innovation, but also the **intensity of speculative discourse** surrounding it – particularly with regard to human enhancement. These visions, often fueled by techno-optimist imaginaries, migrated in subsequent years toward neurotechnology and artificial intelligence, where they became further amplified by prominent figures such as Elon Musk and Peter Thiel.

In our IANUS WP4 research, we interrogated the **trust implications of such exaggerated future narratives**. While some may dismiss them as fringe or fantastical, they nevertheless shape public perceptions, policy agendas, and investment decisions – often without sufficient scrutiny. Our critique focused not only on transhumanist rhetoric, but also on the ways in which these imaginaries obscure **more immediate, tangible concerns**. What happens in terms of trust relationships when, for example, users of implanted neurotechnology face abandonment by commercial actors, when warehouse workers face the introduction of technologies at their workplaces, or when quantum technologies are celebrated as transformative while remaining epistemically opaque?

The overarching rationale for selecting this case study – "From nano to neuro" – was thus to examine how trust and mistrust evolve in **fields where technological developments are entangled with speculative futures, uneven risks, and asymmetric access to knowledge**. In our co-creation activities, we explored both macro-level imaginaries (e.g., human enhancement) and micro-level experiences (e.g., trust and mistrust of workers in technologies). Importantly, future speculations often shape current practices, and present-day practices can unintentionally prevent imagined futures.

Quantum technologies were included not because of widespread public concerns, but precisely due to their paradoxical position: while built on a highly successful scientific paradigm, they remain conceptually inaccessible to most non-experts. This raises a distinct kind of trust issue—not rooted in fear, but in *epistemic exclusion*. When understanding becomes the privilege of a few, and science communication retreats into either mystification or over-simplification, public trust can erode not through hostility, but through alienation.

With regard to neuro-prosthetics, we have worked with experts and stakeholders to identify the **problem of neuro implant abandonment** as a serious ethical problem

and a key issue for the future of the entire field. The phenomenon of neural implant abandonment is due to some companies not being able to sustain operations for commercial reasons. The abandonment in this area of STI naturally has more serious consequences for users than in other areas of technology – and the problem therefore also poses a risk to the entire field itself, as potential early adopters may be reluctant to use new implants or may be lured into using them by ethically problematic means.

In February 2025, we convened an interdisciplinary expert workshop in Berlin that brought together stakeholders from neuro-prosthetics, ethics, law, STS, disability and crip studies, technology assessment, and patient activism. The goal was to co-design a participatory framework that addresses the growing problem of *neuro-abandonment* – a phenomenon in which users of neural implants are left without long-term support due to market withdrawal or corporate collapse. Rather than focusing solely on device development, our approach framed ‘prosthetics’ as encompassing entire socio-technical ecosystems: from hardware and clinical interfaces to healthcare policy, reimbursement schemes, entrepreneurial infrastructures, and the regulation of innovation.

A particular emphasis was placed on improving conditions for early adopters of neurotechnologies, who often bear the burden of risk in underregulated markets. The group explored possible interventions – public, private, or hybrid – that could ensure sustainable access, continuity of care, and institutional accountability. The workshop thus laid the groundwork for a user-centered co-creation process that not only integrates technical expertise but also centers on the lived experiences of disabled users.

We are currently synthesising the workshop’s results – which highlight, among other things, the systemic fragility of innovation pathways, the need for binding long-term commitments by manufacturers and funders, and the transformative potential of including disability expertise in the innovation cycle. These insights will soon be circulated for feedback among user groups and activist communities involved in prosthetic technologies.

Another focus of IANUS WP4 co-creation activities is on **trust and mistrust towards technologies in the context of manual work**. On the one hand, we look at the topic of exoskeletons in physically demanding labour. On the other hand, we are analysing technological developments in the logistics sector and industry and in particular workers’ views of them.

Key activities are still ongoing, but we have already **learnt a number of lessons** in this context. One of them is that **co-creation activities with workers need to be**

organised differently from the usual co-creation activities, which are primarily aimed at time-rich, academically educated citizens. On the one hand, ELSA and RRI researchers need to try to require as deep an understanding of the **working conditions of the workers** they engage with as they do when they engage with natural scientists, engineers or other professionals in ELSA or RRI projects. On the other hand, in various interactions with workers it proved to be useful, also in terms of trust relationships, to share with them information and assessments of our **own working conditions** in publicly funded research institutions.

Another lesson is that there are **doubts among workers that technological progress will be good for them** and little knowledge about technological developments that might be in their interest. We have also encountered distrust of university-based R&I among non-unionised workers, as they could not believe that such R&I could be aimed at the well-being of workers and not (only) at the economic interests of companies.

One of the lessons learned in the discourse on nanotechnology is that highly speculative visions of the future were seen as dangerous for the future of the field and at the same time dominated academic ethical discussions about them. We thus decided to take a closer look, in an additional written case study, at the **discourse on quantum technologies**, which has variously been compared to the one on nanotechnology.

While the latter suffered from the strong transhumanist influence in it, researchers in the field of quantum technologies are more concerned about so-called “**quantum mysticism**”, metaphysical beliefs and practices that seek to draw connections between consciousness, intelligence, spirituality or mystical worldviews and the principles of quantum mechanics and its various interpretations. Since quantum physics is the basis of quantum technologies, which are always based on quantum-mechanical measurement processes, the **question** arises as to **whether trust problems can follow** for the new, widely covered and strongly funded generation of quantum technologies **from** the – in terms of technological developments – incredibly successful **quantum theory**, due to its obvious gaps in the description of individual (measurement) processes.

A key **lesson learnt** in this study is that there is a **fine line between fighting quantum mysticism and turning quantum technologies into a mystery for the public**. One example is Richard P. Feynman's famous statement that “nobody understands quantum mechanics”. Taken out of context, this statement may disregard all achievements in the understanding of quantum mechanics and the development of quantum technologies. This in turn can open the door to quantum mysticism and shake

confidence in quantum technologies. And it can also exclude people without technological or quantum-mechanical knowledge, which in turn can lead to secondary trust problems if only a few people determine the development of quantum technologies. However, if we put Feynman's statement in the context that 'nobody knows why nature behaves quantum mechanically' and that it is also counterintuitive to our classical worldview, we may be able to stimulate interest in the theory and technologies while recognising the strangeness and complexity of quantum mechanics.

We would therefore argue that **trust in science, which is fundamentally based on doubting the status quo, can perhaps be most sustainably achieved through an honest debate about its current shortcomings.** This advice could be used for communication strategies and the creation of attractive, but not overly simplistic, narratives. In discourse on nanotechnology, Arie Rip has coined the term 'nanophobia-phobia' – the nanotechnology community's irrational fear of massive irrational fears about nanotechnology within society – and we would argue that **quantum mysticism phobia should not prevent us from science communication that takes interested citizens seriously.**

3.3. ICT (Information and Communication Technologies)

In this case study, we focused on the broader **societal impact of ICT-amplified online (dis)information.** Specifically, we first examined reported public perspectives on the use of AI algorithms in social media, with a focus on AI recommender systems, the overall personalized and algorithmic news curation, and their role in spreading false information and potentially diminishing online public trust. Then, within WP4 activities, we extended our focus and delved deeper into how AI - with a focus on Generative AI and Large Language Models (LLMs) - is perceived by the public with respect to its ability to analyse and report information accurately. For this reason, we combined physical participatory activities and citizen engagement with virtual online interactive mechanisms (e.g. LLM-driven tool for political discourse analysis, corresponding AI features and data exploration and visualizations) and collected both quantitative and qualitative data to investigate how public attitudes and trust towards this tool are shaped. In the following, after a brief thematic introduction based on insights from the historical case study on AI algorithms in social media, key activities of co-creation for this case study are described.

