Remember Hiroshima?

Exploring the structure, antecedents, and outcomes of public perceptions of scientists

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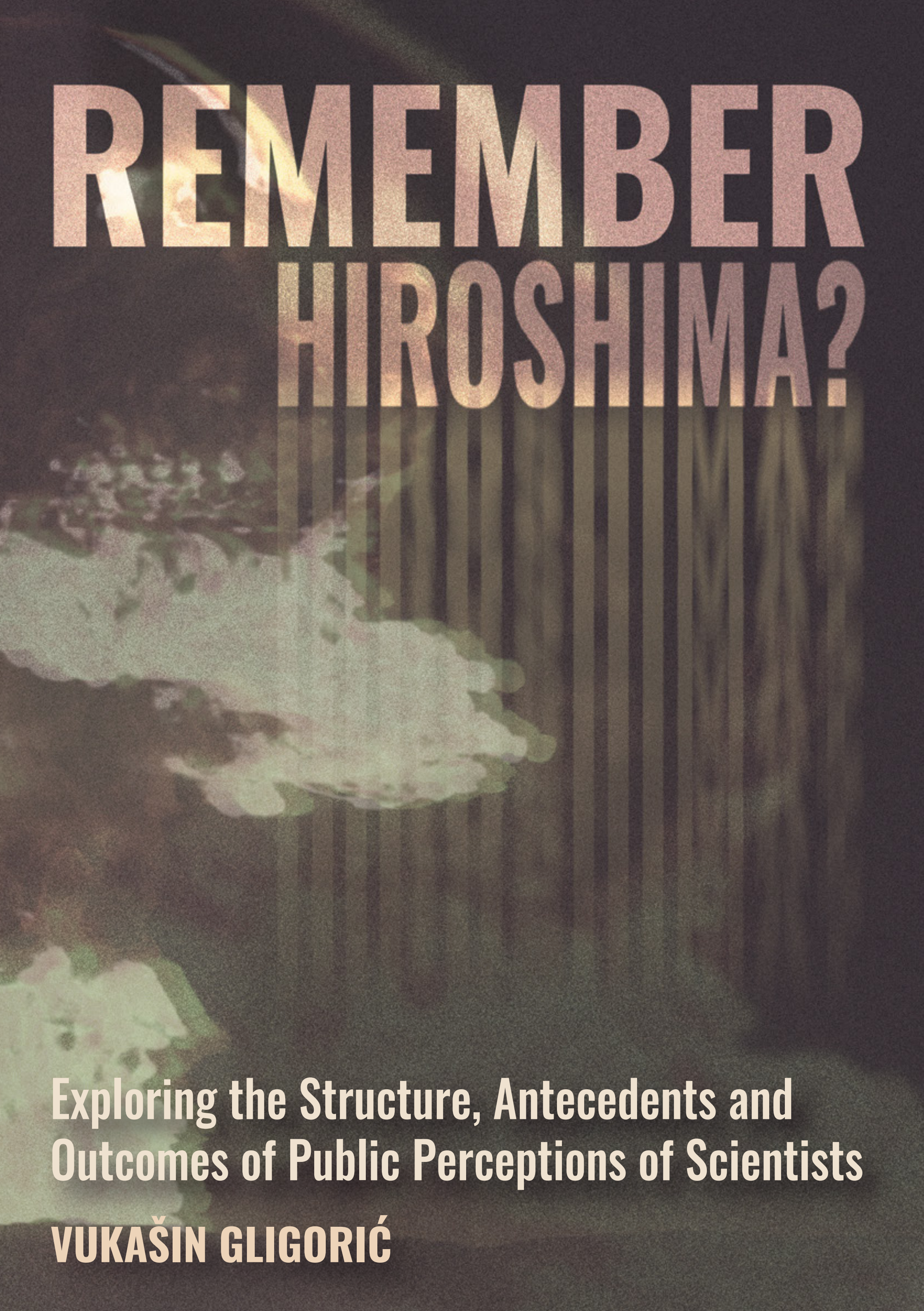

REMEMBER HIROSHIMA?

