Trust in Science and Changing Landscapes of Communication

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About this Series

The ALLEA Discussion Paper series is an initiative to provide up to date and informed perspectives from the academic world on some of the most pressing issues facing societies across Europe and beyond. The objective is to contribute to and connect debates in the fields of science, society and policy. It serves as a transnational forum of the academies of sciences and humanities for outstanding scholars to present and discuss their work within ALLEA. Issues may draw on workshop reports, statements and position papers by ALLEA working groups or other ALLEA initiatives. The series provides an intellectual space to reflect on complex questions and potential solutions and seeks to inform policy decisions as well as the public debate.

About the ALLEA Working Group "Truth, Trust & Expertise"

The ALLEA Working Group "Truth, Trust and Expertise" is a platform for perspectives on the nature and relationship between truth, trust and expertise in the field of science and research. The expert group, chaired by Baroness O'Neill of Bengarve and Professor Ed Noort, aims to interrogate and explore current and past dynamics of public trust in expertise and contested norms of what constitutes truth, facts and evidence in scientific research and beyond. Central themes of the group include: the alleged loss of trust in science and evidence, questions of how valid knowledge can and should be acquired and communicated, and how different academic disciplines are dealing with these challenges.

About ALLEA

ALLEA (All European Academies) is the European Federation of Academies of Sciences and Humanities. It was founded in 1994 and currently brings together almost 60 academies from more than 40 countries in the Council of Europe region. Its Member Academies are self-governing communities of leading scholars and researchers across all scientific fields. Independent from political, commercial and ideological interests, ALLEA contributes to the improvement of framework conditions under which science and scholarship excel. Together with its Member Academies, ALLEA addresses the full range of structural and policy issues facing Europe in science, research and innovation. Via its interdisciplinary and international working groups, various public engagement activities, and by participating in pan-European projects, ALLEA informs European policy and society through evidence-based advice.

Executive Summary

This is the third paper in a series of papers analysing the trust-relations between science and society – central objective of the ALLEA Working Group Truth, Trust and Expertise. It is the outcome of various meetings and discussions with academicians and experts from all over Europe.

As the discussions in the previous papers reveal, trust means "deferring with comfort and confidence to others, about something beyond our knowledge or power, in ways that can potentially hurt us."[1] In order to establish and maintain trust in science, such comfort and confidence relies on communication by trustworthy and trusted mediators. That is why the objective of this Discussion Paper is to examine the relationship between trust in science and changing landscapes of communication.

This paper sketches the main challenges that the changing landscapes of communication pose for trust in science and expertise. It highlights the importance of trust as an integral condition for science to fulfil its role in society; it discusses the specific characteristics of trust in science as mediated communication; it asks the questions if, how and why trust in science is eroding; and it shows how this is related to transformations of media and communication in an increasingly digital society.

The technological, political and social changes underlying these transformations imply a whole new set of processes and mechanisms that we need to deal with in order to understand and tackle the challenges they pose. Although this is a very complex topic and the specific challenges analysed in this paper are by no means exhaustive, it can be concluded that the rise of social media and the platformisation of public discourse lead to specific trends that are challenging long-established trust-building mechanisms.

The trends identified in this paper are: a context collapse, a confirmation bias, and a polarisation push. These trends are linked to and partly reinforced by certain economic, political and social phenomena: 1) the corporatisation of communication, 2) computational propaganda, 3) an increasingly polarised political climate, and 4) the establishment of new forms of detecting and signalling trustworthiness. All of this has substantial consequences for the communication of science and could lead to a pluralisation that might threaten the core pillars of trust in science as well as media: integrity, transparency, autonomy and accountability of researchers and journalists.

It is a crucial task for researchers, journalists and other communicators of research to safeguard and reinforce these pillars in order to counter a loss of trust in and trustworthiness of science and research. They need to convincingly prove that a free and just society means a society in which all people are equal, but not all expressions are equally true. It is a society in which everyone should have unrestricted access to data and information, but also the opportunity and civic duty to acquire the skills needed to evaluate knowledge claims. This is why it is crucial to reflect on how we can effectively organise and defend a democratic digital society in which trust in expertise is anchored in longstanding and well-established standards – but wrapped in new mechanisms. Suggestions on how the research community can develop such mechanisms and overcome the obstacles ahead are sketched in this paper.

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1   Whyte, K.P. and Crease, R. (2010), Trust, Expertise, and the Philosophy of Science. *Synthese 177(3)*, 411-425, p. 412.

Introduction

Since antiquity, ethical and epistemic standards for communication have periodically been disrupted by technological innovations, then encapsulated and adapted by cultural as well as by legal and regulatory changes. However, the disruptions to standards of communication produced by the growth of online technologies over the last two decades seem to pose particularly great challenges, while at the same time providing new chances for deliberation and democratisation.

The rise of online and social media could, in principle, bring about a golden age of communication, as it offers unprecedented opportunities for a diversification of debates and for global platforms to exchange information with people from many social and cultural backgrounds. Science[2] and research in particular are facing a rapid development of new digital technologies and growing opportunities to communicate more directly with the public. Greater diversity and higher transparency could in turn, at least theoretically, strengthen trustworthiness of and trust in science.

Scientists and research communicators are confronted with a wholesale transformation of basic patterns of mediated communication that has not been fully understood and certainly does not seem to live up to these hopes (yet?). Quite on the contrary, recent political developments all over the world provide impressions on how digital media may instead be sowing false beliefs and distrust, or reinforcing certain ideological or political biases.

Two of the societal institutions that are affected by this transformation are science and media. Both rely heavily on trust and trustworthiness, albeit in slightly different ways.[3] That is why academics and media practitioners need to reflect not only on how people's ideas and the practices of policy-makers might be affected by changing landscapes of communication, but also how to confront these challenges when communicating science and evidence to a broader society. The shift has strong implications for researchers, but also for policy-makers, society and intellectual life more broadly. It means that researchers and academic institutions, to maintain and reclaim trust and trustworthiness, must rethink the way in which they present research to and engage with different publics.

