**Identifying different audiences of scientific information: tackling disinformation on scientific issues**

**MODULE DESCRIPTION AND GUIDELINES FOR THE INSTRUCTOR**

***Module description***

This module aims to provide an overview of how and why audiences become misinformed about science. Outcomes:

* Analysis of science communication in new media environments.
* Importance for audiences to be misinformed about science
* How to tackle disinformation on scientific issues

***Module learning objectives***

* to tackle disinformation on scientific issues.
* find the right and reliable sources upon scientific issues.
* employ tools for evaluating sources of scientific information.
* employ techniques for evaluating scientific information.

***What Does It Mean for Citizens to be Misinformed or Uninformed About Science?***

First, it is important to note that “misinformation” can be broadly defined as information that is incorrect, possibly by accident. Comparatively, “disinformation” has sometimes been used to denote a specific type of misinformation that is intentionally false. However, the distinctions between these terms—as well as terms like “rumor” or “fake news”—have not always been clearly drawn in research pertaining to these topics.[[1]](#footnote-1) Similarly, there has been some conceptual debate surrounding what it means to be “misinformed,” compared with “uninformed.” Being misinformed is often conceptualized as believing in incorrect or counterfactual claims. However, the line between being misinformed or uninformed— that is, simply not knowing—has long been blurry in different literatures.

Of course, citizens can be uninformed and misinformed all at once—for example, they may be uninformed about how scientific processes work while being misinformed about the facts of a specific scientific issue—and these factors may influence each other. In practice, then, it is difficult to cleanly separate the “misinformed” from the “uninformed.”

The overall success of the scientific method also means that when someone wants to make claims that go against established scientific knowledge and are not grounded in the scientific method, they must seek to undermine the trustworthiness of the scientific method or scientists per se. Thus, paradoxically, scientific language is often adopted at the same time as scientific activities themselves are being questioned.

***Disinformation in scientific issues***

Science Mis- and Disinformation False information is as old as humankind. Any knowledge void can be filled with beliefs or assumptions that are incorrect. Here we will focus on information that is known to be false, but that is deliberately planted and disseminated, nevertheless.

Further distribution of this false information can, again, happen either with or without awareness of the lack of evidential support for the claims it contains. Any information that is incorrect is generally described as misinformation. Disinformation is a subcategory of misinformation: information that is incorrect and that has been produced deliberately, i.e. with the intention to deceive.

‘Science disinformation’ can be understood as factually incorrect information regarding claims that concern scientific matters and that is fabricated or deliberately manipulated with the intention to deceive. It also includes claims that deliberately look and sound scientific although they are not. This can include the deliberate spread of science misinformation; incorrect information regarding scientific matters that has been produced by mistake but without the intention to cause harm, caused for instance by scientific misconduct, lack of research integrity, or poor communication of scientific results.

Much of the progress and welfare of human societies has been made possible by remarkable efforts in the systematic collection of information about our world carried out systematically and interpreted using well-established rules of evidence, they can be described as using scientific methods, and hence as ‘scientific’. The progress made through scientific methods has been so spectacular that products and approaches without a scientific basis are often marketed using scientific terms or jargon. Scientific research has become an envied and prestigious endeavour, and its language frequently plagiarized.

***Characteristics and Mechanisms of Science Disinformation***

***Knowledge Resistance & Confirmation Bias***

We humans are generally prone to absorbing information that supports our established personal beliefs and opinions based on previous information or emotional appeal, an effect known as 'biased assimilation'[[2]](#footnote-2) that often leads to ‘motivated reasoning’[[3]](#footnote-3) and may even result in self-deception. This often leads to counterarguing or finding reasons to disparage sources of evidence. It can be both value-based and identity-protective. Opinions can also rely on misplaced trust, i.e., trust in authorities that turn out to be unreliable sources of information, which may be unpleasant to admit. We filter out information that contradicts personal views with such ease that we hardly notice it. Once information that we judge to be likable or convincing has been established in our minds, it becomes difficult to replace it with diverging information, even if this new information is more accurate. Hence, we are by nature prone to confirmation bias. Resistance to new knowledge may prevail because of the cognitive dissonance that may arise when novel facts contradict previous notions.[[4]](#footnote-4) However, bias is not the only mechanism; it has also been proposed that a lack of reasoning or lack of thinking in an analytic way, described as ‘lazy thinking’, leads to susceptibility to disinformation.[[5]](#footnote-5)