Artificial Intelligence has become a focal point in current debates on trust and mistrust in science, technology, and innovation. The pertinent discussions also address **trust towards online social media and platforms that strongly rely on AI algorithms.** The notion of **trustworthy AI** now plays a prominent role in both policy discourse and public expectations. Public trust in AI, however, is far from monolithic – it

is shaped by demographic factors, contextual use cases, and levels of technological literacy.

Of particular concern are AI-powered online platforms and social media, which constitute the primary information environment for large segments of the population – especially younger users. These platforms rely heavily on algorithmic curation, influencing not only what content appears in users’ feeds but also how reality is framed and filtered. EU-wide surveys such as the *Eurobarometer on Digital Technologies* and related academic studies have repeatedly shown that citizens across member states express low levels of trust in these algorithmic systems, both with regard to their opaque operational logic and the integrity of the content they amplify.

Users worry that personalisation algorithms may reinforce bias, trap individuals in echo chambers, or promote polarised and misleading content.

Mistrust is further fueled by concerns that AI systems are insufficiently capable of distinguishing between legitimate news and misinformation – particularly when poorly implemented. These anxieties have been echoed even within the tech community: Geoffrey Hinton, often referred to as the ‘godfather of AI’, publicly resigned from Google in 2023, warning of the ease with which generative AI could be used to fabricate convincing fake texts and images.

This highlights a major shift: **trust in AI** is no longer only about technical reliability or accuracy, but increasingly about social and epistemic responsibility – who controls these systems, under what values, and with what safeguards?

Against this backdrop, we organised a **co-creation ‘AI and us’ workshop in Greece**. It aimed to explore **public attitudes and trust toward generative AI and Large Language Models (LLMs) within the context of an LLM-driven tool for political discourse analysis**. Public attitudes and trust were explored in detail by investigating whether and why workshop participants consider accurate or inaccurate the analysis and information provided by the LLM-driven tool regarding political speeches in the Greek pre-election period in 2023. The 29 participants were briefed on the workshop’s objectives and contributed a diverse range of data through pre-study questionnaires (including demographics, political orientations, and attitudes toward AI), in-study and interactive, digital tasks (evaluating the accuracy of results and information generated by the tool), and post-study questionnaires (assessing trust in the tool, associated organizations, and scientists). A central focus was the workshop’s design and implementation, which were tailored to examine trust through the conceptual trust framework developed in IANUS, positioning trust as a two-place relationship between the

trustor and trustee. In this framework, participants (as potential users) acted as trustors, influenced by contextual factors such as demographics and sociological aspects. The trustee was the LLM-driven tool, conceptualised as consisting of four distinct elements: trust in science, scientists, scientific products, and science as a system.

Our quantitative data analysis, primarily conducted through statistical methods, revealed several insights into the relationships between trustors and the trustee. The main **lessons learned** were: Firstly, distinct contextual factors appear to influence trust in the trustee's elements in varied ways. For instance, sociological aspects (such as attitudes toward scientists and funding schemes) impact trust in science (AI and LLMs in this case), while trust in the tool itself is predominantly shaped by ideological factors, such as moral values and familiarity with the tool's domain (e.g., politics). Secondly, the human-centric features of the LLM-driven tool, specifically the human-in-the-loop evaluation process and the transparency of specific results, significantly affect trustors' levels of trust. For example, when data are validated by humans or experts (e.g., data journalists), they are perceived as more accurate, whereas results that lack transparency experience a significant decline in accuracy ratings. These findings are expected to inform practical recommendations, supporting multiple stakeholders in fostering a robust ecosystem of trust around LLMs.

Following the analysis of workshop data, **follow-up interviews** were conducted to delve deeper into the most intriguing and critical perceptions and attitudes of participants. A critical sampling approach was applied to select **ten participants** for these interviews. The primary aim of each interview was to uncover the **underlying reasons behind participants' initial responses** to the pre-study, in-study, and post-study questionnaires and tasks, thereby enhancing the understanding of trustor-trustee relationships. Discussions during the interviews focused on interviewees' past experiences with AI and LLM-driven tools, their attitudes toward institutions, scientists, and funding sources involved in the 'AI and us' study (particularly those associated with the tool's development), and the significance of human-centric elements, such as transparency and human-in-the-loop techniques. After addressing general questions, participants were reminded of their specific responses during the workshop and asked to elaborate and reflect on them. Finally, they were encouraged to offer recommendations for improving the tool's trustworthiness, enabling a fruitful co-design process.

Our qualitative data analysis, primarily conducted through deductive thematic analysis, uncovered interesting insights into the relationships between and within trustors and the trustee. It also aided in gaining rich insights not able to be captured through quantitative data. The main **lessons learned** are described in the following.

Participants' past experiences with AI, and especially LLMs, highly influence whether they trust the results provided by the LLM-driven tool. Those generally using LLMs tool critically – e.g. using LLM outputs as an initial basis that requires further personal interpretation and often follow-up checks – are hesitant to completely trust them and consider their results entirely accurate. Considering that the 'AI and us' tasks asked participants to rate LLM results accuracy on a scale 1-5, several individuals suggested that they would generally refrain from giving the score 5 ("I definitely find this accurate") for AI-generated results and information. An exception should be noted, though, referring to an over-reliance on LLM tools observed among some participants (resembling to unwarranted trust). Indicatively, they consider that AI tools are more capable of analysing and reporting political discourse objectively, when compared to human experts that may be biased by their own political positions or have guided interests. Since the domain experts in the examined LLM-driven tool were **data journalists**, this probably relates to the overall skepticism that exists in Greece about the independence and professional practices of journalism representatives. Additionally, participants highly praise the involvement of **public universities** in such types of studies and tools development, believing that it is their mission to deliver high-quality knowledge for the benefit of the public. This contrasts with their views about the potential involvement of the **industry sector** in such studies, as there are concerns about potential conflicts of interest and profit-driven decisions. Finally, several interviewees suggested drawing on their own background knowledge of the Greek political scene to evaluate the accuracy of the LLM-driven tool for political discourse analysis – especially when the way the analysis results were provided was not transparent. This strongly verified statistical findings on **trust in the tool itself being strongly shaped by ideological factors**, including individual's familiarity with the tool's domain (i.e., politics). This further suggests that **citizens wish to maintain agency** in tasks involving AI, rather than rely exclusively on the competence of AI, and embrace their vulnerability in the face of it.

A main lesson learned is thus that **different attitudes exist towards the various institutions** involved in research about AI, including LLMs. Citizens often trust **public universities**.but not the **industry sector** in such studies, as there are concerns about potential conflicts of interest and profit-driven decisions.

3.4. Ecological Challenges (Climate Change and Sustainability)

For our **written case study** on global ecological challenges, we analysed the University of East Anglia's Climatic Research Unit email controversy, widely known as **Climategate**. We used this incident to explore issues related to distrust in climate

science, including the role of transparency, the broader sociopolitical context that interacts with distrust in climate science, and the consequences of appeals to a value-free image of science. A summary of this analysis is provided in a forthcoming book chapter. Here, we note that, during Climategate, both scientists and climate change denialists invoked a value-free image of science. We stress that everyday scientific practice indeed adheres to strict methodological and epistemological standards of objectivity. Still, scientific research does not take place in a vacuum but is embedded in an institutional and societal context. **The social and institutional embedding of science may be at odds with an ideal of a detached and value-free science.** Bringing this embedding to the foreground often sparks public outrage and can be easily weaponised to discredit robust scientific findings. Here we might observe **a clash between two metanarratives about science:** positivism, on the one hand, and social constructivism, on the other. Investigations into trust in science will need to address this friction in perspectives.

For our **co-creation work** on the case study on global ecological challenges, we organised **small-scale but high-engagement activities**. These activities aimed to compile a repertoire of views, positions and arguments about trust and distrust in the context of climate change and sustainability. In terms of research focus, topics were partially motivated by insights gained from our aforementioned written case study on Climategate, including, among others, a) the **documented appeal of climate denialists to a value-free image of science** and b) the **highly politicised and emotionally charged** debate on this topic. In addition, our activities aligned with our commitment to creative and artistic methodologies, by e.g. foregrounding **artistic perspectives** on a given issue. All co-creation activities on climate change and sustainability took place in the Netherlands.