The preceding ALLEA Discussion Papers have looked at different aspects of trust in science and expertise. While Discussion Paper 1 asks what constitutes trustworthy behaviour and how people place and refuse trust in science and expertise,[4] Discussion Paper 2 critically examines how science should be conducted in order to generate trust and trustworthiness *within* science.[5] Both trust *in* and *within* science depend to a considerable degree on mediated communication. That is why this Discussion Paper examines the relationship of trust in science and changing landscapes of commu-

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2   Throughout this paper, 'science' is used in its wider, *Wissenschaft* sense of the word, including all forms of academic research, and thus explicitly includes the humanities and social sciences.

3   Trust among scientists is an essential component of the conduct of science, but not all scientific endeavour is or should be meant to produce socially useful findings or to have societal consequences. Science is not monolithic. Different forms of science serve different purposes, we may rationally place trust in some science but not necessaritly in all, indiscriminately. Trust in science can mean many things, e.g. trust in science as an institution, a method, a set of norms, trust in its findings or its people.

4   See All European Academies (2018), Loss of Trust? Loss of Trustworthiness? Truth and Expertise today. *ALLEA Discussion Paper 1*. Online source: http://www.allea.org/wp-content/uploads/2018/05/ALLEA_Discussion_Paper_1_Truth_and_Expertise_Today-digital.pdf (accessed 08/01/2019).

5   See All European Academies (2019), Trust within Science. Dynamics and Norms of Knowledge Production. *ALLEA Discussion Paper 2*. Online source: https://www.allea.org/allea_discussion_paper_2/ (accessed 17/01/2019).

nication in order to inform researchers, journalists, policy-makers and the interested public on how to better communicate science and ultimately (re-) establish trust.

How are modes of communication changing? What are the implications of such changes for the communication of scientific evidence, and, most importantly, for trust in media and scientific expertise? Those are the guiding questions of this paper.

Trust and Science: A Mutual Relationship

Science is a specialised, expert endeavour that provides societies and policy makers with applicable and useful knowledge for societal and political decisions; at the same time, this knowledge is difficult to comprehend for outsiders. That is why public trust matters greatly for science: scientists will never be able to provide the public with full knowledge or control over their actions in a way that would make trust obsolete. Trust rests on science's (perceived) expertise, integrity (grounded in institutional checks and balances), and benevolence. In turn, without such trust in science, societies and their governments run the danger of taking decisions based on (more or less well) informed opinions rather than scientific evidence.

Trust is a substitute for knowledge and/or control – and not its synonym or its 'natural' outcome. Where one has complete information, evidence or proof, trust becomes redundant. Trust is anticipatory, because one must rely on anticipated actions of another person that one cannot be completely sure about or control. Trust is asymmetrical, because one must accept the mutual dependency on one another's expert knowledge as well as on someone's future actions. Although the

decision that leads to such an acceptance of interdependency can be based on rational considerations, it still involves a strong emotional aspect of showing confidence in an uncertain future. Finally, but not less important, trust is relational. It always involves a giver and a recipient of trust.[6] In this sense, trust can be understood as an "ego's acceptance of dependency on the outer world or the alter in the absence of [complete] information about the outer world or the alter's reliability."[7]

There is an important difference between trust *within* science and trust *in* science. Trust *within* science refers to trust among researchers, be it within a research project, academic discipline or the global research community. Due to growing specialisation and time pressure, "[m]odern knowers cannot be independent and self-reliant, not even in their own fields of specialisation".[8] This implies that scientists have to trust each other's competency, honesty and adequate epistemic self-assessment, meaning that they are explicit about what they can do and what they cannot.

Trust *in* science means people's trust in a societal institution, represented by a group of professionals that produce knowledge that is consequential for people's future wellbeing. Although trust *in* as well as *within* science are anchored in institutional checks and balances, such as critical peer review and methodological transparency, they are largely built on shared norms and values: "Knowledge is a collective good. In securing our knowledge we rely upon others, and we cannot dispense with that reliance. That means that the relations in which

6   Cf. Schäfer, M.S. (2016), Mediated Trust in Science. Concept, Measurement and Perspectives for the 'Science of Science Communication'. *JCOM 15(5)*, 1-7; See ALLEA Discussion Paper 1 for a more profound reflection on the relation of truth, trust, trustworthiness and expertise.

7   Engdahl, E. and Lidskog, R. (2014), Risk, Communication and Trust: Towards an Emotional Understanding of Trust. *Public Understanding of Science 23 (6)*, 703–717, p. 710.

8   Hardwig, J. (1991), The Role of Trust in Knowledge. *Journal of Philosophy, 88(12), 693-708*, p.693.

we have and hold our knowledge have a moral character, and the word [...] to indicate that moral relation is trust."[9] This shows the importance of the relational, but even more the epistemic and moral components of trust and trustworthiness.[10]

Over the past years, we have witnessed widely publicised attacks on science by (generally right-wing) politicians and commentators doubting its trustworthiness and integrity on the one hand, and, on the other hand, provoking a counter movement culminating in a 'March for Science' and countless other initiatives. Such counter movements explicitly promote the values and norms on which modern science is based, while also expanding coverage in (social and traditional) media of topics related to trust in science and, even more so, expertise.