Exploring the Structure, Antecedents and Outcomes of Public Perceptions of Scientists

VUKAŠIN GLIGORIĆ

“REMEMBER HIROSHIMA?”
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“Remember Hiroshima?” Exploring the Structure, Antecedents, and Outcomes of Public Perceptions of Scientists

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[*Solaris*, 1972; dir. Andrei Tarskovsky]

"Obviously, positive science and technology set off unpredicted and uncontrollable social processes. The scientist who does not care about the broader social context of his [sic] inquiry loses all control over the product of his work. The history of the creation and use of nuclear weapons is a drastic example. Another one is the abuse of science for ideological purposes. The most effective and, therefore, most dangerous propaganda is not that which is based on obvious untruths, but that which, in order to rationalize the interests of privileged social groups, uses partial truths established by science..."

"Insofar as in man [sic] there is a profound Faustian need to rebel against any permanent, historically-determined limitations in nature, in society and in himself, he will strive to supersede such limitations, to develop further his human world and his own nature. Such an activistic attitude towards the world will always need a philosophical and scientific thought which would constitute a bold radical criticism of existing reality."

Mihailo Marković (1968)

CHAPTER 1
GENERAL INTRODUCTION: WHY SCIENTISTS MATTER

Now I am become Death, the destroyer of worlds.
(J. R. Oppenheimer, 1949/1965)

Scientists are at the forefront of combating a wide range of large-scale societal challenges – spanning from climate change, risks to ecosystems and biodiversity loss (Albert et al., 2021; Cardoso et al., 2020; Pyšek et al., 2020; Ripple et al., 2020) to pandemics (Else, 2020), social inequality (Piketty, 2014), and threats to entire knowledge systems (Fernández-Llamazares et al., 2021). Indeed, the most widely co-authored journal article ever (with over 15,000 authors) warns of environmental destruction and calls for urgent preventative measures (Ripple et al., 2020), highlighting scientists' commitment to addressing global challenges. Numerous challenges, and their proposed solutions, have put scientists into the spotlight, whose public role was particularly evident at the outset of the COVID-19 pandemic. During the pandemic, scientists have been, at the same time, lauded as heroes (Park & Ducharme, 2021) and subjected to extreme harassment, including death threats and lynching attempts (O'Grady, 2022), underlining the complexity of people's perceptions of scientists.

Given that scientists occupy a prominent public role, it is no surprise that they have been the protagonists in numerous fictional works in Western film and literature (Haynes, 2003). The archetype of scientists as brilliant, though eccentric and possibly dangerous, was present in Western culture as early as the 16th century (e.g., as evidenced in Marlowe's Doctor Faustus). Classic literature characters such as Dr. Frankenstein (1818) or Dr. Jekyll (1886), as well as classic movies such as Metropolis (1927) and Jurassic Park (1993), demonstrate that the stereotype of "mad scientists" who cross the ethical boundaries of "playing God" permeated even later. More recently, contemporary movies such as Oppenheimer (2023) and Poor Things (2023) stand as evidence that the stereotype has not lost its appeal. In all these works of fiction, scientists are represented as geniuses who set on an ambitious quest for knowledge, simultaneously engaging in a moral quandary due to the threatening nature of their work (Haynes, 2003).

Early research recognized scientists' distinguished position in society as well. In their pioneering study, Mead & Métraux (1957) investigated the image high-school students hold of scientists by simply asking them to describe (i.e., write a short essay about) scientists. Whereas other researchers in this area employed new methods such as rating scales (Beardslee & O'Dowd, 1961) and scientist drawings (Chambers, 1983), the findings nevertheless converged: Decades of research have shown that scientists are stereotyped as white, middle-aged to old men, associated with lab coats, glasses, or books, and as potentially dangerous (Ferguson & Lezotte, 2020). Thus, the public image of scientists seems to match, at least partially, the "mad scientists" stereotype.