A central strand of our co-creation activities focused on the notion and dilemmas of the ‘**entangled scientist**’. Specifically, we investigated the **tensions between science as a disinterested enterprise, on the one hand, and science in its societal role, on the other**. During the BioArt Laboratories firepit debate, we explored **three types of entanglement (activism, policy advice, industry collaborations)** while our Exploring Science in Society initiative zoomed into the topic of **science activism**.

3.4.1. Bioart Laboratories Firepit Debate (October 2023)

On October 29th, 2023, we organized a firepit debate, in collaboration with the art and design institute BioArt Laboratories. The debate took place at the premises of BioArt Laboratories during the Dutch Design Week 2023 (DDW2023), a prestigious design festival of international stature taking place annually in the city of Eindhoven (NL). The

firepit debate concept follows a House-of-Commons debate: it invites participants to explicate and articulate their positions on a series of provocative statements, whilst participants can also change sides based on these articulations. During our firepit debate, participants (approximately 20 laypeople, visitors of DDW2023) were asked to move to the left or the right side of the room depending on whether they agreed or disagreed with the discussed statement and were further encouraged to justify their position. Our debate statements explored the notion of the ‘entangled scientist’ by highlighting cases where science meets social action. Specifically, we probed perceptions of trustworthiness in cases of a) scientific activism b) policy advisory and c) collaborations with industry. Interactions with the firepit debate participants indicated **awareness of the complex relations between academia and industry as well as considerable distrust towards industry**. The prevailing attitude towards scientists was favorable, science being attributed a capacity to contribute to better governance and a better environment. However, responders also pointed to the limits of scientific expertise and called for radical thinking and systemic change when dealing with the present ecological crisis. In terms of public trust, **scientists seemed to enjoy a high level of trust, with responders being predominantly skeptical about external influences**. The negative impact of the industry (and, occasionally, of political actors) was thus reaffirmed as a reason for warranted distrust. In response, participants demanded that scientists **behave ethically** by both resisting the pressures of industry and considering the (societal and ethical) implications of their research.

3.4.2. Exploring Science in Society (November 2023 - January 2024)

Several responses during our firepit debate signaled a demand for scientists to “do good”, i.e. to act ethically in ways that exceed research ethics. This raises challenging questions about **the professional role responsibility of scientists and the source of scientific trustworthiness**. Our research into the notion of the ‘entangled scientist’ continued with an investigation dedicated to **science activism**. Specifically, we engaged with a group of science students who also conducted an interview study with scientist activists. Interactions with these key informants (scientist activists) revealed intriguing links between activism and scientific credibility. Rather than diminishing scientific credibility, **science activism was suggested to reinforce credibility** either by means of professional consistency or as a new form of commitment to society. However, interviewees also acknowledged a professional requirement **to show, represent, or integrate multiple views which may conflict with an activist stance**. This concern is particularly relevant **in the context of participatory methodologies**. We expand and reflect on the findings of this investigation in a conceptual paper presently accepted for publication.

3.4.3. iBreathe Exhibit and IANUS Art-Science Event (Spring 2024)

One of the aims of our case study and co-creation activities on climate change and sustainability was to explore how **artistic research** might yield new perspectives on the science-society interface. To this end, we collaborated with a group of young interdisciplinary artists studying at the interdisciplinary bachelor programme iArts at the Maastricht Institute of Arts (MAIA). Our multi-week collaboration with these young artists resulted in a concrete output, namely the **iBreathe exhibit**. This output constitutes an autonomous artist response to issues raised within the IANUS project. In addition, the work was used as a **stimulus for discussion and reflection among a group of invited experts in trust and science communication during the IANUS Art-Science event**. This expert workshop on trust, climate science, and science communication took place on Oct 24th, 2024, during the Dutch Design Week 2024 (DDW2024). A detailed description of this event is provided in Section X.

In contrast to our other case studies and co-creation activities – which primarily involved citizens with limited familiarity with the structures of the science system, scientific methods, and the logic of interdisciplinarity – **the activities addressing ecological challenges often engaged with highly informed and critically reflective participants**. This difference shaped the character of our interactions: rather than centering on scientific explanation or clarification, discussions here quickly turned to the **normative dimensions** of scientific practice itself. Participants critically questioned not only what science knows, but also how it operates within a societal context.

3.5. Selected Co-Creation Events

To give a more detailed impression of our co-creation activities for WP4, we present three examples of co-creation events in this subsection. They differ in terms of our role in them, e.g. in terms of organisation, and reflect different aspects of our methodological approach.

3.5.1. Engagement at the NWO Life2024 Event

Against the backdrop of our case study work on virology and vaccination (see Section 1.1), we aimed to stimulate further deliberation on the role of academic expertise in public debate on viral threats and preparedness. As Erasmus University Rotterdam, notably Erasmus Medical Centre, played such a prominent role in public debates and policy development, we believed it worthwhile to reflect on our experiences. Do we still see the public sphere as a trustworthy arena for deliberation? What are important requirements for a meaningful debate? How to deal with tensions between disciplines and paradigms and the conflicting views resulting from this?

An opportunity for conducting such a debate was offered by the NWO Life2024 event on Trust in Science, organised by the Dutch Research Council (NWO) on May 21, 2024. On Tuesday evening, 21 May, 2024, prior to the NWO Life2024 conference, NWO and the Life Sciences Round Table organised an interactive strategic session over dinner. The theme for this year was ‘Trust in science’. IANUS coordinator Hub Zwart presented the lecture, followed by Prof. Noelle Aarts (Radboud University) who discussed the ways in which science and society interact, followed by discussions about the role of life scientists in the public debate and how we can build and retain public trust. What does it take to bring science and society closer to each other, both on an individual and on an institutional level? How can you engage in dialogue and address concerns with understanding and involvement? The audience consisted of representatives from the research field (e.g., group leaders, members of the Biology Council, board members of disciplinary associations in the life sciences, deans, NWO board members and policy makers).

During this event, preliminary insights arising from the IANUS project were presented. Suspicion, we argued, entails the view that, whereas the politics of preparedness allegedly serves the public good, other (political, commercial) interests are at work. The best way to address this is to make scientific research more open to society, develop participatory and inclusive methodologies, responsive to societal values, questions and concerns, lowering barriers between academic and societal knowledge, using societal concerns and scepticism as a source of information and inspiration. We agreed that this is not an easy approach, as we are facing emerging challenges: societal polarisation (often in response to disruptive technologies), growing inequalities and the replacement of a common public sphere by communicative bubbles and social media.

The discussion focused on the question of how to address this challenge. Trust in science is never a given and should never be taken for granted. Scientists should actively seek dialogue with non-academics, not only to inform public audiences about the latest research results, but also because such deliberations can make us more aware of our own knowledge deficits and blind spots, notably when it comes to translating research results into policy advice. The ethos of science entails a readiness to put established insights to the test, and distrust in science must be addressed in an open-minded manner. What is its moment of truth? Participants argued that in current debates, scientists and scientific institutions are seen as belonging to the elite strata of society. Often, science is seen as a self-serving enterprise, driven by funding opportunities (offered by governments and companies, who thereby steer the agenda of research) rather than by societal responsibility and commitment. Together with politicians and mainstream-media,

academics and their institutions are seen as part of the national or global elite. Scientists themselves run the risk of entrenching themselves inside an information bubble. To prevent this, we need to address the tension that emerges between experiential (lifeworld) knowledge and scientific research results, the lack of resonance between scientific knowledge claims and real-life experience. While tested research methodologies produce knowledge in a transparent and reliable manner, there is always an element of uncertainty involved, so that advice coming from scientists may change over time or experts may voice diverging opinions (concerning the use of face masks for instance). A new social divide is emerging, between the academically educated, who see themselves as progressive drivers of innovation, and the practically educated, who see themselves as underrepresented and unheard. Academics are privileged, in terms of knowledge and power, but also in terms of salaries and opportunities for mobility. Both groups increasingly seem to speak a different language. This divide can only be bridged by becoming more sensitive to the disruptive implications of policy measures supported by science. And this requires epistemic inclusion and participatory research, building a knowledge coalition which includes not only the academically educated, but also the knowledge and experience of practical professions, of teachers and caretakers, and the experiential knowledge of those affected by policy measures.