All this may be taken as an indication of a decline of trust in science. However, major polls show that in modern democracies trust in science has generally not declined much. Empirically, it is shown to be high and stable over time.[11] This can be explained by several reasons, one of them being that there is a lack of differentiation in the polls between who the reference objects of trust are. We can distinguish between trust in science as a social system, in the scientific method, in scientific organisations, or in scientists themselves – and those are sometimes not even correlated.[12] People's answers in surveys also differ significantly depending on individual biases such as political ideologies, economic and social status and others,

as will be further discussed below. In short, claiming that there is a widespread and alarming loss of trust in science in all its forms seems inadequate.[13]

Trust in Science as Mediated Communication

Independent of questions about the extent of decline of trust in various aspects of science, the ways in which scientific knowledge is disseminated is a crucial feature of the relationship between science and society. The communication of science to non-scientists was hardly ever 'unmediated'. This means that trust has traditionally been mediated by technological and human intermediaries: journalists, media (in whatever form), and other science communicators. This 'mediatedness' of trust in science thus presupposes a double layer: trust in science/scientists is intertwined with trust in media/journalists. The questions if, how and why trust in science is declining are thus very much linked to the questions how and why trust in media has declined. While trust in the former may not have declined significantly (yet), the latter has been subject to significant changes.[14]

Trust in science is highly influenced by and dependent on (media) representations of its

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9   Shapin, S. (1994), *A Social History of Truth: Civility and Science in Seventeenth-Century England*. Chicago: University of Chicago Press, p. XXV.

10   For a more detailed discussion of trust *within* science, see ALLEA Discussion Paper 2.

11   See, e.g., Ipsos M.O.R.I. (2014), *Public Attitudes to Science 2014*. Ipsos Mori.

12   See, e.g., Achterberg, P., de Koster, W., & van der Waal, J. (2017), A science confidence gap. Education, trust in scientific methods, and trust in scientific institutions in the United States. 2014. *Public Understanding of Science, 26(6)*, 704-720.

13   See Discussion Paper 1 for a more elaborated discussion on whether there is a loss of trust in science and expertise that one should worry about. It highlights that refusing trust on the basis of reasoned scepticism and legitimate critique of particular directions in science and technology is not the problem, while it is the alleged loss of well-placed trust that we should be concerned about.

14   In contrast to science, trust in (news) media empirically declined in many Western, especially Anglophone countries. This is not a uniform picture all around the world, where in many parts trust in media looks to be on the rise. However, the challenges referred to in this paper should apply to most cultural and geographic contexts. See Hanitzsch, T., Van Dalen, A., & Steindl, N. (2018), Caught in the Nexus. A comparative and longitudinal analy-sis of public trust in the press. *The International Journal of Press/Politics, 23(1)*, 3-23.

protagonists and institutions, because there is mostly no or insufficient direct contact and exchange of information between scientists or scientific organisations and 'the public'. Knowledge about and perception of science are to a great extent derived from journalistic media. When it is meeting people's existing knowledge, values, political ideologies and identities, this mediated information can either build or diminish trust in scientists, scientific institutions, academic disciplines, or even the whole system of science. It is finally a triple configuration of trust in science: media themselves are also objects of (dis)trust and thus affect the trust in science by the public.[15] (see figure 1)

public debate, including dissent (balanced views where appropriate), physically separate news and paid ads, disclose interests, allow letters to the editor, and present rationally sound arguments. Those practical and ethical guidelines are thereby resembling professional codes for scientists to guarantee research integrity.[16] Both institutions rely on a system of institutional *checks* and *balances* — organised control that is crucial for creating and maintaining societal trust. Where scientists are geared toward creating *common ground* in mutual dialogue, journalism seeks *common sense*.[17]

Figure 1: Configuration of trust in science via media.
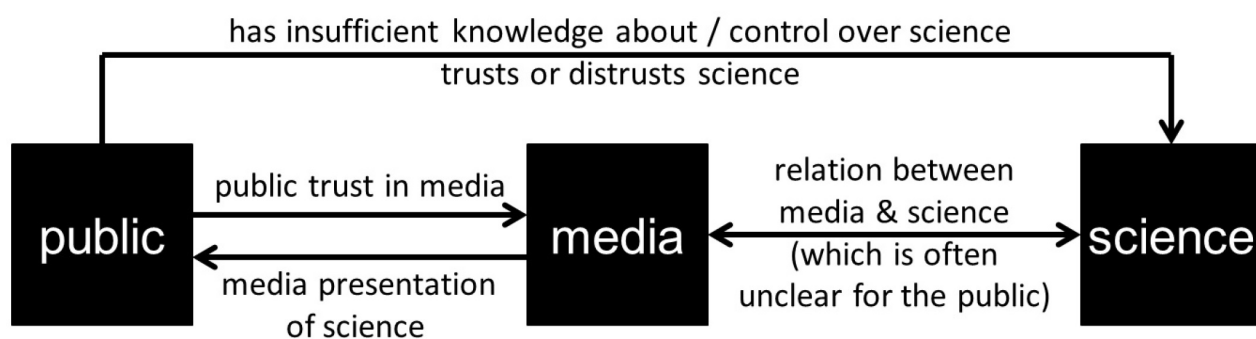
Source: Schäfer, M. S. (2016) Mediated Trust in Science: Concept, Measurement and Perspectives for the 'Science of Science Communication'. *Journal of Science Communication 15(05)*, 1-7, p. 3.

It is thereby important to distinguish the effects on trust in science and media as separate institutions, but especially focus on how they interact. Trust in media as a societal institution rests on the same pillars of trust as science does: integrity, transparency, independence and accountability. Both are based on institutionalised systems that have been crucial for societal trust. For instance, journalists working for trustworthy news organisations are supposed to (double) check facts, separate facts and opinions, sketch comprehensive

The interrelation between journalism and science has always been contentious. However, there are certain transformations in the field of communication that pose new challenges. First and foremost, there is an ongoing diversification of the (digital) media landscape, accompanied by a

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15   Cf. Kohring, M. (2004), *Vertrauen in Journalismus. Theorie und Empirie*. UVK Verlagsgesellschaft, p.165.

