**NÓRA FALYUNA, KATALIN FEHER,
MÁRTON DEMETER, GÁBOR SZÜDI,
JOSEPH E. USCINSKI**

Against Disinformation: Bridging Science and Public Discourse

The Science and Society Research Group at the Ludovika University of Public Service organised a conference in Budapest on 13 October 2023 titled: 'Science and disinformation: how science can support society against disinformation'. The conference explored the complex relationship between science, society, and disinformation. A panel discussion was held with the aim of examining the challenges and strategies for science communication in the context of the ever-increasing issues of dis-/misinformation. The discussion highlighted the multifaceted factors that influence public trust in science; the role of digital culture on science communication and scientific knowledge production; the impact of artificial intelligence; and the relationship between science and business developments on science disinformation, especially on science-related conspiracy theories. The participants helped shed light on how science communication strategies can be improved to stabilise trust in a multi-stakeholder information environment. This article summarises the main insights and conclusions from the discussion.

Keywords: *conspiracy theory, digital technology, disinformation, science communication, scientific knowledge*

Author Information

Nóra Falyuna, Ludovika University of Public Service
ORCID: 0000-0002-5636-903X, E-mail: falyuna.nora@uni-nke.hu
Katalin Feher, Ludovika University of Public Service
ORCID: 0000-0003-3293-0862, E-mail: feher.katalin@uni-nke.hu
Márton Demeter, Ludovika University of Public Service
ORCID: 0000-0002-9888-9682, E-mail: demeter.marton@uni-nke.hu
Gábor Szüdi, Centre for Social Innovation (ZSI)
ORCID: 0000-0001-8006-4052, E-mail: szudi@zsi.at
Joseph E. Uscinski, University of Miami
ORCID: 0000-0003-2179-6952, E-mail: uscinski@miami.edu

1. Introduction[1]

Interpreting the effects of disinformation or misinformation has been a key issue in recent years with the ever-increasing spread of dis-/misinformation. The reasons and circumstances for the phenomena of disinformation and misinformation are complex. First, there have been many changes, for example, in the nature of publicity and the construction of reality, the range and behaviour of communication actors, the way information flows, who holds information power, the structure of trust, the credibility of information sources, the development of digital technologies, the expansion of global communication possibilities, and in the world seemingly entering a 'post-truth era'. Concerns have been raised as disinformation and misinformation can significantly affect a range of issues, including public opinion, social conflicts, trust in institutions, crisis management, capital accumulation, corporate reputations, and information warfare (Feher and Veres 2023; Lazer et al. 2018; Tandoc 2019). If one considers some significant world events of recent years, for example the COVID-19 pandemic (see e.g. Islam et al. 2020), these have seemingly favoured the spread of fake news, science disinformation, conspiracy theories, and a wide range of misleading information that it could be crucial to tackle. While proposals for solutions to tackle these issues are multifaceted, it is essential that experts on the subject who represent different disciplines should work in cooperation and communicate with each other to find working solutions. There is also a vital need for strategies for more effective communication between science and society. Indeed, in today's information society, effective science communication is increasingly relevant for dealing with disinformation and misinformation. It can also improve the relationship between science and policymakers, industry and the market, civil society, and different academic disciplines. Besides this, effective science communication can strengthen the role and support for science in society and reduce the social alienation of science (for these points cf. e.g. NASEM 2017). Finally, it could support further tech-based or AI-driven solutions as they emerge in the future (Feher et al. 2024).

The public's understanding of science and conversely, how science comprehends society are equally important today, as is the understanding the phenomenon of disinformation in the modern era, which could help facilitate the cognitive 'inoculation' of people and public participation in science communication and the social engagement of scientific actors (Falyuna 2022). However, the study of such things and the practices that support them also requires a complex approach.

On 13 October 2023, the Science and Society Research Group of the Ludovika University of Public Service organised and held a conference in Budapest titled: 'Science and Disinformation: How can Science support Society against Disinformation?' (Harangozó 2023). This event focused on the complex relationship between science, society, and disinformation. The key focus was on the impact caused by the spread of disinformation, fake news, conspiracy theories, and pseudo-scientific or anti-scientific beliefs on public opinion, social publicity, and social trust in institutions. Disinformation as a weapon was discussed in its relationship to information and cyber security, as well as in the context of applications of technology, with a particular focus on artificial intelligence (AI), considering the debates on these issues in social, political, scientific, and media discourse.

Additionally, the conference panellists highlighted various potential practical solutions, particularly in regard to science communication, and the role of science in policymaking, media/platform regulation, content management of social media, and the development of information, and digital and media literacy.

In the comprehensive, interdisciplinary panel discussion at the conference, five experts explored the challenges and opportunities for science communication based on the latest research. Below, we present the panel discussion, which focused on the following key topics:

- the issue of social trust and distrust in science;
- the logic of conspiracy theories, especially science-related conspiracy theories;
- the factors and circumstances that influence society's perception of science;
- the impact of digital culture on science communication and the processes of scientific knowledge production;
- the impact of artificial intelligence technology on science, disinformation, trust, and credibility;
- the issue of the relationship between science and business.