3.5.2. The Congress of Futures (2023)

From 13-15 October 2023, IANUS partner KIT co-organised the **Congress of Futures** in Berlin, a public event in collaboration with the Theatre of the Anthropocene and the RambaZamba Theater. Set against the dual backdrop of ecological crises (such as biodiversity loss and climate change) and the ongoing cyborgisation of the human body, one of our flagship co-creation activities brought together scientists, artists, writers, curators, activists, and thinkers from across disciplines (Claus Biegert, Sebastian Blanz, Penelope Chatzidimitriou, Christopher Coenen, Volker Demuth, Nils Emmerichs, Armin Grunwald, Stephanie Guse, Paul-Philipp Hanske, Jens Hauser, Jacob Höhne, Reinhard Hüttel, Jonaid Khodabakhshi, Thomas Köck, Charlotte Maier, Aiki Mira, Kevin Mooney, Djamal Elangui Okoko, Nicole Scheunemann, Ewald Schnug, Frank Raddatz, Hans-Jörg Rheinberger, Somidh Saha, Markus Schroer, Tilo Wesche, the RambaZambaTheater ensemble, and others). They explored how trust and mistrust in science and technology are shaped by cultural narratives, artistic practices, and speculative imaginaries. The event staged diverse perspectives on topics ranging from neurotechnology and transhumanist visions to climate change and the rights of nature. It also highlighted the power of embodied, affective, and artistic formats to surface latent concerns, provoke ethical inquiry, and foster new forms of public engagement beyond conventional formats of science communication.

After introductory remarks by Grunwald on the concept of ‘futures’ in technology assessment research, Rheinberger gave a lecture on the ambivalence of the future in the sciences. This was followed by a session on the future of urban nature, in which Saha combined a thoroughly scientific presentation with personal reflections and a discussion of emotional aspects of human-plant relationships in an urban context. Schroer, in turn, offered a geo-sociological perspective on the city as a forest, while Hanske spoke about plants following humans like a second nature and what this botanical migration means for the future of cities. Already in this session, there was a remarkable interweaving of excellent academic presentation, emotional appeal and lively discussion. In the evening, Mira read from their novel NEONGRAU, as a cyberpunk reading with sound. Bodily experiences in light of technification were reflected and enacted. This was followed by Kevin Mooney’s reimagination and musical performance of fragments of *The World, the Flesh and the Devil* (1929), a key text in the (pre-)history of transhumanism by the Irish scholar John Desmond Bernal.

On the second day, the exchange on key topics of our case study ‘From nano to neuro’ was continued with presentations by Coenen on past visions of the future of the human body such as the one of Bernal and their influence in today’s controversial discussions about neurotechnology and other fields of STI. Mira discussed science fiction as body revolution, and Okoko explained how futures can be created with input from disability studies. This was followed by sessions that focused on ecological challenges, the topic of our fourth case study. The first session dealt with soil with presentations by Hüttel, Scheunemann and Demuth who noteworthily all used humanising metaphors for non-human nature in their titles. The final session on the second day was dedicated to the topic of the rights of nature. Wesche explained key concepts and activities in this context, Maier presented a proposal on how to mediate in human-environment conflicts, taking the river Spree as her example, and Biegert discussed ‘the river in him’. In the evening, the Theatre of the Anthropocene and RambaZamba Theater performed *Anwälte der Natur*, a play mixing art performance and science communication in line with the programmatic of the [Theatre of the Anthropocene](#).

The third day started with a panel on cycles, in which Chatzidimitriou used the mythological figures of Prometheus and Dionysus to reflect on ecocriticism and the Dionysian today, Blanz and Khodabakhshi presented their work in material recycling, and Schnug described and warned about key ecological challenges. The final session was dedicated to the future of the arts and reflected on art-science collaborations, with contributions by Guse, Köck and Hauser. In the evening, the RambaZamba Theater performed *the world flames like a discokugel (styx spricht)*, a planetary end-time scenario.



Figure 1 Scene from the the world flames like a discokugel (styx spricht)

A core insight emerging from our activities is that **warranted public trust** in science and technology cannot be cultivated through information about science and technology alone, nor through simple promises of innovation, efficiency and societal usefulness. Instead, it **requires that STI become embedded in broader cultural transformations** – transformations that actively engage with legitimate concerns about technological trajectories, social inequalities, and our shifting relationship to non-human nature.

Within this context, the **arts do not serve as decorative outreach or illustrative support**. They offer **distinct epistemic and affective registers** through which the public can encounter science: by holding up a mirror to society, questioning dominant visions of progress, and provoking emotional resonance where facts alone fail to persuade. Artistic interventions can unsettle established narratives, open spaces for scepticism and dissent, and invite audiences into modes of engagement that are not limited to comprehension, but include ambivalence, critique, and imaginative speculation.

In our co-creation processes in WP4, we observed how these interfaces between science and art enabled **moments of reflection that would have been difficult to achieve within conventional formats of science communication**. This suggests that trust in science is not only a matter of facts and accuracy, but also of relationality, narrative, and the capacity to integrate alternative ways of knowing. **In this sense, art–science collaborations can play a key role in transforming how science becomes visible, discussable, and negotiable in democratic societies.**

3.5.3. Debating Trust and Distrust in Climate Science Through the iBreathe Installation

The **IANUS Art-Science event** was an expert workshop on trust, climate science, and science communication, organised by Radboud University in collaboration with the Maastricht Institute of Arts (MAIA). The starting point of this expert exchange was the *iBreathe* installation displayed at the [collective MAIA exhibition during the Dutch Design Week 2024 \(DDW2024\)](#). The *iBreathe* exhibit was the outcome of an earlier collaboration between Radboud University and the MAIA programme of interdisciplinary arts (iArts). This collaboration aimed to explore how artistic research might yield new perspectives on the science-society interface. The work on display was created by a group of 5 iArts students (Ariane Sinn, June Betten, Grace Peters, Lilla Jaroncinska & Nina Aichberger Feller) under the supervision of iArts coach Milla de Lange.

The IANUS Art-Science event brought together invited experts in fields such as science education and communication, art-science collaborations, socio-ecological interactions, philosophy and science policy. The workshop took place on October 24th, 2024, at the site of the MAIA exhibition (DDW2024, Eindhoven, NL). Invited experts visited the *iBreathe* exhibit, attended a presentation by the makers of *iBreathe*, and engaged in a discussion and exchange of perspectives between experts and makers. This in-depth exchange, moderated by Laurens Landeweerd (Radboud University), addressed the nature and origins of **trust and distrust in climate science**, the **role and responsibilities of science communicators** amidst a polarised public debate, and the potential contribution of *iBreathe* to convey alternative perspectives regarding these issues.

3.5.3.1. The iBreathe Installation

The *iBreathe* exhibit (Fig. X) consists of four components: a hollow plastic torso with green and white patches (“the corset”), a video projection showing a happening (“the event”), a large, densely printed printout (“the VOIDARC report”), and a video of an advertisement for the corset (“the ad”). The first three components are presented in a layered manner. The corset is placed on a pedestal in front of a white wall-high panel. On this panel, the video projection of the event is overlaid on the printout which is pinned on the panel. The printout spreads across two rolls of paper and covers the entire panel. On the right of this setup, there is a second pedestal with a screen and two white headphones attached. On this screen, the corset ad is being looped. The projection and printout are bathed in a purplish light while the ad references telemarketing commercials and has an obvious satirical quality.