16   See, for instance, All European Academies (2017), *The European Code of Conduct for Research Integrity*. Online source: https://www.allea.org/wp-content/uploads/2017/05/ALLEA-European-Code-of-Conduct-for-Research-Integrity-2017.pdf (accessed 09/01/2019).

17   Cf. All European Academies (2019), GA Conference Proceed. Online source: https://www.allea.org/allea-conferenceproceedingsdigital/.(accessed 17/01/2019).

concentration of (conventional) media ownership.[18] The rapid technological development of the last decades has created entirely new dynamics, most notably the possibility for large scale dissemination of un-checked facts, rumours and propaganda through global channels of "mass self-communication."[19] However, this transformation is not simply caused by technological changes, but it is an intricate and complex relationship of socio-technological and political-economic changes relating to media, (the perception of) science, and public opinion (audiences).

Those socio-technological and political-economic changes impacting the landscape of communica-tion are not just a neglectable backdrop; they bring along a whole new sort of principles and mechanisms that we need to deal with in order to make sense of the danger they pose to trust in science. In the following sections, the central features of those transformations are identified, the main challenges they pose to trust in science are deduced, and suggestions on how to tackle those challenges are made.

Digital Transformations

The rapid rise of online platforms and social media has radically changed the way citizens and institutions communicate, and the way information is disseminated. Over the past 15 years, we have seen a profound shift away from traditional mainstream media towards digital and social media. The focus of public debate has shifted from traditional media (where debates

were mediated by professional journalists) to online media, in particular social media platforms such as Facebook, YouTube, Twitter and thousands of networked blogs. This shift has profound implications for how science is communicated and how we assess trust in science as mediated communication.

There are different types of social media that have become mediators of trust relations. They are often trusted as 'neutral' or merely facilitating tools, and hence have turned into powerful mechanisms for signalling trustworthiness. Consequently, social media can also affect the perception of trustworthiness and therefore trust in science. There are many rationalisations for these observa-tions that are prominently discussed. This paper, however, focuses on some significant trends. It makes sense of the changing media landscape in order to ultimately better understand the changing relationships of trust between citizens, science and media.

Context Collapse

Online sources for information about science are becoming increasingly important. They provide new, low-threshold opportunities to communicate. The public has access to a multitude of sources, which are ubiquitously available, often free of charge. While this seems to be an improvement, the credibility of such sources is more difficult to assess. The relationship between expert (scientist) and layperson ('ordinary citizen') has changed. Everyone can now generate, publish, and dissemi-nate information. Knowledge increasingly tends to be considered as something you can 'search and find' online.

Thereby it is often unclear who says what in which context and based on what authority or expertise, particularly if information is decontextualised from its original source and distributed through social

18   See, e.g., Schäfer, M.S. (2017), How Changing Media Structures are Affecting Science News Coverage. In: Hall Jamieson K., Kahan D. & Scheufele D. (eds), *Oxford Handbook on the Science of Science Communication.* New York: Oxford University Press, 51-60.

19   Castells, M. (2009), *Communication Power*. New York: Oxford University Press.

media. There is no established and reliable system of checks and balances in place. This phenomenon can be referred to as context collapse: in an online environment where everything is content, the truthfulness of text, image, and sound can often no longer be determined directly from the context. It thus also affects the authority of content, for example when scientific news on social media does not provide a 'scientific' or 'authoritative' context.[20] Information can sometimes be traced to recognisable organisations, but often users themselves will have to evaluate the reliability of a source. Assessing a source's validation, independence, and accuracy may prove difficult if it has all the outer features of a 'trustworthy' scientific source and users do not have the skills to see through them. So, while online users may feel empowered to conduct their own 'research' online, this should not be confused with an expert's evaluative knowledge – the knowledge and experience to weigh sources and information.[21]

Not only is communication about science being changed by online sources, communication within science is also changing. The whole debate around open access and the growing difficulty to assess reliable and high quality research is relevant here. How can a predatory journal be distinguished from a serious quality publication? What markers of peer approval should be used to evaluate trustworthiness? How are members of the public to judge the validity of scientific claims if the primary literature is controlled by commercial publishers and only available in expensive libraries or behind paywalls? Science, and scholarly communication more generally, need effective gate-keepers to eliminate fraud and guarantee high standards of

quality and research integrity, but the old print-based systems seem to be failing and it is not clear what should replace them.

Confirmation Bias

There is now more heterogeneous information from partly opaque sources with new contextual cues (likes, shares, comments etc.) that influence the perception of what is communicated. This requires us to take a closer look at the behaviour of human users of social media. A recent study published in *Science* revealed that social media users pay more attention to misinformation than to 'true' items. Moreover, many users let themselves be led by their prior knowledge or prejudice in assessing the value of a message.[22]

All this is partly due to a technical transformation, but with considerable social and political implications, as users start to rely heavily on information derived from their surprisingly isolated and self-reassuring digital communities. Such 'echo chambers' can produce feedback loops that may reinforce people's issue preferences and frames.[23] Trust is no longer anchored in institutions of media, but in networked communities and driven by platform mechanisms. As a result, users who already hold sceptical views regarding science may increasingly be exposed to content which confirms or even reinforces their scepticism. This is what is referred to as confirmation bias.

Growing distrust or scepticism towards science also does not necessarily have to be equated with

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20   For an extensive analysis and description of the concept of 'context collapse', see Davis, L & N. Jurgen-son (2014), Context Collapse. Theorizing Context Collusions and Collisions. *Information, Communication & Society, 17(4)*, 476-485.

21   See Nichols, T.M. (2017), *The Death of Expertise: The Campaign Against Established Knowledge and why it Matters*. New York: Oxford University Press.