By explaining and informing people that it is normal to automatically reject new facts that contradict a habitual notion, whether based on previous information or on emotional appeal, it may be possible to increase their willingness to consider new information. Awareness can be raised by explaining confirmation bias, thereby reducing knowledge resistance, and the spread of disinformation.

***Sense-Making Stories***

Many misconceptions resulting from misinformation have become established as common beliefs because they have a certain appeal. They are stories that appear to make sense. Knowledge gaps are challenging to most people, which is why we tend to fill missing links in our chains of knowledge with invented explanations rather than the acceptance that our knowledge is temporarily incomplete.[[6]](#footnote-6)Stories without knowledge gaps are easier to remember because they offer continuous chains of explanations. Made-up stories can usually be recognized because they are typically vague about the sources of information, for instance so-called ‘urban myths’. Furthermore, personal anecdotal episodes or testimonies may have a strong emotional appeal. However, anecdotes cannot be compared with the explanatory power of large scientific investigations when it comes to determining whether a correlation between observations also has a causal relationship. If an incorrect description is to be replaced by a correct explanation, the new information should completely replace the misconception in a way that makes sense, i.e. no knowledge gaps should remain and it should address the emotional appeal and sense-making of the (mis)information it is trying to replace.

***Sources evaluation***

Many sources compete for attention online, including partisan blogs and bogus sites posing as legitimate news organizations. It can be tough to know what information to trust. So, what does “credibility” look like, and how can you recognize it?[[7]](#footnote-7)

1. **Do a quick search:** Conducting a simple search for information about a news source is a key first step in evaluating its credibility.
2. **Look for standards:** Reputable news organizations aspire to ethical guidelines and standards, including fairness, accuracy and independence.
3. **Check for transparency:** Quality news sources should be transparent, not only about their reporting practices (see above), but also about their ownership and funding.
4. **Examine how errors are handled:** Credible news sources are accountable for mistakes and correct them. Do you see evidence that this source corrects or clarifies errors?
5. **Assess news coverage**: An important step in vetting sources is taking time to read and assess several news articles.

In addition to these five steps, this infographic includes a list of “trust busters” that indicate you should immediately look elsewhere for credible news. They include:

* False or untrue content
* Clickbait tactics
* Lack of balance
* Manipulated images or videos
* State-run or state-sponsored propaganda
* Dangerous, offensive and malicious content

***Conspirational beliefs***

Conspiracy theories appeal to our psychological need for a simple explanation and someone to blame. You can stumble across them online even when searching for reliable information. These compelling narratives, and the false evidence they include, can draw you in, manipulating your emotions and using your cognitive biases against you to trick you into believing them.

* Theories in which explanations for events and phenomena offer “*as a main causal factor a small group of persons (the conspirators) acting in secret for their own benefit, against the common good*”.
* Conspiratorial beliefs can thus involve not only a willful **rejection of scientific consensus but also false attributions of intent** to members of the scientific community, as well as the fabrication of relationships between actors.
* Conspiratorial beliefs are typically understood as **distinct from simple ignorance or misperception** about isolated facts. Many of us believe in facts that turn out to be wrong.

***The 5 characteristics***

Whether the topic is climate change, lung cancer’s link to smoking, vaccines & autism, AIDS or MSG, denial of scientific findings relies on a set of techniques that can be summed up by the acronym FLICC:



**Fake experts**: climate science is huge and complex field, as you can see from IPCC reports that need 4,000 pages merely to summarize the state of the field. No expert knows everything about it, as the field has numerous specializations. While many articles on denial blogs are written by “scientists” (such as computer scientists or geologists), most articles are not written by contrarian climate scientists, and contrarians themselves are not experts in most of the subspecialties they criticize. Pseudo-skeptics trust people with little or no credentials in the field, and may even think they themselves are experts after reading a pseudo-skeptic book or two. So when TV networks put Bill Nye on the screen to face off against an AGW pseudo-skeptic, other pseudo-skeptics may point out that Bill Nye is not a climate scientist?—while cheering on the other guy, who is not a climate scientist either.