Figure 2 The iBreathe installation as presented at the DDW2024 (photo by: A. Kallergi)

3.5.3.2. The Artists' Presentation

The IANUS Art Science event was opened with a presentation by the makers of *iBreathe*. The makers positioned their work in the methodological tradition of speculative design and explained each of the four components of the exhibit. As also shown in the video of “the ad”, the speculative world envisioned by the makers is faced with air pollution and lack of oxygen. A breath-restricting corset is proposed as the solution to preserving “our dwindling oxygen resources”. The presenters further explained that multiple corsets were supposed to be connected to each other via a chip and automatically regulate air allocation: the more people present, the less air one breathes. The “citizen assembly” event shown in the projected video was a performance of a fictitious citizen deliberation meeting taking place in this speculative world. At this happening, invitees were guided and instructed by an AI voice while the makers were facilitating the proceedings dressed in white suits and without speaking. The AI voice introduced the attendees of the event to the technology of the corset and asked them to reflect on this solution by means of non-verbal communication only, namely drawings. The happening concluded with the revelation that the organisers were rebels fighting against the corset and an after-talk with makers and attendees. The so-called “VOIDARC report” (Very impOrtant Ianus reseARch DoCumentation report), shown as a printout at the *iBreathe* exhibit, is the automatically generated transcript of the audio recording of the “citizen assembly” performance.

3.5.3.3. Highlights from the Discussion

The expert discussion kicked off with broad questions about the nature and origin of distrust in climate science. In their responses, participants indirectly referenced psychological aspects of distrust and affirmed that distrust does not necessarily stem from a rational evaluation of scientific facts. One participant commented that, in times of crisis,

people have little capacity to think of abstract things such as climate change and that often scientific facts feel as a direct and personal attack to one's belief system. Another associated distrust with unsafety: they defined trust as the psychological state of being securely attached and as a disposition developed in childhood. Yet another expert pointed out that perceptions of benevolence are a crucial dimension of trust. In general, the invited experts seemed to agree on a need for a more personal and tangible connection with the issue of climate change, which was seen as beyond one's personal experience or immediate interests.

A significant part of the conversation evolved around the challenges of science communication in the context of climate science. Specifically, participants pondered extensively about the use and role of emotions in science communication. Several participants remarked on the successful use of emotional and ideological content by extreme media. Extreme media also convincingly communicate that their interests align with those of their audiences. Participants observed that both progressive media and science communicators are wary of using emotional language or persuasive tactics (a no-go, a taboo). While participants stopped short of endorsing persuasive practices, they suggested that scientists should communicate more about their human side and that alternative ways of communicating facts (such as art, design, or spirituality) may be considered.

The discussion on science communication was enriched by references to the "citizen assembly" event, i.e. the dialogical space staged by the makers. Participants valued the possibility to engage an audience at the experiential level, i.e. via an actual and shared experience, as opposed to constantly receiving information online. They were also positive about the effort to engage an audience without the use of language. However, the work was also met with some scepticism, with participants questioning the intentions and success of the work. Finally, one participant welcomed the use of humour for climate change communication, especially as an alternative to the depressing narratives that accompany this subject.

When explicitly asked about the capacity of the work to reach climate sceptics, invited experts hypothesised that the work may make those audiences feel more understood. One participant noted that anti-vaccine publics felt strongly about a loss of their freedom. The covid masks in particular (and the feeling of suffocation they were associated with) became a symbol for taking one's freedom away, which resonates with the breath-restricting corset of *iBreathe*. Another participant remarked that sceptics may identify with an element of rebelling against authority traceable in the work. Finally, it was remarked that it is precisely these audiences who need to be engaged differently, i.e. not at the level of language.

In conclusion, the IANUS Art-Science event resulted in an engaging discussion that reaffirmed the limitations of fact-based climate science communication. The expert responses and reactions point to a pressing need for and a strong interest in emotional and experiential forms of engagement. *iBreathe*'s proposition to exploit **silence and nonverbal communication** was welcomed by the experts, especially with regard to highly distrustful audiences for which rational or fact-based argumentation is ineffective.

4. The IANUS Media Panel

In our project proposal, we argued that **media coverage has paramount relevance for public confidence, trust and distrust in STI** and therefore defined a major task on this topic in IANUS WP4, the **IANUS Media Panel**. In our co-creation work, we thus involved science journalists and other science communication professionals as a key expert stakeholder group. Furthermore, we engaged with activists who have on the one hand gained a large extent of public visibility beyond the traditional media and are on the other hand often negatively impacted by the **new ‘structural change of the public’** (to borrow the Habermasian term), a change that is driven forward mainly by **social media platforms** that have recently become the object of massive political and cultural conflicts and controversies (e.g. in the case of X, formerly Twitter). In our work for the IANUS Media Panel, we profited from results of the IANUS case study and co-creation work in WP4 that was described in Section 1 of this report and other IANUS work – and, vice versa, fed results of our IANUS Media Panel work into them.

Following conceptual work and literature studies, we conducted **national IANUS Media Panels** – focusing on Germany (with 19 panels), but also, to gain insight into diversity within the EU, in Italy and Lithuania – as an integral part of our efforts to understand and improve trust in science communication. The primary goal of the national IANUS Media Panels was to systematically analyse and discuss the results of our conceptual and literature-based work on such topics as media representation, expertise and authority, public perception, misinformation, communication strategies, institutional trust, social media influence, cultural context, public engagement, and historical context. By engaging with experts from diverse backgrounds and experiences, we gained comprehensive insights into the complex dynamics of trust in science in contemporary society. Methodologically, we used in the co-creation activities **anonymised group discussions and interviews**. In the national IANUS Media Panel activities in Germany, participants, which included young science student journalists, professional journalists in a variety of outlets, and science communication professionals from a major German non-university research association, highlighted concerns about media representation, and in particular noted changes in trust since events such as the first election of Donald Trump and the COVID-19 pandemic. An important lesson learned was that the **wide variety of work contexts in journalism** – from highly respected media outlets that have for decades shaped public discourse in Germany via the traditional yellow press / boulevard to newer outlets that are open to political fringe positions and sometimes spread obvious disinformation (and from journalists only rarely and peripherally dealing with STI issues to specialised science journalists)– creates also a **diversity of different trust and mistrusts relationships**, within journalism itself and between the media and citizens. We identified a number of **key topics for further**

discussions such as transparency and accountability, translation and simplicity in communication, the promotion of diverse voices and inclusivity, the improvement of science literacy, collaborative approaches to science communication, ethical reporting of research, addressing misinformation, challenges posed by generative language models, the role of editors, and navigating the distinction between science journalism and science PR. We furthermore identified needs to more deeply reflect on the **impact of the Covid-19 pandemic** (rise of misinformation, need for transparency and critical thinking), to have a **long-term perspective** (evolution of public trust, changes in the media landscape), to consider more strongly that journalists have to deal with challenges resulting from **individual socio-economic pressures** to balance institutional loyalty (or chances to get published as a freelancer) on the one hand and journalistic integrity on the other hand, and, finally, to critically reflect on the overall pressure, also in established media outlets, to bow to sensationalism due to **online journalism's 'clickbait' attention economy**.

As regards the **impact of the pandemic**, a German journalist whom we interviewed on the changing perception of trust in science in German society, said: “The pandemic heavily politicised science. [...] the overlap between media, politics, and science during the pandemic blurred these lines, leading to public confusion. Media should work harder to clarify and contextualise scientific findings to help the public navigate [...] complex issues.” Like other journalists we spoke with, she has experienced numerous threats and even experienced some physical aggression.