22   See, e.g., S. Knobloch-Westerwick, B.K. Johnson, N. A. Silver & A. Westerwick (2015), Science Exemplars in the Eye of the Beholder. How Exposure to Online Science Information Affects Attitudes. *Science Communication 37(5)*, 575-601.

23   The issue of echo chambers is still contested because it is unclear whether they exist if exposure to information is taken as the indicator variable. If engagement with content is taken as indicator, then there is clear evidence for their existence, see, e.g., Garrett, R. K. (2017), The 'Echo Chamber' Distraction. Disinformation Campaigns are the Problem, not Audience Fragmentation. *Journal of Applied Research in Memory and Cognition, 6(4)*, 370-376.

a loss of trust in science. There are some authors arguing that trust and distrust are "not opposite ends of a single continuum" but "functional equivalents".[24] This could also offer an explanation for the apparent paradox that on the one hand studies are showing that trust in science remains high, while on the other hand concerns prevail that distrust towards science is on the rise. Apart from that, the absence of authorities and the presence of new credibility cues are positive developments of digital network communication, because they allow for credibility judgements that are not regulated by intransparent institutions but made by people themselves.

Polarisation Push

So-called newsfeeds are now dominating many people's daily routines in receiving information. In the US, for instance, almost 40% of the population receive their news via social media, mostly Facebook's News Feed function — a function that is designed on the basis of commercial incentives to personalise news in conjunction with advertisements.[25] Users of social media rely heavily on social media networks, platforms' recommender systems (steered by algorithms and bots) and data-driven personalised newsfeeds.

Recommender systems work on the basis that people get fed with recommendations of what they themselves or others with similar interests have looked for before, so called 'collaborative filtering'. However, such systems do not only show people what they already know. Instead, underlying algorithms are built to provide new incentives to keep people interested. For that

reason, algorithms feed people with similar content while attempting to draw attention by emphasising spectacular, speculative or suggestive aspects.

By highlighting certain aspects of a study, by promoting one particular expert on a certain issue, and by disseminating all of this at high speed via blogs or social media (bots), some individual actor may be able to deliberately undermine trust in scientific evidence or science as a whole. Strategies can be manifold and particularly the climate change debate is full of examples. Another effect is that scientific results are increasingly debated publicly on social media. They seem also to be increasingly presented as a controversy and in simplistic binary oppositions in order to generate higher attention and feed the algorithms of platforms.

For many scientists and scholars, such deliberate polarising efforts come as a shock – understandably, because they are nursed in a scientific culture marked by careful hypotheses where balanced, nuanced reasoning should reign. Now, suddenly, they find they have to defend themselves in an online world in which all opinions are considered equal and where individuals claim to be right until proven wrong. This social media environment has come to epitomise a world where opinions are more profitable than facts, where statements do better than logical argument, and where polarisation prevails over common ground and common sense.

However, early analyses investigating the effects of social media should be treated with caution, regardless how convincing the given arguments might sound. For instance, recent scholarly literature suggests that echo chambers and filter bubbles may be less pronounced than feared in early studies.[26] In turn, these phenomena may only occur with regards to specific science issues like

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24   Cf. Lewicki, R. J., McAllister, D. J., & Bies, R. J. (1998), Trust and Distrust. New Relationships and Realities. *Academy of Management Review, 23(3)*, 438-458.

25   Cf. Reuters Institute for the Study of Journalism (2018), *Digital News Report 2018*. Online source: http://www. digitalnewsreport.org/survey/2018/overview-key-findings-2018/ (accessed 14/01/2019).

26   See Knight Foundation (2018), *Avoiding the Echo Chamber About Echo Chambers.Why selective exposure to like-minded political news is less prevalent than you think*. Online source: https://medium.

vaccination or climate change and within a specific (often anglophone) context.[27] There is no reliable evidence so far on how they translate to other (European) contexts.

Corporatisation of Communication

Social media take advantage of reinforced biases, fragmentation and polarisation. By giving individual users exactly the kind of information to which they are receptive, platforms generate more clicks and hence attention. Since the Facebook-Cambridge Analytica scandal, we know how many detailed information (or 'data points') tech companies can collect on every individual user. But besides built-in personalisation mechanisms that exploit confirmation bias, there is also a major role here for the human 'friend' who forwards the message. Facebook friends can be central in disseminating certain information on certain aspects via social media – a process of peer pressure that impacts teenagers and young adults in particular.

The exploitation of confirmation bias by tech-companies goes along with another significant change: online social network services and mass communication platforms are almost entirely owned by commercial corporate organisations that are setting the rules in an automated, algorithmic distribution of information. What this 'platformisation' shows is that trust in well-established democratic processes and institutions is currently challenged by a technological system that is underpinned by highly non-transparent structures. Facebook, Twitter, Google and others function as new objects of trust and multipliers of a new configuration of trust. At the same time, those media companies that are dominating the new evolving system have denied their responsibilities for a long time by insisting that they are not media companies and thus cannot be held accountable for the accuracy or content of the messages distributed through their channels.

Computational Propaganda

Over the past years, the problem of trust in media – and to a certain degree science – has been further epitomised by the recurrent problem of fake news and disinformation. These are intricate and highly complex issues and a lot more research is needed to fully understand what is actually going on. Such phenomena are not new, but the scale and speed at which manipulation and disinformation spread via online media, and how they have become a central geopolitical controversy, is new. What we increasingly observe here seems to be that the social media environment undercuts established societal/sectoral systems of trust, accountability and responsibility.

Automated accounts ('social bots', mostly known from Twitter) as well as malicious human users ('trolls') play an important role in contemporary forms of disinformation. Reinforced by the anonymity of most online communication, bots and trolls may bias the users' perceptions of the distribution of opinions, views and evidence. They can also be used strategically for computational propaganda. It has been shown that a combination of bots and trolls is most effective to manipulate public opinion online.[28]

Actors trying to create or fuel doubt may intentionally use technologies or even socio-technical assemblages, e.g. networks of bots and trolls, to convey false perceptions of public

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com/trust-media-and-democracy/avoiding-the-echo-chamber-about-echo-chambers-6e1f1a1a0f39 (accessed 09/01/2019).