That session was attended by the present paper's authors, namely Nóra Falyuna, whose main research area is science communication, pseudoscience and anti-science, and disinformation in digital communication; Katalin Feher, whose main research area is AI media, generative AI, and sociotechnical systems and their ethics; Márton Demeter, whose main research area is science metrics, publication networks and strategies, academic knowledge production, and communication and media studies; Gábor Szüdi, whose main research area is the knowledge economy, social innovation, research and innovation policies, and science communication; and Joseph E. Uscinski, whose main research area is political science, public opinion, and mass media, with a special focus on conspiracy theories.

2. Science communication in a (dis)information society

2.1. Social trust and distrust in science

Nóra Falyuna: Let us begin by discussing the topic of conspiracy theories. At the conference, one of the key focuses was the impact of conspiracy theories, which

have become increasingly intertwined with disinformation and misinformation. As misinformation becomes increasingly problematic, it is essential to consider how science should communicate and how trust, or distrust, in science can manifest. The potential consequences of science-related conspiracy theories are significant because they can erode trust in science and its fundamental tenets. As such, it is imperative that this issue be addressed with care and attention to ensure that society remains informed and engaged with science. Professor Uscinski, what do you think the link between conspiracy theories and trust in science is?

Joseph E. Uscinski: People pick and choose their conspiracy theories, so very rarely do people who distrust science distrust all of science. Here is a good example: People who say they do not trust Big Pharma or the medical establishment might not get vaccinated, but if they were to break their femur, they would go straight to a hospital, they would get a cast, and they would not say, 'I do not trust big plaster, so I am not going to get a cast, and I will just let it heal naturally'. But when it comes to something like vaccines, they will say, 'Oh, I do not want to get the vaccine. It is unnatural, and I do not trust them. They just want to make money from me, and I only like natural things'. So people always pick and choose which science they like and which science they do not like. There is rarely if ever a distrust of all of science. In some sense then trust matters, but it is important to know where and when people choose to direct their trust and distrust. Often there are organised groups, political leaders, or people in the media who attract audiences that have distrustful views and then focus those audiences on something specific. Same thing with people who say, 'Oh, I do not like genetically modified food', but then eat all sorts of things that are equally modified and probably not great for their health. They apply their distrust wherever they see fit at any given moment.

Nóra Falyuna: Today's information societies face a paradox regarding the relationship between science, society, and disinformation. Although expertise is highly valued and in demand across all sectors, the credibility of scientific claims and trust in experts is being challenged (or they have a limited impact on public opinion, see e.g. Klofstad and Uscinski 2023), particularly in the online public sphere. This begs the question: Can we identify the factors and circumstances that shape trust in science and society's perception of science? Also, is there a widespread distrust of science? Moreover, what new questions could arise for science communication due to these factors and circumstances?

Márton Demeter: It was during Dr Szüdi's presentation on the TRESCA project that we realised that we need to change our idea of science as the sole basis for decision-making. It is much better to recognise that science should inform the public, and it also has the potential to inform policymakers. However, this is no longer the only possible perspective. As scientists, we must acknowledge and understand this. I believe the first step is to recognise that we need to change our perception of science and scientists. Only then can we consider if and how we can influence society itself.

Katalin Feher: Trust is an issue in this context. How can we translate a complex subject for society? This task is absolutely essential and a notable challenge in the scientific domain. Reflecting on the early months of the COVID-19 pandemic, there was a clear demand for accurate information from scientists and politicians, highlighting the importance of their collaboration despite them not always finding common and trusted ground. Often, disagreements and conflicts of interest came up. In this context, social media influencers and people claiming to be experts tried to make their own space, which added to the confusion. Scientists, in response, were compelled to defend their prestige through effective communication, while navigating the political landscape and the surge of various experts appearing on social media, ranging from genuine experts to mere amateurs on COVID-19. This scenario highlighted the urgent need for a deeper understanding of what had transpired and the adoption of risk-management strategies, a concept derived from business studies, but equally vital in anticipating societal and environmental risks. With well-crafted plans and guidance, scientists can be better equipped to face new risks and potential disasters, maintaining their crucial role in informing and protecting society and building societal trust.

Gábor Szüdi: OK, let me go back to the first recommendation of the TRESCA study. There was a very optimistic part in it saying that the reputation of scientists would increase. That was what we thought at the beginning of the COVID-19 pandemic. I am not so convinced about that any longer. We were trying to stress this evidence-informing aspect, which I think is very important. The question is: How can you communicate evidence not just to policymakers, but also to the general public? For instance, it is really challenging to communicate uncertainty in science because – as you have said – people want clear-cut answers, which we do not have. And let's not talk about social sciences because these usually do not deal with life and death issues, but COVID-19 was really about life and death. And there are different opinions on how to communicate uncertainty. Some say that we should not communicate it at all, and others say that we should, but in a way that is not oversimplified. It should rather show people proof that you cannot be absolutely certain of things but could still showcase scientific consensus. I think this honesty could lead to a better appreciation of science in the long term.