From a **long-term perspective**, discussions within the IANUS Media Panels suggest that we may be witnessing a **profound transformation in the architecture of the public sphere**. Social media and other digital platforms have evolved into arenas of intensified participation, shaping new modes of audience engagement and reconfiguring traditional journalistic authority. At the same time, these **platforms have become critical sites of political contestation, vulnerable not only to state-sponsored manipulation but also to the interventions of a new generation of media magnates** who blur the boundaries between technological entrepreneurship and political power – most visibly in the U.S. context. This dual character of digital media – as both **enabling democratic engagement and facilitating algorithmically amplified mis/disinformation** – raises urgent questions about the conditions of trust in contemporary knowledge ecologies and the responsibilities of communicators and institutions navigating this shifting terrain.

Against this backdrop, we organised **the IANUS 'Journalism's Impact on Public Trust in Science' workshop** in Berlin on February 25, 2025. The event gathered

researchers, journalists, and a wider variety of professionals, practitioners and activists to discuss the role of media in shaping public perceptions of science, as well as the challenges posed by misinformation and digital transformations in the media landscape. It provided an interdisciplinary forum for examining the relationship between journalism and scientific communication. Dana Mahr (IANUS partner KIT) opened the workshop by situating the discussions within the larger framework of the IANUS project. She outlined the evolving role of journalism in mediating scientific discourse and emphasized the need for critical media engagement in an era of information overload and misinformation. Drawing on insights from the IANUS media panels, Mahr highlighted key challenges and opportunities in contemporary science communication in different European contexts. She underlined the **urgent need for interdisciplinary and transdisciplinary collaboration to ensure accurate and responsible dissemination of scientific knowledge**. The event opened with a keynote lecture on “*Investigative Journalism and Scientific Integrity*.” Investigative journalist Brian Deer delivered an in-depth presentation on his investigative work uncovering fraudulent scientific claims, focusing on the infamous 1998 study by Andrew Wakefield that falsely linked the MMR vaccine to autism. Deer's meticulous investigation revealed that Wakefield had manipulated data and failed to disclose significant conflicts of interest, leading to widespread public fear and a decline in vaccination rates. Deer's findings were instrumental in the full retraction of the original study by *The Lancet* in 2010 and Wakefield's subsequent removal from the UK medical register. The ensuing discussion delved into the **critical role of investigative journalism in exposing scientific misconduct, the ethical responsibilities journalists bear when reporting on complex scientific issues, and the broader impact it has on restoring public trust in scientific research**.

Afterwards, the first session, “*Journalism and Science – Prospects for Collaboration*” saw political Journalist Katja Thorwarth and Dr. Moritz Post (author, journalist, media critic) explore the complex relationships between journalism and academia, focusing on the potential for constructive collaboration while acknowledging the inherent tensions that can arise in communicating scientific knowledge to the public. The discussion examined the **expectation that journalism should present an objective and accurate representation of scientific advancements**, while also recognising the **constraints imposed by editorial priorities, economic pressures, and the evolving media landscape**. A significant point of discussion was the **politicisation of science in media representations and how such framing influences public perception**. The session further emphasised strategies for fostering more effective engagement between journalists and scientists, advocating for greater transparency, accessibility, and mutual understanding in science communication. The second session was centered around “*Whistleblowers, Science, and Public Credibility*” and explored the

role of whistleblowers in exposing issues of public concern. Patrick Reitz (whistleblower, former event technician) shared insights from his own experience and discussed the broader legal and ethical framework for whistleblower protection. The discussion included an **examination of Strategic Lawsuits Against Public Participation (SLAPPs), the impact of digital media on whistleblowing, and the evolving role of social media as a platform for disseminating information** outside traditional journalistic channels. The third session, *“Disinformation on Social Media – Challenges and Responsibilities”* delved into the **proliferation of disinformation on social media and its detrimental impact on public trust in science, particularly in relation to transgender healthcare**. Journalist and Trans activist Janka Kluge highlighted how **social media platforms, particularly X/Twitter**, have become **arenas of anti-trans narratives and misinformation**, leading to widespread misconceptions about transgender healthcare and identities. She highlighted the **role of algorithms** in amplifying such misleading content, as these systems often prioritize engagement over accuracy, inadvertently promoting sensationalist and harmful narratives. Kluge also discussed the **limitations of current platform moderation** policies, noting that they often fail to effectively curb the spread of transphobic misinformation. She shared her personal approach to addressing these challenges, which involves **engaging in dialogue with people who hold opposing views**. Despite the emotional toll, Kluge believes that open conversations can build understanding and potentially reduce the spread of misinformation. The session highlighted the need to improve digital literacy to enable users to critically evaluate online information. It also called for the development of more robust moderation policies by social media platforms to combat the spread of harmful content, thereby fostering a more informed and inclusive public discourse. The following session, *“Trust in Science in a Post-Election Context,”* saw Stephan Anpalagan, a German theologian, journalist, and managing director of the non-profit consultancy *Demokratie in Arbeit*, examining the ways in which political discourse influences public trust in science, particularly in the wake of Germany’s recent federal elections. The central theme of his talk was the **role of xenophobia and exclusionary rhetoric in shaping societal divisions, including its impact on scientific debates**. Anpalagan highlighted how political narratives can reinforce public skepticism toward expert knowledge, contributing to the erosion of trust in scientific institutions. He underscored the **increasing entanglement of scientific facts with ideological positions**, demonstrating how discussions on climate policy, public health, and social justice often become battlegrounds for political identity rather than spaces for evidence-based decision-making. The discussion also examined the responsibilities of scientists, journalists, and policymakers in counteracting these trends by fostering inclusive, transparent, and fact-based communication in public discourse. The fourth session focused on *“Expertise,*

Authority, and Addressing Misinformation.” Silvio Duwe, a reporter for the important German public TV investigative program *Kontraste*, addressed the ethical responsibilities journalists bear when reporting on scientific topics, particularly in the context of sensitive health-related issues. Duwe drew upon *Kontraste*'s investigative work concerning claims about "Vaccine-Acquired Immunodeficiency Syndrome" (VAIDS), a purported condition suggesting that COVID-19 vaccinations could lead to immune system deficiencies. This concept has been widely discredited by the scientific community. *Kontraste*'s reporting critically examined the origins and dissemination of such misinformation, highlighting the role of certain legal professionals in promoting unfounded fears about vaccine safety. The session underscored the **necessity for journalists to possess a robust understanding of scientific principles to effectively counteract misinformation**. It also emphasised the importance of adhering to ethical standards that prioritise public health and informed discourse, especially in an era where misinformation can rapidly proliferate through digital platforms. The final session covered a presentation on “*AI and Journalism*.” IANUS partners Eva Paraschou and Maria Michali (Aristotle University of Thessaloniki) introduced an AI-driven methodology for analysing political discourse, applied during the 2023 Greek elections (see above: Section 1.3. of this report). This collaborative project, conducted with iMedD (incubator for Media Education and Development), used advanced AI models, including OpenAI's ChatGPT, to perform algorithmic analyses on pre-election speeches delivered by six Greek political party leaders. The analysis focused on identifying prevalent topics, assessing sentiment, and evaluating levels of polarisation and populism within the speeches. The project aimed to provide a comprehensive understanding of the political landscape and to evaluate the efficacy of large language models in political speech analysis. The discussion highlighted the capabilities of AI in processing and analyzing large volumes of political text, offering insights into rhetorical strategies and public messaging. However, it also emphasised the limitations of AI, particularly concerning contextual understanding and potential biases inherent in language models. The presenters underscored the necessity of human oversight to interpret AI-generated data accurately, ensuring that automated content analysis tools are used responsibly and effectively in journalistic practices. The “*Public Trust in Science*” closing panel of the workshop examined contemporary challenges and future directions for researchers and media practitioners. Contributions by Rebecca Richter (legal expert in fake news), Christopher Coenen (political scientist of IANUS partner KIT), Alfonso Pantisano (civil rights activist, Queer Berlin Liaison Officer of the Berlin senate) and Andrej Reisin (media critic, *Funk*, *Übermedien*, *Tagesschau*, *Zapp*) addressed key themes of the workshop, discussing practical measures to reinforce public trust in science. The conversation highlighted **legal approaches to misinformation, ethical frameworks for journalism, and strategies for enhancing engagement between scientific**