27   See Schmidt, A. L., Zollo, F., Scala, A., Betsch, C., & Quattrociocchi, W. (2018), Polarization of the Vaccination Debate on Facebook. Vaccine, 36(25), 3606-3612, or Williams, H. T., McMurray, J. R., Kurz, T., & Lambert, F. H. (2015), Network Analysis Reveals Open Forums and Echo Chambers in Social Media Discussions of Climate Change. *Global Environmental Change, 32, 126-138.*

28   See Keller, T. R., & Klinger, U. (2018), Social Bots in Election Campaigns. Theoretical, Empirical, and Methodologi-cal Implications. *Political Communication*, 1-19.

opinion regarding science or scientific evidence. Contentious scientific debates are becoming favoured targets of geopolitical fights carried out on the internet. Evidence of Russian interference into online discourse on vaccinations is a recent example of political actors making strategic use of fake news and disinformation online.[29]

The essence of fake news and trolling is to sow discord, to prevent dialogue and to destroy common ground – by reinforcing the existing polarisation push. However, such interferences are very hard to detect empirically and seem less influential with regards to science and research compared to other sectors of society.

Increasingly Polarised Political Climate

Another challenge concerns the increasingly hostile political climate for traditional societal institutions such as the press, mainstream media, and science in a growing part of Western societies. Particularly in liberal democracies this is a somewhat new phenomenon, but not one confined to the US, where President Trump is frequently attacking the traditional media outlets and is trying to undermine their legitimacy. Other, mostly right-wing populist movements and political parties are also using such methods successfully. In countries such as Poland, Hungary or Turkey, the freedom of the press is under increased pressure. News media — like science and universities, institutional pillars of fact finding — have come under attack in a political climate that is increasingly fueled by populism and anti-rationalism.

Journalists in the US and elsewhere have recently reacted to this hostile political climate with an initiative emphasising professional standards and ethical guidelines in order to restore trust in their profession and traditional media as an institution. In mid-August 2018, 300 news outlets in the US protested against a political climate for the press in which it is being touted as the enemy of the people by refusing to acknowledge evidence-based knowledge or news.[30]

This reminds us of a protest from scientists all over the world: scientists and citizens took to the streets in over 600 cities worldwide to join a March for Science on 22 April 2017. This march was not about demanding more funding or privileges for science. It was about asking the world to support their institutional grounding in trust in expertise while the world goes through major political, technological and ecological transformations.

New Mechanisms of Detecting and Signalling

Finally, online communication via social media creates problems in detecting and signalling trustworthiness. As pointed out before, digital channels for spreading knowledge often give users little basis as to who says what in which context and based on what authority or expertise. Information can sometimes be traced to recognisable organisations, but often users themselves will have to be able to find and assess the reliability of a source. Even content producers with best intentions may therefore have difficulties signalling trustworthiness of their online content.

This altogether resembles an ideological and socio-technical power shift: we are moving from institutional systems of trust, which establish and verify facts based on societal systems (judiciary, science, media) towards a technical-industrial system of trust, in which very uncertain rules of power are in place, which is predicated on personalised

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29   Cf. Broniatowski et al (2018), Weaponized health communication: Twitter bots and Russian trolls amplify the vaccine debate. *American journal of public health, 108(10)*, 1378-1384.

30   Kate Lyons (2018), More than 100 US Newspapers Plan Editorials Decrying Trump Media Attacks. *The Guardian, London*, 13 August. Online source: https://www.theguardian.com/media/2018/aug/13/more-than-100-us-newspapers-plan-editorials-decrying-trump-media-attacks (accessed 14/01/2019).

information flows and tech-corporations' business models. It represents a totally new game of negotiations and power strugles over values and norms that will dominate this new media system.

Pluralisation of Science Communication

Science Communication as Public Relations

So far, we have examined major transformations that have implications for how we communicate about science via media and lead to a pluralisation of science communication. They provide growing opportunities for those in politics, government, agencies, companies and others to take their messages about science to the public. As a result, communication departments of research institutions and science journalists are under mounting pressure to confront and accomodate those changes. Scientific results are increasingly distributed online and via social media by people who may pick their sources selectively (confirmation bias) and weaponise them through selected internet channels (polarisation push). Consequently, the focus of research institutions, universities and individual researchers is running the danger of increasingly shifting from information/knowledge transfer to reputation control and image building.[31]

Press releases of public relations departments of research institutions often find themselves at odds with media dynamics fueled, to a large extent, by the mechanisms mentioned above.

The urge to set 'trending topics' in order to gain 'viral popularity' and thus attention tends to lead to an exaggeration or simplification of results. It thus contributes to a sometimes exaggerated and even sensationalist communication by the media. Reliability seems no longer to be the central value, it is more about being visible and getting attention from a broad audience. Sensational news is favoured by algorithms and users on social media platforms. This results in a streamlining in which people are only talking about two or three 'hot' topics for a short period of time, likely at the expense of diversity in public discourse.

These tendencies can threaten the trustworthiness of such communication. They seem to have rather negative implications for trust in science. When the balance is shifting from independent science journalism in traditional media towards a self-representation of science resembling the PR of companies, when communication increasingly appears to be loaded with subjective interests of individuals or institutions, fundamental preconditions for trust might erode.

The Decline of Science Journalism

The effects of an increasingly direct communication of science are reinforced by a decline of science journalism. The traditional news business model is in crisis due to shrinking audiences and private as well as public funding. The result is a further marketisation of news in a way that favours such news that is cheaper in its production and apparently more popular with audiences and thus advertisers. Production cycles are getting shorter. This altogether does not favour science journalism, which does not generate much market value, depends on careful research, profound knowledge and thus long-term funding conditions. The result is a decline of established sources of trustworthy information and orientation about science.