Joseph E. Uscinski: So, I am not shocked that almost 20% of Americans have not received even one COVID shot, but I am amazed that 81% or 82% did, because I find that trying to get anyone to do anything is like herding cats. Many people do not want to do what they are told to do. In a classroom, if I give an assignment to my students, half of them will do it, some will turn it in on time, some will turn it in some other time, and some will do it completely wrong. And that is in a situation in which I have methods to make them do things, because there will be negative consequences if they don't, like getting a poor grade. So the fact that 80% of people in my country (US) actually went and got the shot was shocking, because I just did not think that would have been achieved, especially with what had been going on up until that point. I think we should reframe the questions. Instead of: 'Why aren't people doing what they are supposed to do?', we could ask: Why did so many people do what they were supposed

to do? Which I think is a really neat thing. Furthermore, I would add that we (on this panel) are not 'normal' people. We are in the top 1% of the world's most educated. We are not 'the average Joe on the street.' If we want to know about climate science, we can talk to climate scientists. If we want to think about data, we can examine the data ourselves. Probably, we know people who work in vaccines, climate science, and in every branch of science. We know these scientists, and we understand them. Furthermore, many of us in this room even know politicians, and we occasionally interact with them, and we say, 'Oh yeah, they are normal people just like us'. But 'Joe on the street' does not have access to us or other scientists or the politicians we have access to. To regular folks, they see these distant, faceless, nameless institutions, people they do not know and will never meet or interact with and they say, 'Who are those people and why should I trust them?' So, the question is not really, why do people distrust these things? Sometimes, I wonder why they would trust Congress at all. Why would they trust the NHS or the CDC at all? Because they do not know them, and they do not interact with them. I think maybe one thing going forward is we ought to start thinking about how we can make people feel empowered and then give them more access to scientists. They would hopefully then say, 'Oh, yeah, they are normal people, not part of some plot to stick a tracking device in my neck'.

Nóra Falyuna: Dr Szüdi, you are contributing to the VERITY Horizon Europe Project, the aim of which is to strengthen public trust in scientific research, to encourage informed decision-making based on scientific evidence, and to promote a better relationship between science and society. Could you share some details about the VERITY project and its achievements so far in achieving these goals?

Gábor Szüdi: VERITY is an acronym derived from the long project title of 'developing scientific research with ethics and integrity'. It is about trust in science. It builds on the results of the TRESCA project, but I think the main difference here is that we also want to check the influence of other, non-traditional stakeholders in science. For instance, people such as influencers, social media platforms, and their interaction with other stakeholders. And I think that is something that has not been really been taken into account until now. We started only last September, but we already have some results on the state-of-the-art sources of mistrust in science. We research not only how people perceive issues such as COVID-19, but we are also focusing on increasing numbers of other topical issues, such as global warming or moving forward to carbon neutrality. We check how stakeholders work together around these scientific issues to address mistrust. We call this 'the ecosystem of trust', which I think is a nice term. For example, we organised a workshop with journalists in Austria, and they all told us that they feel neglected, and feel that they are not as essential as they used to be because people are increasingly getting their scientific facts from social media or influencers. This can be problematic because, of course, there is no gatekeeping function in social media, which they had provided. The question is how we can we solve this? We could implement a hard-line solution and, of course, ban content or introduce some restrictions on social media. Or we could start to understand how to involve these social media influencers in solving this problem. We

could start some normal conversations on these scientific issues. The whole process should lead to a so-called protocol that contains recommendations for the whole ecosystem, not just for academic people. The recommendations will go to the Commission, so hopefully, they can find some substantiated information for their own people, too.

Nóra Falyuna: And what are the main differences between VERITY and the other Horizon 2020 project TRESCA?

Gábor Szüdi: The objectives are similar, but as I have said, approached from a more systematic view in the case of VERITY project. We want to understand the reasons for mistrust in science and to identify the right methods to deal with them. In terms of methodology, the projects are similar in that we use various participatory approaches, such as workshops or focus groups. At the end of the projects, we would like to write various articles and produce policy recommendations. The main difference in VERITY is this ecosystem view. For instance, in TRESCA, when you check the work packages, one is about policymakers. Now we are trying to bring all the stakeholders together in each task, which is a challenge, but I think it is the way forward because these people should cooperate with each other. If we really want people to believe more in scientists and policymakers, then that is even more difficult than, for instance, increasing trust in journalists. So, I would again just say that we all need to work together, which differentiates this from previous projects. The partnership is also different. Previously, for instance, we had a partner on board producing videos, so that was a bit more visual.

2.2. Advantages and disadvantages of digital technology in the production of scientific knowledge

Nóra Falyuna: Digital culture has had a significant impact on the production of scientific knowledge, with open science and public access to preprint publications being notable examples. These developments have facilitated real-time, global communication and collaboration in the scientific community, making it easier to share knowledge with the public (Fraser et al. 2021). However, the availability of preprint publications during the COVID–19 pandemic has been linked to the spread of misinformation (Koerber 2021). This raises the question of how the scientific publishing process can be compatible with situations where science has to react and communicate quickly.