Nevertheless, the research line on the image of scientists has left important questions unanswered: It has remained unclear how different characteristics attributed to scientists (e.g., intelligence, competence, social ineptness) converge and how they relate to trust – one of the most robust predictors of compliance with scientific solutions (Algan et al., 2021; Cologna & Siegrist, 2020; Motta, 2018). It is also unknown whether people hold uniform perceptions of all scientists versus more nuanced views of different scientists, and whether the diversity of scientists potentially matters for trust. To answer these questions, the current dissertation employed the latest theoretical advances in stereotypes and social evaluation research (e.g., Abele et al., 2021), cutting-edge methodological (stimulus sampling, bottom-up approach in stimulus development, development of new measures) and analytical (e.g., cluster analyses, multilevel modeling) approaches, as well as high standards of open science (high powered studies, pre-registrations, and registered report). The overarching research aim was to investigate the nature and the structure of the perceptions of (different) scientists. These perceptions include different social evaluations (e.g., views of scientists' competence, warmth, morality) and stereotypes (image of scientists), whose antecedents (worldviews, primarily political ideology) and outcomes (most crucially, trust in scientists) were investigated.

Before I[1] present the empirical studies conducted in this dissertation, I review some of the key research on how the public views—and whether they trust—scientists. I also identify the gaps that hinder our understanding of the perceptions of scientists, and consequentially, the ability to advance scientific solutions to societal problems. Then, I will outline the five empirical chapters of the dissertation. In the first two empirical chapters (Chapters 2 and 3), we acknowledged the diversity of scientific occupations and investigated social evaluations of multiple types of scientists and their relation to trust. In Chapter 4, we investigated how two types of perceptions of scientists – social evaluations and stereotypes – relate to each other, and their respective antecedents (worldviews) and outcomes (trust in scientists and appeal of a scientific career). Chapter 5 investigated the antecedents of extremely negative perceptions of scientists revolving around harassment and violence against scientists, which became a widespread problem during the COVID-19 pandemic. Finally, Chapter 6 dived deeper into the relationship

1 Throughout the dissertation, I use both "we" and "I". The usage of "we" is reserved for all empirical chapters given that they were carried out as collective work (e.g., with other collaborators or supervisors).

between ideology and trust in a large group of scientists, and tested theoretically grounded interventions to increase trust in scientists among conservatives. In total, the dissertation contains 5 pilot studies and 10 main studies with a total of 14,162 unique participants.

Public Perceptions and Trust in Scientists: State of the Art

How do people view scientists? Although seminal work on the image of scientists offered some preliminary answers, this line of research has been largely atheoretical. More recent research, however, has been informed by theoretical models of how social perceptions are organized. One such model – the Stereotype Content Model (Fiske et al., 2002) – posits that most social perceptions can be reduced to two dimensions: competence (e.g., intelligence, capability) and warmth (e.g., friendliness, morality). Comparing perceptions of scientists to other social groups, Fiske and Dupree (2014) showed that scientists are perceived as very competent but not warm, sharing the 'competent but cold' cluster with occupations such as accountants, researchers, CEOs, and lawyers (Fiske & Dupree, 2014). Later research theorized that perceptions of morality are distinct from warmth (e.g., Leach et al., 2007). This distinction turned out to be relevant when evaluating scientists who are generally perceived as high in morality (Rutjens, Niehoff, et al., 2022). However, at the same time, scientists are perceived as capable of immoral deeds such as serial murder (Rutjens & Heine, 2016). In general, this research shows that theoretical models of social evaluations can offer new avenues to understanding the perceptions of scientists, although some seem inconclusive or contradictory (e.g., perceptions of scientists' morality).