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31   For a concise overview of these changes, see Schäfer, M.S. (2017), How Changing Media Structures are Affecting Science News Coverage. In: Hall Jamieson K., Kahan D. & Scheufele D. (eds), *Oxford Handbook on the Science of Science Communication*. New York: Oxford University Press, 51-60.

'Fake News' and Science Denialism

Parallel to the technological and social changes over the last two decades described above, there seems to be a growing presence of 'fake' scientific publications – predatory journals which are not grounded in accepted practices, such as independent and anonymised peer review. Fake scientific publications complicate the assessment of good research and reliable scientific evidence for mediators and audiences. While ignoring institutionalised standards of conducting and publishing scientific research is nothing new and has always existed to various degrees, it seems to have been a far less visible phenomenon in Western democracies for a long time. This rising visibility is accompanied by a growing concern expressed by researchers and journalists alike. It seems that fraudulent research and 'fake news' that have always been around somewhere, now move from the fringe to the centre and increasingly enter and dominate political and sometimes even scientific debates.

One of the consequences is that we increasingly see cases where scientists start to engage in self-censorship because of certain expectations of how the public would react to it. For example, researchers were reportedly holding back publications and results because they expected they might be taken up by anti-vaccine campaigners, interpreted in a problematic, one-sided way and proclaimed either as a proof for the dangers of vaccination or a reason to publicly defame the scientists and their research. Those scientists engaged in self-censorship because they feared that key facts could be twisted, a phrase taken out of context, conclusions stretched further than they ever imagined, and results misrepresented and exploited so that it could ruin their trust-relationship with audiences.[32]

While institutionalised mechanisms to distinguish between fact and fiction are being attacked and partially undermined in a rapidly changing media environment, new rhetorical tactics are used to attack established academic researchers and journalists. They are themselves accused of being 'denialists' because they do not accept 'alternative facts' derived from misrepresented research or research that ignores the established rules of research integrity. It is an inversion tactic that reminds us of right-wing populist leaders all over the world calling mainstream media 'fake news'.

However troubling a denial of scientific findings and the proclamation of alternative truths might be, at least 'denialism' works within the rhetorical boundaries of mainstream science. Denialists take pains to stay within the conditions of rational discourse: they have an ambition to be acknowledged by science and pretend to bolster their claims with seemingly rational arguments, publications and academic titles. However, those are mostly fake, produced to bolster certain (often conspiratorial) beliefs and do not fulfil minimal standards of research integrity. Examples are the denial of human induced climate change, the link between Aids and HIV, evolution or the Holocaust.

In his recent book, Keith Kahn Harris analyses the shift from everyday denial to widespread denialism as a societal phenomenon and further points to a difference between denialists and what he calls 'post-denialists': "Whereas denialism explains – at great length – post-denialism asserts. Whereas denialism is painstakingly thought-through, post-denialism is instinctive. Whereas denialism is disciplined, post-denialism is anarchic. [...] While it [is] still based on the denial of an established truth, its methods liberate a deeper kind of desire: to remake truth itself, to remake the world, to unleash the power to reorder reality itself and stamp one's mark on the planet. What

32   Lewandowsky, S.; Oreskes, N.; Risbey, J. S.; Newell, B. R. & Smithson, M. (2015), Seepage. Climate change Denial and its Effect on the Scientific Community. *Global Environmental Change, 33,* 1-13.

matters in post-denialism is not the establishment of an alternative scholarly credibility, so much as giving yourself blanket permission to see the world however you like."[33]

It looks as if the transformations described above are propelling a healthy and desirable organised scepticism to a degree that it finally leads to unorganised scepticism, (wilful) misinterpretation of scientific evidence, widespread science denialism and finally post-denialism. In order to counter these trends in an increasingly digital society, we need to reinvent trust.

Reinventing Trust in a Digital Society

All aspects discussed so far provide a background and partial explanations of decreasing trust in traditional media in a rapidly changing technological, social and political environment. They also clearly show the challenges that public institutions are confronted with in the current transition towards a digital society. They have to reinvent themselves in order to survive in a changing environment of big data, platforms, algorithmic governance, and worldwide online activity. That process of digitisation and 'platformisation' is relevant for all sectors, including science, journalism and education.[34]

The conditions and challenges that come with this transformation and that have been sketched here mean that trust in science and expertise is no longer rooted in long-established, institutional-

ised systems of checks and balances that scholars traditionally derived from their professional status. In a digital society, institutions are easily bypassed by online platforms, knowledge replaced by search engines, and information considered equal to data. The underlying processes and resulting mechanisms challenge the integrity, transparency, autonomy and accountability of researchers and journalists alike.

So, what should be done to avoid a continuous erosion of trust in science? Shall it be left to online platforms and social media to establish trust? Should researchers concentrate on doing their research and leave communication about science results to others? The developments described in this paper indicate that this would be irresponsible. Instead, science as an institution has to confront the challenge of adapting to the demands of the 21st century's landscape of communication while at the same time secure its traditional pillars of trustworthiness.

This means that researchers need to become even more transparent, more 'observable', and more public than before. Therefore, we need to reinvent how integrity and trustworthiness are anchored. Scientific evidence, its meaning and limits need to be articulated and defined in each specific research context. Researchers are explicitly urged to present the sources and origins of their data, but they also need to clarify their methods of data processing and interpretation. Open data implies the opening up of databases to fellow-experts, so they are able to verify and replicate studies. Archives and libraries in the public domain have to reinvent themselves to render knowledge open, accessible and reliable. Without transparency and openness, control on scientific integrity is simply impossible; but at the same time, 'transparency' in and of itself does not guarantee trust in a digital society.[35]

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33   Kahn-Harris, Keith (2018), Denialism. What Drives People to Reject the Truth. *The Guardian, London*, 3 August. Online source: https://www.theguardian.com/news/2018/aug/03/denialism-what-drives-people-to-reject-the-truth (accessed 14/01/2019).