**Magnified Minority**: Though 3% of experienced climate scientists disagree with the consensus, media often give pseudo-skeptics 50% screen time. There is another small minority of scientists, and perhaps the occasional climatologist, who believe there will be much more warming than typically thought?—we might call these “alarmists”. But some media treats the consensus position itself as “alarmist”, so instead of pitting “contrarians” against “alarmists”, it’s “contrarians” versus “mainstream scientists whom we call alarmists to discredit them”.

**Logical fallacies**: Most pseudo-skeptic beliefs are based on logical errors and/or an absence of knowledge and context. Most myths about climate change can be described in terms of a few fallacies (see below).

**Impossible expectations**: demanding more precision and more perfect information than climate science can realistically deliver. For example, J.S. Sawyer estimated in 1972 that by the year 2000, atmospheric CO2 levels would rise about 25% compared to 1969 and that global temperatures would rise 0.6°C. Temperatures did in fact rise slightly more than 0.6°C by the time CO2 rose 25%, but it took until after 2010 for this to happen; I assume this is because early estimates of the rate at which carbon sinks (oceans and vegetation) absorb CO2 were too low. Most people would see this as a remarkably accurate prediction, especially since the temperature record in 1972 showed no hints that temperatures were about to rise. Pseudo-skeptics, however, seize upon the imperfection of the prediction as ‘another example’ of why we can’t trust climate science. Similarly, the 1995 IPCC projections (unlike the 1990 and 2000 ones) substantially underestimated the amount of warming that would occur by 2016. Upon learning this, a pseudo-skeptic I spoke with saw it as more evidence of bad science. (“so you’d disagree with anyone who calls the IPCC alarmist?” I asked. “Alarmists don’t underestimate.” He ignored the question.)

**Cherry picking**: cherry picking is another logical fallacy, but pseudo-skeptics tend to use it far more than the others. For example, the pseudo-skeptic says correctly that the antarctic is gaining sea ice, that one study (controversially) says it’s gaining land ice, and that specific parts of Greenland are gaining ice. But they avoid the bigger picture: the water around Antarctica has warmed up, it may be losing land ice, the arctic is quickly losing ice, Greenland as a whole has been losing ice at an accelerating pace for about 13 years, and far more glaciers are losing ice than gaining ice. They also cherry-pick predictions from individualclimatologists that turned out to be inaccurate, while ignoring predictions from contrarians that were more wrong (past contrarians predicted imminent cooling. Since that didn’t happen, remaining contrarians tend to imply it’s impossible to predict climate?—?a concept that will allow denial to continue forever, no matter what happens).

**Conspiracy theories**: last but not least, pseudo-skeptics need a way to explain why most climate scientists came to the “wrong” conclusion, so conspiratorial thinking fills in the blanks. I’ve seen claims of conspiracy or corruption many times, but always with a striking lack of detail. I’ve never encountered a complete story: why it happened, when it happened, who did it (specific people), and how it was pulled off. The best they can do is misunderstand a handful of leaked emails. This makes sense if the idea of conspiracy, or corruption, or a vast global network of incompetent scientists, is all just a backdrop?—?a curtain hastily installed to cover up the consensus so it can be ignored. But there is another interpretation for this lack of detail. Perhaps the idea of conspiracy or corruption is actually the primary belief held by most pseudo-skeptics, but because there is so little direct evidence for it, pseudo-skeptics are forced to rely on indirect evidence in the form of scientific findings that are “flawed” according to black-belts in FLICC-fu. “Conspiracy theories turn out to be unusually hard to undermine or dislodge; they have a self-sealing quality, rendering them particularly immune to challenge.” –

Here are the main logical fallacies:

**Red Herring**: a minor detail used to mislead or derail a discussion. For example, pseudo-skeptics may point out that CO2 is a “trace” gas (less than 0.1% atmospheric concentration). They can admit that all plant life would die without CO2, yet claim that a trace gas can’t possibly have a noticeable effect on climate. This is a red herring and an example of the “argument from incredulity”. Of course, there are many examples of small things making a clear difference: microscopic windshield coatings to reduce glare, tiny pits that increase airplane fuel efficiency, fluoride in water. Another example: CO2 dissolved in water is carbonic acid, and causes the ocean’s pH to fall toward the “acid” side of the pH scale. We call this “ocean acidification”. However, ocean water is on the alkaline (non-acid) side of the pH scale, so pseudo-skeptics distract by questioning the intellect of people who use the word “acidification”. In short, if sea horses start dying, it’s okay because they’re not really horses!

**Misrepresentation (straw man or half-truth)**: misstating scientific predictions or findings. For example, pseudo-skeptics may misrepresent the 2nd law of thermodynamics to “prove” that the greenhouse effect can’t be real. Or they pretend that scientists are certain about precisely how much warming CO2 will cause, and then attack a certainty that doesn’t exist. Or they misrepresent how scientists reached their conclusions, to demonstrate a “circular reasoning” that doesn’t exist. Or they quote an erroneous news article that misstated a scientific prediction. They might even find a prediction that says “by 2050” and call it “failed” because it hasn’t happened yet. The list goes on and on.

**Jumping to conclusions**: when you really want something to be true, it’s easy to ignore details that contradict your conclusion. For instance, the urban heat island effect may raise some temperature readings due to urbanization. Also, satellite records interpreted by UAH show less warming than other records. So they jump to the conclusion that warming has been small. However, almost the same warming can be seen based on rural temperature stations and rural records alone; and weather balloons and high-resolution proxy records also show similar warming. In fact, ocean records are the main factor in global average temperatures, since they make up 71% of Earth’s surface. As for satellites, the same satellite records interpreted by RSS show significantly more warming than UAH. Why? Satellites don’t measure temperature, and the data is very tricky to interpret. Satellites show day-to-day differences reliably, but the readings drift in multiple ways as years and decades pass. Both UAH and RSS have repeatedly changed how they compensate for drift, which in turn changed their temperature trends retroactively.

False dichotomy: incorrectly assuming there are only two possibilities, then showing one of the possibilities is wrong to “prove” the other. The most common false dichotomy is to point out that CO2 lagged temperature before humans started burning fossil fuels.

***Communicating Science in the New Media Environment***

New media transforms science communication from a relatively linear process of gatekeeping, publishing, directed search and retrieval, to a multi-stakeholder socialized digital sphere of interactivity, discussion, and recommendation (Lievrouw 2010). New media introduced ―prod-users‖, blurring the lines between producers and consumers of information, and enabling any Internet user to create and share content. Building on this idea, new media are changing people‘s expectations about the sources, availability, and uses of information. A question worthy of discussion is whether the growing use of an interactive new generation of computer-mediated technologies (new media) could revive modes of science communication, that contrast with big science. Competing with the old-fashioned hierarchy of science communication means defying science institutions‘ hegemonic structures, which currently dominate the research realm, the publishing industry, and platforms that communicate science-related topics (McGarity and Wagner 2008). [[8]](#footnote-8)

Although the research on science communication has significantly increased during the last few decades and a ‘science of science communication’ has been established, there are still substantial research gaps — particularly when it comes to questions regarding online and social media. In particular, the current situation of the novel coronavirus pandemic has highlighted the enormous relevance of online and direct science communication and informed evidence-based decisions of politicians as well as citizens.

Despite the relevance of science and science communication in modern societies, the potential benefits and threats of social media have both been mostly analyzed in the context of politics and political communication. Only a small proportion of studies have addressed the dissemination of science and online discussion of science-related topics. However, these are no less important for democracy and informed citizens. For example, mis-/disinformation regarding science topics can affect participation in climate protection, the formation of filter bubbles around vaccine sceptics to undermine health protection measures, or hate speech towards scientists, hindering their ability to present their findings to the public. Even though these issues are of clear societal relevance, little is known about how laypeople engage in online discourse on scientific issues. There is an urgent need to understand how citizens engage with science and how the way in which such scientific information presented affects this engagement.