Márton Demeter: Science should not provide answers hastily; originally, being fast was not part of the scientific self-definition. It is a connection with business, markets, and the neoliberal logic of academia, of which I am keenly aware because I work in the science publishing industry. Thus, I frequently discuss ways of expediting the publication process. While there are methods for publishing more quickly, being fast was not originally part of a scientist's self-identity. This inclination towards speed

reflects a capitalist ideology that everything should be treated as a product. It's intriguing that we now talk about science production or the production of science, treating papers as productions that somehow measure the productivity of individual researchers and institutions, universities, and countries. Perhaps we should not prioritise publishing hastily. Moreover, I would like to emphasise that we are not 'normal' in the sense that, as scientists, we want to provide the truth. I am not sure if our perspective applies to all of society, as people may seek fun, and many other things not directly related to what we provide. So, we can offer solutions promptly, but in many cases it may not be what the audience truly needs. To illustrate, during a recent talk show on Hungarian television discussing vaccination, five professionals, all in life sciences, biologists, etc., provided different perspectives. In the end, when asked which vaccination they recommended, each suggested a different type, Astra-Zeneca, Pfizer, etc. Even these five scientists could not agree on the best option. For scientists, such disagreements are common in conferences, but it can be confusing for the general public, who are seeking solutions and peace of mind. The production of science is uncertain, and it is unclear whether it can provide solutions for the general public, who may not even need the information in many cases.

Joseph E. Uscinski: When you think about these two institutions, science and government, these are two institutions that are predicated on distrust. Peer review was built on the idea that you have to convince other experts of your ideas, you do not get to publish them just because you want to. Democratic societies are built on the idea that we should have a healthy scepticism of our leaders. So it is very difficult to then turn around and say, 'Well, you should trust government all the time', because you really should not trust government all the time; and you cannot say you should trust science all the time, because even we do not trust science all the time. Good scientists have a very sceptical view of everything they read, particularly if they are peer reviewing. And I really like the example that you just gave. I think it may be even worse than that, because during the COVID-19 pandemic random doctors were coming out of the woodwork in the US saying things like, 'Oh no, this is all made-up, and you can cure your COVID if you just walk barefoot on a sandy beach'. In that sense, people can follow political leaders and experts and still be wrong if they pick the wrong experts and leaders.

Gábor Szüdi: On the VERITY project, I had an interview with a person working in a field related to trust in science, and he told me that this whole trust in science is something that we should abandon because you should not trust science at all. You should always be sceptical about science. I understand this point of view. I would not abandon trust in science, but there should be healthy scepticism about all these things. What is interesting, and we must also be aware of it, is that even people who say they do not trust science do trust some people or some organisations. So, science is a very abstract concept. However, if I ask you, do you trust Joe is telling you the truth, they would say, 'Of course, but I do not trust this whole COVID-19 business at all'. So, if you go down to a smaller, more personal level then I think the situation is not so bad, that people do not trust science. But then again, coming back to what we were discuss-

ing, I think that you shouldn't lie about the uncertainties. For example, if you are not sure which vaccinations are best, then you should tell them, 'Yeah, we have these and these facts and we are working on it', because otherwise it can just cause confusion and even mistrust. We are also seeing this with other topics, such as climate science.

Katalin Feher: Considering science as an abstract concept allows people to seek facts and information, yet perceptions of what constitutes science vary widely. For some, science is epitomised by prestigious accolades, such as the Nobel Prize, reputable journals, and recognisable scientific brands. These elements symbolise science in specific contexts. However, the significance of science in policymaking diverges, perhaps only intersecting in aspects like the influence of notable brands, which can serve as a common ground. Nonetheless, the scientific research process – characterised by extensive, often decades-long studies and the necessity of revising and expanding knowledge continually – may seem too gradual and intricate for the fast-paced demands of policymaking. This difference in pace is particularly evident in the slow peer-review process, where the acceptance or rejection of research findings can take several months. Failures and rejections, while common in the scientific process, are typically invisible to the public, who may only see the success stories and prominent figures in the field.

Gábor Szüdi: That is why I consider open science to be very important. There is the Open Research Europe platform where you can publish more quickly. It is also the Commission's intention that researchers will publish something within the project framework within 2–3 years, but the peer review bit comes afterwards. We submitted the TRESCA results on that platform, and received many questions from the editors, for instance, about the methodology. Afterwards, we were published, but the peer-review process has still not concluded after one and a half years, but the preliminary project results are available to the public. I think that is also something that we must decide. Do we want the results to be published more quickly, or do we want to publish only what has already been peer-reviewed? Otherwise, we are going to be in the situation once again where even the best intentions of open science could lead to controversial results, due to which people may not trust science. Scientists have said, not just from social sciences, but also from medical sciences, that they cannot publish negative results. I am not against open science, but I see here the drawbacks, quite frankly in terms of the trust in science for the general public. If we publish very controversial scientific results very quickly, without putting them into context, then that could foster mistrust in science.