Trust in scientists is probably the single most important concept in research on public perceptions of scientists: It robustly predicts compliance with and acceptance of scientific solutions across various scientific fields. For example, in the context of COVID-19, Algan and colleagues (2021) showed that trust in scientists "is the critical determinant of societies' resilience in their fight against the pandemic" (p. 1), given that it predicted the support for nonpharmaceutical interventions (e.g., closing schools, non-essential businesses, implementing curfews), compliance with health recommendations (e.g., hand washing, maintaining physical distance) and higher willingness to get vaccinated. Similarly, in the context of climate change, people who trust scientists are more likely to accept scientific consensus (Motta, 2018) and have stronger intentions to engage in both low-impact (e.g., using more efficient lightbulbs, switching to canvas bags) and high-impact (e.g., using the car less, having a sustainable diet) pro-environmental behaviors (Cologna et al., 2022; also see Cologna & Siegrist, 2020). There is indirect evidence that trust in scientists has a key role in other scientific areas as well, given that "deference to scientific authority" (which resembles trust in scientists) predicts support for agricultural biotechnology (Brossard & Nisbet, 2006) and embryonic stem cell research (Ho et al., 2008).

Given the importance of trust, an important goal is to determine levels of trust in scientists in society. In a survey of the global population, the Wellcome Global Monitor (2019) reports that 18% of participants indicated high trust in scientists (score above 3.5 on a scale from 1 to 4), 54% indicated medium trust (score between 2.5 to 3.5), 14% indicated low trust (below 2.5), and 13% had no opinion. In the US, scientists garner more trust compared to other civic and governmental institutions (e.g., police officers, business leaders, elected officials, religious leaders), with 84% of participants reporting they were 'somewhat' (46%) or 'very' (38%) confident that scientists provide the public with trustworthy information (Lupia et al., 2024). Although seemingly encouraging, there are two noteworthy caveats regarding these *relatively* high levels of trust. First, the trust levels are actually not very high in an absolute sense, as the majority of participants indicated 'medium' levels of trust. This is often inadequate for addressing issues that require high levels of public participation, such as vaccination campaigns or social dilemmas like climate change. Secondly, trends show that trust in scientists (and other experts) has declined in multiple countries such as the US, Italy, and France during the COVID-19 pandemic (Algan et al., 2021; Lupia et al., 2024), as well as among the conservatives in the US (Gauchat, 2012). This is especially alarming given the urgency of climate change and environmental protection (Ripple et al., 2020) and other pressing societal issues for which scientists propose solutions (e.g., social inequality, potential future virus outbreaks), as well as other technological advances scientists make (e.g., cancer and other medical research, nanotechnology).

Given the important role of trust in scientists, it is no surprise that a swath of recent research has attempted to determine its predictors. This research has revealed numerous factors such as science education, trust in other institutions, urban vs. rural background, and perceptions of household income (Wellcome Global Monitor, 2019). However, some research has drawn more from theoretical work that highlights the crucial role of social evaluations as fundamental components of trust (Fiske & Dupree, 2014; Mayer et al., 1995; Wei et al., 2024). This research line indicates that perceptions of competence, integrity, and benevolence represent the main factors of trust (Besley & Tiffany, 2023; Hendriks et al., 2015), with a possibility of a fourth factor of openness (Besley et al., 2021).

Notably, most of this research fails to account for the diversity of scientific occupations, by focusing on trust in generic *scientist(s)*. Importantly, however, scientists are not a homogeneous group: Not only do they work in different areas (for example, sociologists and nuclear physicists conduct very different research), but their work often emphasizes dissimilar values, and their solutions for societal problems could have divergent implications (e.g., what economists vs climatologists offer as solutions to climate change). Finally, a plethora of work has shown that science skepticism – unwarranted rejection of science – stems from different worldviews across different fields of science (e.g., spirituality is more strongly related to vaccine skepticism, political conservatism with climate change skepticism; Rutjens, Sutton, et al., 2018). Therefore, any intervention aimed at understanding and improving perceptions of or trust in scientists would need to take that diversity into account. I demonstrate the importance of taking a systematic approach to the diversity of scientific occupations in Chapters 2, 3, and 6 (see below).