34   Van Dijck, J, Poel, T & De Waal, M. (2018), *The Platform Society. Public Values in a Connective World*. New York: Oxford University Press.

35   The trend to establish citizens fora where face-to-face

Transparency and openness can make researchers more accountable and signal their trustworthiness, but it also might render them more vulnerable. As mentioned in Discussion Paper 1, the appeal to openness and transparency without boundaries is therefore problematic. Like all good ideas, bad-faith actors can twist openness into a very bad thing indeed—for example, when hacking or seeking personal email correspondence for quote-mining. In its recent response to Plan S, an initiative for open access publishing supported by a consortium of research funders, ALLEA identifies a number of challenges to be considered in order to prevent perverse incentives and unintended consequences in the scientific publishing sector and the research evaluation system when moving towards open access.[36]

Openness within certain boundaries should nevertheless mean that academic research remains open to dialogue with both expert colleagues and the public at large. Such openness may be even more important when this public is more or less deliberately misled via online platforms and social media, or when particular elements exploit online instruments of misinformation as a means to spread doubt and to polarise. Academics should engage in online debates regarding their field of expertise and guide non-experts by systematically deconstructing and refuting deceitful stories and outright fabrications. However, it is ultimately impossible for scientists themselves to prevent all misrepresentations — simply because they would not be able to do their actual job anymore.

Another partial solution might be to develop online tools for assessing the reliability of (open)

sources in digital universes. Automated tools for fact-checking, flagging, online linking and referencing have to be developed and carefully tested in order to help citizens identify quality information. However, fact checking and quality controls come at a cost. The business model of online media channels funding away from serious reporting, calling for higher funding and efforts to make responsible reporting profitable again.

Trust in science relies on external references that were usually provided in a critical but constructive manner by science journalism. The latter's erosion might trigger an institutional domino effect: once journalism is eroded, it becomes more difficult for other societal institutions like science to generate trust and/or legitimacy. More than ever, scientists, journalists and other science communicators such as public relations offices of research institutions should serve as role models by sticking to established professional codes and standards. Both institutions will have to invest in digital innovation while acknowledging long-standing standards of trust-building. Resilient societies are anchored in scientific expertise whose instruments and tools need to co-evolve with societal needs. For this reason, the confidence of politicians, policymakers and citizens in scientists, and their moral as well as financial support of science as an institution, are indispensable.

However, these efforts might not be enough. We certainly have to invest in restructuring the communication of science and bring it up to meet new realities. Therefore, not only scientific results have to be communicated, but basic scientific methods and norms have to be conveyed. Such effort may involve 'scientific literacy' as much as 'media literacy.' If people learn to reason methodically instead of merely wanting to see their opinion confirmed, they are able to develop autonomous judgments. Such judgment is extremely important

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discussions between scientists and the general public take place are also welcome and effective measures. For one example from Ireland see https://www.citizensassembly.ie/en/.

36   All European Academies (2018), *ALLEA Response to Plan S.* Online source: https://www.allea.org/wp-content/uploads/2018/12/ALLEA_Response_PlanS.pdf (accessed 09/01/2019).

in an environment where everything is 'content' and 'context' is not a distinctive criterion. Students attending schools and universities will have to learn through existing and new ways when expertise is trustworthy and particularly when it is not. The mission to bolster trust in expertise will have to be pursued at all levels and should be prioritised on the agendas of universities, science councils, and academies of sciences.

A digital society cannot function properly without open and public institutions, but this assumes that those who run them actively engage in shaping the online dynamics of which they are inevitably a part. To sustain common ground and common sense as the basis for our digital society, we need to ensure that science and education continue to exist as a common good.

Conclusions

This paper sketches the main challenges that the changing landscapes of communication pose for trust in science and expertise. It highlights the importance of trust as an integral condition for science to fulfil its role in society; it discusses the specific characteristics of trust in science as mediated communication; it asks the question if, how and why trust in science is eroding; and it shows how this is related to transformations of media and communication in an increasingly digital society.

The technological, political and social changes underlying these transformations imply a whole new set of processes and mechanisms that we need to deal with in order to understand and tackle the challenges they pose to trust in social institutions and ultimately democracy in a digital society. Although this is a very complex topic and the specific challenges analysed in this paper are by no means exhaustive, it can be concluded that

the rise of social media and the platformisation of public discourse lead to specific transformations challenging long-established trust-building mechanisms.

All of this has severe consequences for science communication and could lead to a pluralisation that might threaten the core pillars of trust in science as well as media: integrity, transparency, autonomy and accountability of researchers and journalists.

It is a crucial task for researchers and communicators of research to safeguard and reinforce these pillars in order to counter a loss of trust in and trustworthiness of science and research. They need to convincingly prove that a free and just society means a society in which all people are equal, but not all expressions are equally true. It is a society in which everyone should have unrestricted access to data and information, but also the opportunity and civic duty to acquire the skills needed to evaluate knowledge claims. This is why it is crucial to reflect on how we can effectively organise and defend a democratic digital society in which trust in expertise is anchored in long-standing and well-established standards – but wrapped in new mechanisms.

Suggestions on how the research community can develop such mechanisms and overcome the obstacles ahead have been sketched in this paper. However, there is a limit to what researchers and science communicators can do when confronted with an increasingly hostile (geo-)political context. Without supportive political flanking, measures to protect science and research from such threats and the readiness to fight political battles, all well-meaning efforts might come to naught and look like bringing origami flowers to a machine-gun fight.

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