2.3. Impacts of artificial intelligence technologies on science, trust, and disinformation

Nóra Falyuna: AI technology is a subject that typically requires both scientific and technological expertise. As a leading researcher in the field of the socio-cultural impact of AI technology, Professor Feher, I have a question for you. During a recent

roundtable discussion, it was brought to our attention that new technologies challenge science (Feher et al. 2023). Specifically, how will AI technology affect society's perception of science and trust in information sources, and what does credibility mean in this context? Additionally, I would like to hear from others on the potential impact of AI technology developments on the content or logic of conspiracy theories expressing distrust, on disinformation or misinformation spreading, on the way science works, on its publication, and on research processes and norms. Moreover, how the market, policymakers, and science can communicate effectively with each other about the impact of AI technology.

Katalin Feher: The first point addresses the use of AI tools in scientific research. While there is a clear need to integrate more AI technologies for enhanced scientific inquiry, a significant barrier currently exists due to the commercial focus of these tools. Many AI applications ideally suited for scientific advancement are predominantly accessible to the industrial sector, and when available to the academic sphere, they are often gated behind expensive paywalls. This financial barrier discourages many universities from investing in advanced AI services, which thus challenges scientific progress. The second point delves into the potential of generative AI, particularly in enhancing the dissemination and visualisation of scientific work. Generative AI offers a promising avenue for scientists to communicate their findings more swiftly, clearly, and engagingly (Watermeyer et al. 2024). However, as highlighted in a recent comprehensive analysis published in *Nature* (Med 2023), there are both advantages and drawbacks to employing generative AI in scientific communication. Beyond the concerns of plagiarism and the automated generation of derivative content – which risks diluting originality in scientific discourse – generative AI presents an opportunity, especially for researchers who are not native English speakers, to efficiently translate and adapt their findings for broader dissemination. Yet, this innovation faces resistance from major publishing houses, which may view the democratisation of content creation and distribution as a threat to their traditional business models. This tension points to an upcoming challenge for the scientific community as it deals with the changes that may be brought by generative AI. Also, the financial aspect of these AI models is being questioned. A Business Journal article mentioned that the costs of developing and maintaining generative AI systems are higher than the money they make. This implies that there might be changes and adjustments in how we share and use knowledge and information in the future, as we figure out how to handle these new technologies.

Márton Demeter: When discussing whether AI poses a challenge for science, I find it confusing because it can indeed pose a challenge for individual scientists, but it is unclear in what way. AI can efficiently collect data, perform logical analysis, and interpret results based on that data. Logically, these activities are integral to science itself, and they are not something foreign or distinct from science; they are parts of its beauty. For instance, I may analyse 100 papers in a month, but AI can analyse a million in a second. So, the problem lies in the potential harm or challenges that AI poses to individual scientists. We need to ponder on and discuss humanity's role in

science because if artificial intelligence can perform all tasks more efficiently and cost-effectively than we can, then we must redefine our role in the entire system. For instance, in one presentation, the author discussed scenarios where Chat GPT writes a theoretical framework for a paper. However, one of the crucial features of science is that the results do not depend on the author. This underlies the logic of peer review, which is why it should be anonymised. The identity of the author is not interesting in a scientific context. What matters is whether the paper is methodologically sound, if the interpretation aligns with the evidence, etc. The author's personal details, such as income or ego, do not pertain to scientific questions; they belong to a different realm, such as business and promotion, which are part of a distinct social reality.

2.4. Trust and credibility issues around the relationship between science and business

Nóra Falyuna: Technological developments are increasingly shaping everyday life, and scientific research supports this. This impact extends to the relationship between science and business, or industry, and how science works. For example, with the industrial–technological support of science, one of Merton's classic norms, that science is disinterested (Merton 1973 [1942]), is not unconditionally applied. We must consider how the connections between science and industry or business actually affect the working of science and the process of knowledge production, as well as the trust in science. Furthermore, do these links manifest themselves in science conspiracy theories or in anti-science beliefs (e.g. anti-vaccine and anti-5G beliefs)?

Joseph E. Uscinski: I have been asking ChatGPT to develop conspiracy theories, and it is pretty good at it because it makes ones that are far more creative than those most of the conspiracy theorists tend to come up with. Let me flip the question though. I think if you look back in time, you will find that there has been fear about every new technology and method of communication. If you go back 100 years, people were saying, 'Oh my God, people are reading too many novels', and then it was 'people are reading too many newspapers', 'people are listening to the radio too much and it is going to bring about the end of society because their radios are full of bad information'. And then it was 'oh, TV is destroying our youth'. And you could keep going, and now it is 'oh, it's the Internet, and social media is destroying everything'. I read a headline just the other day saying ChatGPT girlfriends are now destroying an entire generation of men. Like, really, where are all these men that have been destroyed by AI girlfriends? At the same time, there are people on X saying that everyone has to stop doing AI research now, and if anyone is doing it, we should immediately scramble jets to go blow up the computers with missiles. I mean, some of the fear-mongering about this has been insane, and it is just a continuation of every other thing that people were afraid of it and said, 'Oh, it is the new thing, and this is what is going to end it all'. I guess what you said about our new role in science is a little bit unsettling, which I think we will all have to come to grips with. Once we are able to tell AI, 'Hey,

here is this massive data set, go write some papers'. And then you have them, then what am I supposed to do for work?