Understanding the factors that shape social evaluations of scientists – and consequently trust in them – is a pressing issue that could pave the way for potential interventions. However, it is yet unclear where the perceptions of scientists stem from. An important body of work points to the role of motivation in attitudes toward *science* (but not scientists). According to the motivated rejection of science (Hornsey, 2020; Rutjens, Heine, et al., 2018), motivational factors such as ideologies, vested interests, conspiracist worldviews, and fears and phobias, drive the rejection of scientific evidence (e.g., the reality of climate change, or skepticism toward evolution). Extending the motivational approach to the perceptions of scientists, I explored the role of different worldviews in Chapters 4, 5, and 6, demonstrating the crucial role of political ideology, which I focus on specifically in Chapter 6.

Additionally, the present dissertation contributes to understanding the overlooked relationship between the work on the image (stereotype) of scientists and social evaluations (Chapter 4) and develops new approaches to measuring trust in scientists (Chapter 3) and stereotypes of scientists (Chapter 4). Finally, it presents a novel approach to understanding and measuring extremely negative perceptions of scientists which resulted in the harassment of scientists, and even violent acts targeted against them (Chapter 5).

Chapters Overview

Below I provide an overview of the following empirical chapters, and I make several notes about the conducted research. As mentioned previously, the overall goal of the dissertation was to improve understanding of the perception of scientists, which would pave the way to improved social evaluations (and consequently higher trust and higher scientific career appeal) and reduced negative perceptions (harassment and violence) of scientists.

In the first empirical chapter—**Chapter 2: Social Evaluations of Scientific Occupations**—I present a systematic examination of the perceptions of scientists, which serves as scaffolding for the following chapters. First, to gain a representative list of scientists, this research used a bottom-up approach by asking participants to list any scientific groups that came to their minds. While overall many scientific occupations were listed (the lists contained over 30 groups of scientists), three occupations – chemists, biologists, and physicists – were especially accessible in people's minds as these groups were mentioned most often. In the second part of this research, we investigated the perceptions of listed scientists using the three latest social evaluation models – the Behavioral Regulation Model (Ellemers, 2017), the Dual Perspective Model (Abele et al., 2016), and the ABC model of stereotypes (Koch et al., 2016). Given a large number of scientific occupations that had to be evaluated on multiple dimensions, we employed a form of stimulus sampling and presented only six (out of over 30) scientific occupations to each participant. The results showed that scientists are generally perceived quite positively – the public perceives them as extremely competent (which turned out to be the most prototypical characteristic of scientists), very assertive and moral, and moderately warm. However, different clusters of perceptions emerged, indicating that the public perceives differences between scientists. For example, neuroscientists and nuclear physicists were seen as more competent than psychologists and sociologists, while oceanographers and botanists were seen as more warm than computer and data scientists. The studies from this research, conducted in both the US and the UK, yielded very similar results, indicating the generalizability of the findings on perceptions of scientists (at least in Western cultures). Overall, this chapter demonstrated that it is more fruitful to consider perceptions of *groups or types* of scientists (i.e., scientific occupations), rather than of scientists as a monolithic entity. We utilized this approach in the following chapter (Chapter 3), as well as in the concluding one (Chapter 6).

In the next chapter, **Chapter 3: How Social Evaluations Shape Trust in 45 Types of Scientists**, we extended the just-described approach, by utilizing the social evaluation model that has the most complex structure (four dimensions – perceptions of competence, assertiveness, warmth, and morality; Abele et al., 2021) to predict trust in scientists. We used the list of scientists obtained from the previous chapter but extended it to 45 scientific occupations (from agronomist to zoologist), and used the same methodological approach of stimuli sampling. Importantly, we did not measure only perceptions of trust, but developed an instrument conceptualized as a consequence of trust. Specifically, we developed the influence granting task, which is a measure of willingness to grant scientists influence on the management of complex societal problems. Participants were presented with an imaginary societal problem and asked to distribute decision-making power across different parties (such as family and citizens), which also always included scientists. In this way, we measured not only trust in scientists but its consequences as well. Overall, we found that trust in scientists was relatively high; however, supporting the conclusions from the previous chapter, we found large differences in trust between scientific occupations. For example, the public trusted political scientists and economists the least, while marine biologists and neuroscientists garnered the highest trust levels. Importantly, we found that perceptions of competence and morality, rather than assertiveness and warmth, contributed to trust in scientists. However, the role of morality, which was the strongest predictor of trust, varied across occupations: It was a much stronger predictor of trust in scientists who work in contentious domains of science (e.g., climate change and social sciences) than other domains, with less impact on today's society (e.g., geography or archeology). Overall, this chapter extends the previous one and supports the conclusion that researchers and practitioners should account for the diversity of scientific occupations to enable scientific solutions to find their way to policy.