As discussed above, different levels of user activity (consuming, participating, generating) have to be distinguished for deeper insight. Moreover, activities must be analyzed against the background of the wider context of societal transformation. For this, we picked up the most prominent strands of technological affordances, a new knowledge order and aspects of trust and rationality. In the following, we will attempt to highlight challenges for future research against this background.

On the **consumption level**, it needs to be highlighted that the internet, and in particular social media, allows for a more intensive and diverse amount of information exposure. Online users may be exposed to and engage with a greater volume and a broader range of science news, for example, by incidental news exposure based on algorithmic recommendation or social network sharing, and this heightened exposure can foster trust in. Moreover, online information is supplemented by social recommendations, such as ratings and comments, which affects content perception and credibility as well as information processing. In addition, it has been shown that users prefer scientists themselves to present scientific information rather than journalists because scientists are perceived as more trustworthy, more precise, and more objective.

Moreover, it is important to widen the focus to the actors that provide the information as a new and seemingly unmanageable variety of new actors appears on stage. The relevant theoretical strand is, therefore, focused on the role of trust and rationality. It is important to acknowledge in future theorizing and empirical analyses that most people will not be able to decide what to believe in the virtue of the specific message but merely based on a person’s expertise. However, the decision on who to trust is complicated by varying and collapsing contexts. Whereas an actor might be able to provide valuable scientific expertise in one context and regarding one issue, he or she might not know about another. A paediatrician might be able to provide relevant knowledge on the extent to which children might suffer from physical distancing during pandemic-related lockdowns but might not be an expert on the specificities of virus dispersion in children. Therefore, it is challenging to decide who to trust. In order to support laypeople with these kinds of decisions in the future, it is important to better understand the mechanisms and conditions of yielding trust.

**On the participation level:** participation and dialogue are generally seen as an effective means of creating a relationship of trust between science and the public. The new media environments offer unique potential for low-threshold participation opportunity for many different users. However, it is still unclear how this affects the trust relationship between science and the public. This research gap is crucial, as Huber, Barnidge et al. [[2019](https://jcom.sissa.it/archive/20/03/JCOM_2003_2021_A05#X0-HuberBarnidgeGildeZunigaLiu2019)] conclude from their 20-country multilevel analysis that social media news use is more strongly related to trust in science than is traditional news use. However, the mechanisms and processes behind this finding are yet to be thoroughly investigated. This need is particularly relevant as other research suggests that given the greater variety of social media actors more emotional postings are available in social media that are more prone to instil emotions instead of increasing fact-based knowledge. The theoretical considerations regarding social media affordances are relevant regarding participation. Here, the degree to which the technological structures of platforms influence the way the public engages with science needs to be better understood. A better comprehension of relevant mechanisms will also enable the design of more helpful platforms for science communication. For example, the choice of features which will be particularly helpful for beneficial interactions between scientists, journalists and the public is possible.

Besides the role of affordances, the relevance of algorithms in selecting and providing information on science issues should be considered. Although previous research shows heterogenous results on the impact of algorithms on individual and public opinion formation and discourse processes, the way users encounter information as well as the role of personalisation is a key concern and should become of focus for public science communication.

**On the generating level**, even less is known about how this behaviour — either of lay users or of scientists — affects trust and credibility judgements. Here, the new roles of scientists need to be considered: as scientists themselves increasingly engage in public online discourse by (participating and) generating, such as reacting to mis-/disinformation or commenting on journalistic content referencing their work, scholarly attention should increase regarding the understanding of reciprocal and dialogue-oriented processes of science-related discussions. Here, it is important to understand more deeply why, how and with what impact people engage — lay users and scientists. It is also to elucidate how potential convergences on the level of communication about science issues affect the generating of scientific findings, and thus add to the processes of generating evidence and its interpretations. The levelling of epistemic hierarchies challenges the functions and roles of scientists as well as of non-scientists.