Márton Demeter: I think what scientists need is a better understanding of how the media operates. Currently, I reflect on a century-long journey with all the knowledge presented through the media. However, scientists, including social scientists, are not aware of this. They are not learning how to communicate within the logic of mass media because it is fundamentally different from scientific logic. When we as scientists attempt to navigate social media or any other form of media, we often do not grasp its logic, leading us to fall behind superstars or influencers who understand media logic better. My question is whether we should change our logic or, once we enter the media realm, adapt to its logic. This seems somewhat generational; for younger generations, it is evident that to communicate effectively in the media or with policymakers, each has its own unique logic. I believe that is something the scientific community should address alongside redefining the role of scientists. Of course, funding agencies can contribute; many grant applications now require you to consider how you will present your results to the general public, or write reports for policymakers. With funding, anything is possible. Either the scientific community initiates discussions on the role of scientists in modern societies or, following a more capitalist approach, funding agencies will make it mandatory. Researchers might need to align their research with mass media logic, engaging in activities like writing blogs, participating in social media, appearing on television, and communicating with the general public. They would also need to understand the logic of politics and communicate their findings to policymakers. If funding becomes contingent on these activities, researchers may find it more effective than relying solely on philosophical discussions.

Gábor Szüdi: One journalist on the VERITY project said that we are in a transitional period of media. I also think it is the end of the traditional media as we have known it for a hundred years. You can try to fight against it, but it does not make sense. The question arising from all these new projects about trust in science is how to regulate social media. I am an economist dealing with political sciences, so I am more for nudging people. However, actually, in some cases, you have to regulate. Otherwise, I think that nudging is a better way to make people communicate with each other. The projects funded by the Commission have clear guidelines on open science and the obligation to do it, which will have spill-over effects in that other people will also practice open science. We need to initiate changes by bringing people together to talk with each other, and find out what their problem is and what we can do to find ways to change communication because social media will not go away. We were talking about artificial intelligence. That is something which is changing rapidly and developing into something new. When we started the VERITY project, there was much less attention paid to it, and now we see that everybody wants to be engaged in it. So, these things will not go away, and I think it would be better that something comes from the bottom up than top down to make social media more human-centred.

3. Conclusions of the speakers

Nóra Falyuna: To close the discussion, let us summarise with a message: What are the biggest challenges and opportunities for an effective cooperation model in today's complex, multi-stakeholder information networks and information societies?

Joseph E. Uscinski: Looking back at my youth, I started out really liking science. Then I got into politics, and then I started denying lots of science, and now, I would not say I like politics, even though I am stuck in political science. However, now I like science again, as I pay less attention to politicians. There is an interesting lesson in that. Most people do not listen to scientists because they do not have direct access to them. They listen to politicians, and when politicians talk about science, oftentimes they get it wrong. But they have a megaphone that is 100 times bigger than the megaphones scientists have. Which is why there is climate denial. It is not that the people who deny climate change were dropped on their heads as kids, or that there is something wrong with them. It is just that they are listening to the person with the megaphone, and what that person says makes sense to them because they have been hearing it for 30 years. It is just common sense for them. I would hate to go down the road of scientists becoming a bunch of YouTube influencers, where we have the responsibility to do the study, doing our best to find truth, and then have to build a YouTube audience. But maybe that is where we have to go because we have to develop an audience for ourselves that is not just ourselves and each other. If we want people to trust us and like us and believe us, not following every scientific finding that comes out but at least the things where there is some consensus, then we have to do a better job of being opinion leaders, and as much as that frightens me, leaving it to politicians is not necessarily a great alternative either.

Katalin Feher: We would need at least one semester, if not a whole master's programme, to teach this subject properly, highlighting the importance of education. This is not limited to university-level learning but extends to younger generations, including those who started their schooling during the pandemic, who are often called 'COVID kids'. Young children and older students who had to navigate their first jobs remotely, an unprecedented beginning that will have influenced their grasp of scientific communication and technology. The second aspect of my response focuses on AI technology, a central theme in my research. The question is how can we leverage technology across the board – not only for future generations but also for our contemporaries and seniors. A simple example comes from a friend in the data science industry who appreciates the persuasive power of technology, who shared how a straightforward online interaction convinced him of the effectiveness of AI. This story illustrates the broader conversation about how we, as scientists or industry professionals, can engage with technology and its applications. The real question is about the value of using technology effectively and meaningfully. If we manage to do so, it could enhance scientific communication and potentially ensure scientific institutions' survival and relevance in an evolving landscape.

Gábor Szüdi: I think what is coming out of the VERITY project is that scientists, journalists, industry representatives, and policymakers need to work together to address mistrust in science. That is very difficult because we will all have to leave our safe space, otherwise things will not change. So, we will surely need to get used to some resistance to change. However, I think the industry people and policymakers should be more open to each other and towards average people and try to cooperate more because technology is really important, but I think humans are even more important in this equation. Being more open and cooperative goes a long way, but I hope this will happen more often in the future.