Given the importance of social evaluations, the natural question is to understand where they come from, as well as how they relate to the image (stereotype) of scientists described earlier. In **Chapter 4: Stereotypes and Social Evaluations of Scientists are Related to Different Antecedents and Outcomes**, we focused on five worldviews most prominently studied in this area of research (political ideology, religiosity, spirituality, conspiracy mentality, and Western enculturation) as predictors of social evaluations and stereotypes of scientists. In achieving this, we needed to adapt/develop a measure of stereotypes of scientists in the Likert-scale format (compared to drawings) to be used more efficiently. Lastly, we investigated how social evaluations and stereotypes of scientists predicted key outcomes, which, apart from trust and influence granting, included the appeal of a scientific career. Here, we built on the idea that the internalization of the stereotype (especially among those who do not conform to the stereotype, i.e., young non-white women) might impede one's willingness to pursue a career in science. We discovered that social evaluations and stereotypes are indeed different concepts that correlate only slightly. Additionally, we found they stem from different worldviews, as political ideology was the most important predictor of social evaluations (right-wing individuals had more negative evaluations of scientists), while stereotypes were shaped by higher Western enculturation and religiosity. Similarly, they had relatively different outcomes given that more positive social evaluations predicted both increased trust and appeal of a science career, while stereotypes of scientists had no relation with trust, but negatively predicted the appeal of a science career. Specifically, the effect of stereotypes was evident in stereotype-incongruent groups: If participants who mismatched the scientist stereotype of middle-aged/old white males had internalized the stereotypical image, they were less interested in a science career. Overall, this research highlights the importance of worldviews in shaping perceptions of scientists, and their consequential role in trust and science career appeal.

Scientists do not harness only (relatively) positive perceptions – during COVID-19, anti-science movements radicalized to the extent that scientists were harassed by receiving death threats, or even physically attacked. One of the striking examples is that of Marion Koopmans, a Dutch virologist who barely escaped an angry mob while visiting a museum. Her example is not an exception: As much as 38% of surveyed scientists who worked in the COVID-19 area suffered from harassment such as death threats, doxing, corruption allegations, and so on (O'Grady, 2022). These findings were a key motivation behind the next chapter, **Chapter 5: Who Harasses Scientists? The Role of Worldviews, Radicalization Risk Factors, and Personality in Violent Behavior Toward Scientists**. Two studies conducted in this chapter aimed to understand the motivation behind extremely negative perceptions and actions against scientists. In this research, we directly integrated different theoretical perspectives – motivational accounts of science rejection, a radicalization framework, and a personality approach. To do so, we developed the attitudinal measure of harassment of scientists, as well as three behavioral measures – a Voodoo Doll Task (DeWall et al., 2013, adapted for scientists), signing a petition against and donating (real) money for the cause of preventing harassment of scientists. Among multiple predictors, we found that science cynicism – the view of scientists as incompetent and corrupt – drives approving attitudes toward scientists' harassment, as well as negative behaviors (refusing to sign a petition or to donate money). Additional contributing factors to approving attitudes toward harassment of scientists were perceptions of scientists as threatening and dark personality traits. This research stands as a novel work that explored negative perceptions of scientists, which may not only help to understand but also to prevent such extreme behavior. It is noteworthy that both this and the previous chapter (Chapters 4 and 5) do not account for the diversity of scientific occupations because both investigated perceptions of "scientists". Even though we established the importance of accounting for the diversity of scientists, we did not apply this differentiation in these two chapters for two reasons. First, it is resource-demanding to include a large group of scientists as a target group, because each additional occupation significantly prolongs the study (i.e., by requiring the completion of the same materials). Thus, this strategy can be applied only when a small number of variables is studied (as in the other chapters). Secondly, it would require developing scales specifically for each scientific occupation (e.g., stereotypes specific to each occupation). Therefore, we decided to use the generic term "scientists" given the complexity of the research models that are tested in Chapters 4 and 5.