institutions and the wider public. The outcomes of this event will serve as a basis for future interdisciplinary collaboration and encourage further dialogue between journalists, scientists and policy makers to develop sustainable solutions for strengthening scientific credibility in the public sphere. Furthermore, a number of academic and popular science **articles** (in English and German) already exist as drafts submitted to journals or are under preparation, with (in the English-language articles) such topics as “Between Distrust and Manipulation: Cognitive Biases, Social Dynamics, and the Spread of Conspiracy Theories About Philanthropists”, “Trust Under Siege in an Age of Misinformation – A Comparative Study of Germany, Italy, and Lithuania”, “We are torn apart by various “truths”: Perspectives of German Science Journalists on Current Controversies that Challenge Public Trust in Science”, and “Trust Under Fire: Science Journalists’ Role in Navigating Misinformation and Public Perception”.

In addition to academic and other written dissemination of results, we also organised two **public events** in the city of Karlsruhe (Germany). One of them was an interactive workshop titled “What Happens When We Trust Scientists – or Don’t?”, held in TRIANGEL Transfer | Kultur | Raum in Karlsruhe on February 5, 2025, organised and moderated by Dana Mahr and Meike Hebich (of IANUS partner KIT). A key feature of the workshop was the “**Who Do You Trust?**” **Barometer**, where participants (almost 20 persons) used a sticker-based voting system to express their level of trust in different science communicators. The aim was to explore which professions in science communication are perceived as trustworthy – and which are not. The results revealed distinct trust patterns:

- **High Trust** was given to individuals associated with traditional media and established institutions, including weather presenters, science journalists (TV, radio, print) and news anchors, medical doctors, fact-checkers, science teachers, scientists featured in documentaries and even authors of popular science books and science-focused podcasters.
- **Mixed Trust** was recorded for press officers at research institutes.
- **Low Trust** was observed for political and digital influencers, including science advisors to policymakers, science-focused social media influencers, ministers of science and education and YouTube/TikTok science creators.

The findings from and discussions at the workshop underline the **need for transparency, engagement, and participation in science communication**. In an era of digital uncertainty, clear, accessible, and interactive communication strategies are essential to counter misinformation and maintain public trust in scientific expertise.

5. Conclusions and Outlook

What are **overarching conclusions** that we can draw from the thematically, methodologically and socially very diverse case studies and co-creation work in IANUS WP4? And how can they be useful with regard to future studies and social co-creation activities on the topic of trust in science?

The **Covid-19 pandemic** and the **political developments in the USA in particular**, but not only, were and are **‘stress tests’ for the relationship between science and society**. The pandemic was a time when large sections of society were forced to take ‘crash courses’ in medico-scientific literacy and in understanding the complex interactions between science, society, the public and politics. These crash courses took place in the midst of what can be described as a **new ‘structural change of the public sphere’, fueled in particular by social media and AI**, as well as **unprecedented changes in the international political order and challenges to liberal democracy**, in which state actors, political parties, social movements and powerful individuals are reshaping the meaning of truth, reason, social cohesion and relationships between science and society.

A key lesson learned in the work in IANUS WP4 is that the **complexity of trust and mistrust relationships** between social actor groups, between institutions, between citizens and institutions, within institutions and organisations and within society as a whole requires analyses of these relationships as well as designs of co-creation activities that refrain from simplistic dichotomies and do justice to the diversity of perspectives and interests. Often our conclusions take the form of ‘on-the-one-hand-on-the-other-hand’ statements. We hope that, rather than, by that, avoiding the difficult questions, we can provide answers that **help society to chart a course towards public reason, respectful, truth-oriented discourse and a new form of social cohesion that accepts diversity without exacerbating social polarisation**.

A first conclusion relates to the topics of the discourse on science, technology, society and the future. We continue to believe that it is extremely important to **strengthen the capacities in society to question any overselling of technoscientific developments** and to **critically engage with problematic visions of the future** in this context – and we do this all the more so in light of current developments in the US

and elsewhere, at a time of a **massive change of traditional relationships between political authority, scientific evidence and public trust in science and political authorities**, in particular in the most politically powerful and also scientifically leading state, the US. This massive change can be illustrated by the figure above, which is a screenshot of parts of a post on the “private” X account of Robert F. Kennedy Jr., United States Secretary of Health and Human Services, from January 2025, in which he reposts an attack by right-wing influencer Ian Miles Cheong on the prominent scientist Anthony Fauci, commenting “More made-up science. If you doubted it back then, you were ridiculed as anti-science, censored, silenced. Now it becomes clear: ‘trust the science’ really means ‘obey authority.’” At the time of writing, this post is identified by the IANUS Crowdsourcing Observatory as [the most popular X post \(tweet\) on the topic of trust in science](#).



Before addressing the systemic shifts in the entangled dynamics between political authority, scientific knowledge, and public trust, let us take a step back and return instead to the **topic of transhumanist and other far-reaching socio-technical visions of the future**. While our initial project design anticipated a continued critical engagement with speculative ethics and transhumanist far-future visions, our empirical work – especially within the co-creation activities – led us to a reorientation. We found it both necessary and urgent to **focus more on the lived realities of technology users who are routinely marginalised and mis- or underrepresented in STI discourses**. These users – often framed as passive endpoints of innovation at best – rarely fit the prototype of the ‘engaged citizen’ imagined in many participatory formats: they may not be middle-class, academically educated, or non-disabled, and the context of their labour and embodiment remain invisible in science communication and RRI activities. Yet precisely these **perspectives are crucial for responsible and responsive innovation**.

A core insight emerging from our work is that sustainable trust in science and technology must be built through materially grounded, inclusive engagement practices – for example in such areas as neuroprosthetics, or human-machine interaction in manual labour. This demands a paradigm shift: **participatory formats must move beyond the usual**

academic comfort zones and be redesigned to accommodate epistemic diversity and embodied difference.

Looking at the massive change in the traditional relationships between political authority, scientific evidence and public trust in science and political authorities, it is clear that transhumanist and similar **technofuturism** has not only become politically radicalised and largely anti-democratic right-wing but is now also influentially **combined with pseudo-egalitarian conspiracy thinking** that is directed against liberal and presumably left-wing elites. This combination is epitomised by Elon Musk. Importantly, **the attack on reason, which entails an attack on science, is often conducted in the name of ‘true’ science**, it is an **anti-science furor masquerading as a defense of science**.

The IANUS consortium itself is highly interdisciplinary and indeed transdisciplinary, and so the lines of conflict regarding this potentially epochal change were also felt between us. Particularly in our case study and co-creation work on the discourse on climate change, we learnt that the **social and institutional embedding of science in this discourse is often at odds with the ideal of a detached and value-free science**. Within the IANUS consortium, those of us who work in the tradition of science and technology studies (STS) as it has developed since the 1960s tend to be very critical of the latter ideal. On the other hand, this ideal also appears to some of us as something to be defended as we are confronted with a massive attack on traditional notions of reason. In IANUS we therefore always look at trust in a way that distinguishes between **warranted and unwarranted trust and mistrust**. We therefore argue that **problematic features of the societal embedding of science** – such as cases of illegitimate industrial or policy influence on science, which are often structurally determined and regularly criticised by citizens involved in our co-creation activities – should not be ignored in our type of research and especially not in co-creation activities.