***Solutions for science disinformation***

Extensive research over the past several years has identified cognitive features of the human mind, as well as fast and efficient transmission channels, that contribute to the prevalence of science disinformation in our societies. Potential solutions cover a range of psychological, technical and political measures including inoculation, debunking, recommender systems, fact-checking, raising awareness, media literacy, and innovations in science communication and public engagement. Together, they contribute to tackling problems such as knowledge resistance, pseudoscience, undermining of trust, confirmation bias, filter bubbles, echo chambers, and other problems related to science disinformation.

A range of psychological, technical and political measures including

* inoculation
* debunking recommender systems
* fact-checking
* raising awareness, media literacy and
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Contribution to tackling problems such as

* knowledge resistance
* pseudoscience
* undermining of trust
* confirmation bias
* filter bubbles

***Ways of tackling disinformation***

***Inoculation***

To limit the harm caused by disinformation, it has been shown that it is "better to prevent than to cure".[[9]](#footnote-9)This strategy aims to provide protection against falsehoods by informing people beforehand about misinformation tactics and presenting its contents in weakened form. This approach has been given a term borrowed from immunology: ‘inoculation’. It is also known as ‘pre-bunking’. Pre-exposure is intended to trigger a cognitive process that generates counterarguments to disinformation like a form of "cognitive antibodies".[[10]](#footnote-10) The method has been shown to work in different contexts. As it makes it possible to recognise disinformation, it has the potential to limit its spread in social media and elsewhere.[[11]](#footnote-11)

***Debunking***

Another major strategy is to respond to misinformation by explaining why it is incorrect, and to provide correct information after this misinformation has been exposed and explained. If it is a case of deliberate disinformation, it is also relevant to uncover the tactics and potential intentions of its sender. For debunking to have the intended effect, it is important to carry it out in a pedagogical way so that the correct information is not confused with the misinformation it is intended to debunk. It is essential both to explain why the misinformation is false and to provide the true information instead (see box). As mentioned above, the fact-based explanation should ideally replace the myth entirely. Naturally, the explanation should be intelligible, i.e., it should avoid unfamiliar terms and can be aided by diagrams as a pedagogical tool. Multiple arguments against the misinformation may weaken it further.[[12]](#footnote-12)

Debunking Steps:

1. Describe the facts.
2. Warn that there is a myth.
3. Explain in what way the myth is incorrect.
4. Repeat the facts to consolidate this information.

***How to debunk***

For debunking, timing can be everything. Tagging headlines as “true” or “false” after presenting them helped people remember whether the information was accurate a week later, compared with tagging before or at the moment the information was presented, Nadia Brashier, a cognitive psychologist at Harvard University, reported with Pennycook, Rand and political scientist Adam Berinsky of MIT in February in Proceedings of the National Academy of Sciences.

Here are some tips from misinformation researchers:

* Arm yourself with media-literacy skills, at sites such as the News Literacy Project (newslit.org), to better understand how to spot hoax videos and stories
* Don’t stigmatize people for holding inaccurate beliefs. Show empathy and respect, or you’re more likely to alienate your audience than successfully share accurate information
* Translate complicated but true ideas into simple messages that are easy to grasp. Videos, graphics and other visual aids can help
* When possible, once you provide a factual alternative to the misinformation, explain the underlying fallacies (such as cherry-picking information, a common tactic of climate change deniers)
* Mobilize when you see misinformation being shared on social media as soon as possible

Prebunking still has value, they note. But providing a quick and simple fact-check after someone reads a headline can be helpful, particularly on social media platforms where people often mindlessly scroll through posts.

***How to check an unfamiliar topic***

* Check whether references to sources are provided
* Check if those sources are reasonably recent (if products are marketed with references to old sources, this may indicate that the results have not been verified, have not held up to scrutiny, or have not been worth pursuing)
* Check if the sources are credible scientific journals

***Science Communication and Public Engagement***

Trust in science, the recognition of trustworthy scientific information and its distinction from misinformation is always mediated. The communication practices of researchers and journalists thus play a central role in tackling science disinformation. Like any part of the media landscape, science communication is also heavily affected by the transformation into a globalised, technologically mediated and commoditised environment. This transformation provides opportunities to reach new audiences with new methods, but also paves the way for the problematic mechanisms described above and puts even more financial and time pressure on science communicators.