Márton Demeter: I think the most important thing is to understand human nature better. It might sound philosophical, but it is essential because we need to stay connected with people. Ignoring this can lead to bad news if we lose touch with what they want, need, and like. This holds true not only for scientists but also for politicians. Another perspective is that humanity is not synonymous with science. Science is artificial, so our mission is to find out if there is something that remains human in science in the future or if we need to change professions and pursue something more aligned with the nature of the majority of the population. As scientists, we have to be realistic.

4. Afterword

Due to the sophistication of the phenomena of deception and manipulation, their potential effects, and the development of technology, the literature describing and investigating the complex phenomena of information disorder and information manipulation is extensive. The panel discussion at the 'Science and disinformation: how science can support society against disinformation' conference, which focused on the complex relationship between science, society, and disinformation, highlighted the importance of cooperation between science and society and between different disciplines, as well as the crucial importance of effective and credible communication. The discussion identified interdisciplinary theoretical and practical considerations that could promote the development of science communication research in the current academic, social, and technological discourse. These include, for example, cooperation between decision-makers and scientists (see e.g. Kang and Liang 2023), or between scientists and journalists (Pereira and de Oliveira 2024) for knowledge sharing to aid dealing with the impact of mis- or disinformation; understanding the role and the nature of the human psyche, information reception in the response to mis- or disinformation, and the effectiveness of science communication (Huang and Wang 2024); trust as a key concept for information security (see e.g. Bak and Kelemen-Erdős 2023); and information literacy (Rab and Török 2020), and thus for information credibility and science communication (Yang and Yang 2024; Lammers et al. 2024). Another important topic in the current academic, social, and technological discourse, which was reflected in the panel discussion on science communication and disinformation, is the socio-cultural impact of artificial intelligence

(see e.g. Héder 2021); its role in shaping mis- or disinformation, conspiracy theories, or distrust in science (Većkalov et al. 2023); and its possible relation with science communication (Henke 2024; Schäfer 2023). The currency of this topic is shown by the fact that the *Journal of Science Communication* dedicated a special issue to this topic, based on the Annual Conference of the "Science Communication" Division of the German Communication Association (DGPuK) at the University of Zurich on 6–7 June 2024.

References

Bak, Gerda, and Anikó Kelemen-Erdős. "Stressz, opportunizmus és bizalom a szervezeti információs és kommunikációs technológiabiztonság tükrében." *Információs Társadalom* 23, no. 3 (2023): 9–26.
https://dx.doi.org/10.22503/inftars.XXIII.2023.3.1

Falyuna, Nóra. "Science disinformation as a security threat and the role of science communication in the disinformation society." *Scientia et Securitas* 3, No. 1 (2022): 69–78.
https://doi.org/10.1556/112.2022.00086

Feher, Katalin, Nóra Falyuna, György Huszics, Viktor Lázár, László Papp, and Bence Ságvári. "MI-kihívások a média, kommunikáció és információs iparágakban." Kerekasztal-beszélgetés. *Egyesület a Marketing Oktatásért* és *Kutatásért*, September 21, 2023.
https://emok.hu/en/news/latest/643-report-on-the-2023-workshop-ai-challenges-in-the-media-communication-and-information-industries

Feher, Katalin, and Zoltan Veres. "Trends, risks and potential cooperations in the AI development market: expectations of the Hungarian investors and developers in an international context." *International Journal of Sociology and Social Policy* 43, no. 1/2 (2023): 107–125.
https://doi.org/10.1108/IJSSP-08-2021-0205

Feher, Katalin, Lilla Vicsek, and Mark Deuze. "Modeling AI Trust for 2050: perspectives from media and info-communication experts." *AI & Society* (2024).
https://doi.org/10.1007/s00146-023-01827-6

Fraser, Nicholar, Liam Brierley, Gautam Dey, Jessica K. Polka, Máté Pálfy, Federico Nanni, and Jonathon Alexis Coates. "The Evolving Role of Preprints in the Dissemination of COVID-19 Research and Their Impact on the Science Communication Landscape." *PLOS Biology* 19, no. 4 (2021): e3000959.
https://doi.org/10.1371/journal.pbio.3000959

Harangozó, Éva. "How can science help in managing disinformation?" Accessed 11 February, 2024.
https://en.uni-nke.hu/hirek/2023/10/25/how-can-science-help-in-managing-disinformation

Héder, Mihály. "AI and the resurrection of Technological Determinism." *Információs Társadalom* 21, no. 2 (2021): 119–130.
https://dx.doi.org/10.22503/inftars.XXI.2021.2.8

Henke, Justus. "Navigating the AI era: university communication strategies and perspectives on generative AI tools." *JCOM* 23, no. 3 (2024): A05.
https://doi.org/10.22323/2.23030205

European Union's Horizon 2020 Research and Innovation Programme. "TRESCA." Accessed 11 February, 2024.
https://trescaproject.eu/

European Union's Horizon Europe Project. "VERITY". Accessed 11 February, 2024.
https://www.verityproject.eu/

Huang, Yan, and Weirui Wang. "Overcoming Confirmation Bias in Misinformation Correction: Effects of Processing Motive and Jargon on Climate Change Policy Support." *Science Communication* 46, no. 3 (2024): 305–331.
https://doi.org/10.1177/10755470241229452