On the other hand, this research should **avoid giving even more attention to malicious actors** such as conspiracy entrepreneurs (from Elon Musk to small profiteers of the crisis of the democratic public sphere). One of the key lessons from our work for WP4 is that **new ways need to be found to increase the scientific literacy of citizens**, and that this must **above all involve an understanding of the ‘scientific method’**, or, more precisely, **the different scientific methods and basic assumptions** in different disciplines and **how interdisciplinarity works or does not work**.

We thus make a plea for **greater transparency of, and reflexivity in our own practices**. When dealing with citizens, they should always have at least a basic understanding of the political economy of the science system, including the working conditions in it. Traditional target groups of science communication, academically educated people from the middle or upper-middle classes, generally have such a basic understanding. However, many other citizens lack it and are therefore prone to positive distorted images (e.g., the disinterested scientist in an ivory tower) and negative stereotypes that feed into conspiracy thinking (e.g. the mad, evil or elitist scientist). At the same time, these and other citizens often have legitimate doubts and concerns, for example, about who benefits from STI and who does not. As members of society, who often pay taxes, they have a right to an **unfiltered picture of how the science system works**. Such transparency and self-reflexivity appear to us as a key to address such citizens' doubts and concerns and to successfully deliberate on them. Here, too, we have to walk a fine line: these citizens often apply a **heuristic of suspicion similar to that of some of our traditions**, for example in STS, but which often can slip into conspiracy thinking. **Transparency concerning our work and openness with respect to our own doubts and concerns**—for example, regarding the massive shift underway in the relationships between science, politics, and society—may enable us to become more often **trustees for these citizens**, who might then be more willing to listen to us when we present scientific evidence and advocate for rational approaches to discourse on social, ecological, and political challenges.

Here, too, we walk a fine line. If we are not accepted as trustees as long as we play the role of the politically disinterested researcher, if **credibility** in the public sphere hinges on more than just adherence to the ideal of value-free science – and if the disinterested researcher is no longer perceived as a trustworthy figure – then a more engaged, even **activist stance** may seem not only legitimate but necessary. As articulated by several of the scientists and science activists we interviewed, such a stance need not undermine epistemic authority. On the contrary, it can signal consistency of values and a deepened commitment to societal relevance.

Yet this shift is not without friction. Especially within publicly funded participatory research, we carry the **professional responsibility to create inclusive deliberative spaces that account for plural, and sometimes conflicting, viewpoints**. An un-reflected activist stance may jeopardise this plurality. One of the key lessons learned, therefore, is the importance of clarifying the layered positionalities of researchers – as epistemic agents, public intellectuals, citizens, and potential advocates. There is a **growing need for nuanced professional guidelines** that enable researchers to navigate these entangled roles responsibly: to act politically without

eroding scientific trustworthiness, and to engage ethically without claiming false neutrality.

For science communication, ELSA, RRI, and any form of publicly funded research, it is in any case **crucial to recognise that the societal conditions for science are changing massively**. More frequent consideration of these conditions together with other citizens, e.g. in co-creation activities, may however contribute to public outrage against science and, as we have argued, can easily be instrumentalised to discredit sound scientific findings. This **conflict between two metanarratives about science** (positivism on the one hand and social constructivism on the other) is a **key element in the ongoing struggle about the future** of science, technology and society, which has become a **dramatic global conflict**. In such a time, co-creative and any ELSA and RRI research should **not ignore the crisis of trust among scientists and science communicators concerning public discourse and significant segments of society**, in particular in the context of the societal discourse about the Covid-19 pandemic but also with respect to such fields as biotechnologies. It is our mission to help society better understand and benefit from science. However, this does not mean that the concerns of scientists, even if only as citizens, are neglected. Scientists—and also journalists who report on scientific topics—are increasingly being targeted and attacked by those who seek to destroy democracy or are incited by them. **Practical solidarity with these scientists and science communicators** is a prerequisite for a relationship of trust between science and society. In this crisis of democracy, it is also **morally unacceptable to adopt the stance of the value-free scientist in controversies in which anti-science forces pose as pro-science and endanger citizens**. The current attack by the US government on transgender and other queer people is, as many commentators have pointed out, essentially a genuinely fascist scapegoating, the malicious singling-out of a small minority. Likewise, the increasing attacks on the human dignity of non-citizens and even citizens with family backgrounds in the Global South will increasingly force co-creative researchers to take sides.

Our experience with participatory and co-creative research activities has shown that conventional notions of **research ethics** – such as informed consent, confidentiality, and neutrality – though indispensable, do not sufficiently capture the ethical complexities of entangled research settings. In these settings, the boundaries between researcher and participant, observation and intervention, are often blurred.

This calls for an **expanded, reflexive and evolving ethical framework** that addresses the situatedness, relationality, and political value of co-creation. Rather than viewing ethics as a static checklist, we understand the ethical framework of such research

as an evolving set of commitments that must be continually negotiated with participants and partners – **especially in contexts where engagement borders on activism.**

Looking back, it becomes clear that the ethics protocol developed at the start of the project – while appropriate in a formal sense and working for the purposes – could have been revised in light of our experiences. **Future participatory, co-creative projects** should explicitly integrate more strongly such questions as how **power asymmetries** can be acknowledged and addressed, what forms of **reciprocity** are expected, and how can researchers remain accountable in **long-term, trust-based relations that extend beyond the data collection phase?**

As we have also found again in our case study work for IANUS WP4, **trust in science is heavily influenced by both engrained, long-term cultural context, as well as short-lived political trends.** Current political trends are rather exceptional and thus massively change the conditions of trust in science too. **Trust or distrust in science can be overlaid by the notion of trust or distrust in governments or ‘experts’ in general,** as science and scientists are either directly ‘used’ by policy-makers to justify specific decisions, or indirectly implicated in that they are perceived as being part of an elitist club of few decision makers. This is not a balance that is purely influenced by two factors, though, since **the media** too can play an important role on how trust/distrust in science and governments is distributed within society. There is still a widespread trust in science and scientists, even if the latter are not working in public research institutions but in companies. In the second half of the twentieth century, there were two public spheres – the elite one, supported by quality newspapers, TV and radio, and the popular one, supported by the boulevard press and entertainment TV and radio. Issues of science were a feature of the former, less so the latter. Today, in the wake of the multimedia revolution, the rise of social media platforms, and the declining quality of the press, **a cacophony prevails in the public sphere.** And in the current massive crisis of democratic societies, **science is often the subject of heated political debates, usually in the context of so-called ‘culture wars’.**

Technological aspects of these developments are an obvious focus for endeavours to strengthen warranted trust in STI. We thus argue for measures to **raise awareness of how AI and LLMs work, are used and could be used.** Research organisations can further raise awareness of AI’s capacities and potentials within the population, also by intensifying public engagement activities. On the other hand, a stronger involvement of citizens can ensure that user-responsive developments are taking place, avoiding ‘ivory tower’ approaches. **Different attitudes of citizens towards stakeholders** (e.g. public universities and the industry sector) should be taken into account here.

Last but not least, we have learned a variety of lessons in the **art-science collaborations** within IANUS. In light of our research results, we argue that **experiential engagement** should be further fostered. More science communication initiatives should be designed that engage audiences experientially, moving beyond information delivery to shared experiences that connect with individuals on **personal and emotional levels**. Emotions, storytelling, humour, and the human side of scientists could be incorporated more often into science communication to foster relatability and counteract the dominance of socially and politically polarising media narratives. **Non-verbal expressions** may more often be used as alternative mediums to communicate complex issues, particularly when addressing sceptical audiences. It is not only in these collaborations that **art and science** are to be understood **as two different approaches to the world**, sometimes incompatible, sometimes not. They are not in all aspects on an equal footing, but there is no general hierarchy in terms of what they can tell us about reality and the future. Where science accepts such a **non-hierarchical understanding of human creativity** it may also regain the trust of some citizens that it has lost in recent years.