In addition to such external factors, there is an apparent lack of exchange between science communicators and scientists. There is clearly a need for more dialogue in science communication practices. A stronger focus on communicating how science works, i.e. standards and methods, will raise science literacy as well as media literacy. Communication with the public must be open and inclusive. Open conversations on an equal footing between scientists and nonscientists, with room for uncertainties, assumptions, values and social questions, could lead to greater mutual understanding and trust. For instance, the model of citizen assemblies on science based policy is designed to bring science closer to the people and engage the public, e.g. on climate science.[[13]](#footnote-13) The virtues of openness and intellectual humility allow for a plurality of voices and apply to experts even more than to the end users of information.[[14]](#footnote-14)However, openness and humility should not lead to an attitude of ‘anything goes’ which neglects certain aforementioned (scientific) standards and methods.

1. Lazer D, et al. (2017) Combating fake news: An agenda for research and action. Shorenstein Center on Media, Politics and Public Policy, Harvard Kennedy School, Cambridge, MA), p 2. [↑](#footnote-ref-1)
2. Biased assimilation: Tendency to interpret information in a way that supports a desired conclusion. Cf. Greitemeyer, T. et al (2009). Biased assimilation: the role of source position. Eur. J. Soc. Psychol., 39, 22–39. [↑](#footnote-ref-2)
3. Motivated reasoning: Constructing seemingly reasonable justifications to arrive at conclusions that you want to arrive at. Cf. Kunda, Z. (1990). The case for motivated reasoning. Psychological Bulletin, 108(3), 480–498. [↑](#footnote-ref-3)
4. Cf. Wikforss, Å. (2019). Critical thinking in the post-truth era. In: Kendeou, P. et al. Misinformation and Fake News in Education, 279–304. [↑](#footnote-ref-4)
5. Cf. Pencook, G., & Rand, D. G. (2019). Lazy, not biased: Susceptibility to partisan fake news is better explained by lack of reasoning than by motivated reasoning. Cognition, 188, 39–50. [↑](#footnote-ref-5)
6. See Duffy, B. (2018). The perils of perception: Why we’re wrong about nearly everything. Atlantic Books. [↑](#footnote-ref-6)
7. https://newslit.org/educators/resources/is-it-legit/ [↑](#footnote-ref-7)
8. (PDF) Communicating Science in the New Media Environment: The Advancement of Science Literacy. Available from: <https://www.researchgate.net/publication/347317651_Communicating_Science_in_the_New_Media_Environment_The_Advancement_of_Science_Literacy> [accessed Dec 06 2021]. [↑](#footnote-ref-8)
9. Cf. Van Der Linden, S. et al (2017). Inoculating against misinformation. Science, 358(6367), 1141–1142. [↑](#footnote-ref-9)
10. Cf. Van der Linden, S., & Roozenbeek, J. (2020). Psychological inoculation against fake news. In: Greifeneder et al. The Psychology of Fake News: Accepting, Sharing, and Correcting Misinformation. [↑](#footnote-ref-10)
11. Cf. Lewandowsky, S. et al (2017). Beyond misinformation: Understanding and coping with the ‘post-truth’ era. Journal of applied research in memory and cognition, 6(4), 353–369. [↑](#footnote-ref-11)
12. Cf. Lewandowsky, S. et al (2020). The Debunking Handbook 2020. Online Source: https://sks.to/db2020 (accessed 07/04/2021) [↑](#footnote-ref-12)
13. See Suiter, J. et al (2016). When do deliberative citizens change their opinions? Evidence from the Irish Citizens’ Assembly. International Political Science Review, 37(2), 198–212. [↑](#footnote-ref-13)
14. See Alfano, M. et al (eds.). The Routledge Handbook of Philosophy of Humility. Routledge. [↑](#footnote-ref-14)