Islam, Md. Saiful, Tonmoy Sarkar, Sazzad Hossain Khan, Abu-Hena Mostofa Kamal, Hasan S. M. Murshid, Alamgir Kabir, Dalia Yeasmin, Mohammad Ariful Islam, Kamal Ibne Amin Chowdhury, Kazi Selim Anwar, Abrar Aahmad Chughtai, and Holly Seale. "COVID-19–Related Infodemic and Its Impact on Public Health: A Global Social Media Analysis." *The American Journal of Tropical Medicine and Hygiene* 103, no. 4 (2020): 1621–1629.
https://doi.org/10.4269/ajtmh.20-0812

Journal of Science Communication. "Announcing a special issue of JCOM on Science Communication in the Age of Artificial Intelligence." Accessed 4 June, 2024.
https://jcom.sissa.it/news/13/

Kang, Jen-Chun, and Chaoyun Liang. "Determinants of the backfire effect: Discrepancies between two groups with different political orientations." *Információs Társadalom* 23, no. 4 (2023): 38–57.
https://dx.doi.org/10.22503/inftars.XXIII.2023.4.3

Klofstad, Casey, and Joseph Uscinski. "Expert opinions and negative externalities do not decrease support for anti-price gouging policies." *Research & Politics* 10, no. 3 (2023).
https://doi.org/10.1177/20531680231194805

Koerber, Amy. "Is It Fake News or Is It Open Science? Science Communication in the COVID-19 Pandemic." *Journal of Business and Technical Communication* 35, no. 1 (2021): 22–27.
https://doi.org/10.1177/1050651920958506

Lammers, Wouter, Sacha Ferrari, Sylvia Wenmackers, Valérie Pattyn, and Steven Van de Walle. "Theories of Uncertainty Communication: An Interdisciplinary Literature Review." *Science Communication* 46, no. 3 (2024): 332–365.
https://doi.org/10.1177/10755470241231290

Lazer, David M. J., Matthew A. Baum, Yochai Benkler, Adam J. Berinsky, Kelly M. Greenhill, Filippo Menczer, Miriam J. Metzger, Brendan Nyhan, Gordon Pennycook, David Rothschild, Michael Schudson, Stecen A. Sloman, Cass R. Sunstein, Emily A. Thorson, Duncan J. Watts, and Jonathan L. Zittran. "The science of fake news." *Science* 359, No. 6380 (2018): 1094–1096.
www.doi.10.1126/science.aao2998

Med, Tem. "Why Nature will not allow the use of generative AI in images and videos." *Nature* 618 (2023).
https://doi.org/10.1038/d41586-023-01546-4

Merton, Robert K. "The Normative Structure of Science." In *The Sociology of Science: Theoretical and Empirical Investigations,* edited by Robert K. Merton, 167–278. Chicago: University of Chicago Press, (1973) [1942].

NASEM = National Academies of Sciences, Engineering, and Medicine. *Communicating science effectively: A research agenda.* Washington, DC: The National Academies Press, 2017. https://doi.org/10.17226/23674

European Commission. "Open Research Europe." Accessed 20 February, 2024. https://open-research-europe.ec.europa.eu/

Pereira, Fábio Henrique, and Raphael Sandes de Oliveira. "Journalists and scientists together: the public problem of science disinformation in Brazil." *JCOM* 23, no. 3 (2024): A04. https://doi.org/10.22323/2.23030204

Programme for the conference: "Science and Disinformation: How can Science support Society against Disinformation?" Accessed 11 February, 2024. https://ludevent.uni-nke.hu/event/3330/

Rab Árpád, and Bernát Török. "Online bizalom a magyar társadalomban." *Információs Társadalom* 20, no. 3 (2020): 92–98. https://dx.doi.org/10.22503/inftars.XX.2020.3.6

Schäfer, Mike S. "The Notorious GPT: science communication in the age of artificial intelligence." *JCOM* 22, no. 2 (2023): Y02. https://doi.org/10.22323/2.22020402

Tandoc, Edson C. "The facts of fake news: A research review." *Sociology Compass* (2019): 13:e12724. https://doi.org/10.1111/soc4.12724

Većkalov, Bojana, Aart van Stekelenburg, Frenk van Harreveld, and Bastiaan T. Rutjens. "Who Is Skeptical About Scientific Innovation? Examining Worldview Predictors of Artificial Intelligence, Nanotechnology, and Human Gene Editing Attitudes." *Science Communication* 45, no. 3 (2023): 337–366. https://doi.org/10.1177/10755470231184203

Watermeyer, Richard, Donna Lanclos, and Lawrie Phipps. "Does generative AI help academics to do more or less?" *Nature* 625, no. 7995 (2024): 450. http://doi:10.1038/d41586-024-00115-7

Yang, Zheng, and Tao Yang. "Differentiated Trust Strategies and Rebellious Acceptance: A Qualitative Comparative Analysis of the Trust Strategies Used by Scientist Communicators and Citizen Science Communicators in Chinese Online Climate Communication." *Science Communication* 46, no. 3 (2024): 247–275. https://doi.org/10.1177/10755470241230487