Finally, the last empirical chapter in the dissertation, **Chapter 6: Political Ideology and Trust in Scientists** builds on the approaches and findings from Chapters 2, 3, and 4. More specifically, we were interested in the relationship between political ideology (liberal vs. conservative) and trust in scientists, given the opposing views in the literature. One line of research claims that liberals trust scientists more than conservatives do (e.g., Blank & Shaw, 2015; Gauchat, 2012), while another claims that this depends on the scientific occupation in question, and that conservatives trust scientists more if they work in areas of economic productivity (Dunlap, 2014; McCright et al., 2013). Given our approach that includes a large number of scientists, we were able to investigate whether and how the relationship between political ideology and trust in scientists varies across different occupations. A pilot study, which used data from Chapter 3, showed that liberals overall trusted scientists more than conservatives did, but the relationship varied across occupations. Liberals were especially likely to trust more in occupations in areas of climate change, medical research, and social issues. Overall, liberals showed higher trust for 43 out of 45 occupations; the only two for which conservatives indicated higher trust were computer scientists and economists. Given this finding, the second part of the research was a large, high-powered (N = 7800) intervention study aimed at increasing conservatives' trust in scientists, using theoretically informed strategies predominantly based on motivational accounts of science rejection (Hornsey & Lewandowsky, 2022). Crucially, the study was conducted as a registered report, ensuring it was reviewed *before* it was carried out, and is to be published regardless of the results. Even though all five interventions were piloted (to make sure they fit conservative worldviews and are believable), none of the interventions proved successful. These results are informative as they cast doubt on many similar interventions that previously failed to replicate (and were barely significant/low-powered in the first place). Apart from this, I also discuss more generally how weak the effects of interventions in the area of science attitudes and communication are (on the verge of practical irrelevance), and possibly non-replicable. The chapter concludes with a short discussion of the internal dynamics of scientific research, in terms of how the wider neoliberal political and economic system might be one of the drivers of the replication crisis in science. I return to some of these issues in **Chapter 7** (General Discussion).

Some Considerations Regarding the Dissertation

Before moving to the empirical chapters, a few important notes are in order. First, all empirical chapters are either published works or manuscripts under review, which is why they can be read as standalone articles and why there is a necessary overlap in theoretical (but also methodological) considerations and discussions. All authors' contributions are given in the part "Authors' Contributions and Funding" at the end of the dissertation.

Second, all research was conducted in line with all ethical standards and guidelines by the Department of Psychology of the University of Amsterdam. For each empirical study, the ethical committee provided ethical approval. All participants were informed about the goals of the study, agreed to participate in it, and (if needed) were debriefed after their participation.

Third, I strongly believe in the importance of open science practices. For this reason, all empirical chapters, materials, data, and analysis scripts are publicly shared on the Open Science Framework. Additionally, all studies in Chapters 3, 4, and 5 were pre-registered. Most importantly, Chapter 6 was conducted as a large-scale *registered report*. This format ensured giving answers to crucial research questions, which, given the results, otherwise might have not been published (or would have been published in a less impactful journal). Such an outcome would hopefully encourage other early career researchers to find their way to publishing non-significant results in impactful journals. Additionally, my hope is that the non-significant results and our discussion thereof will impact the field more than if they were significant. This brings me to the last point of the general introduction.

A more general philosophical approach that I take is that of dialectical materialism, and I believe that only through the use of dialectical analysis one can advance knowledge. Dialectical analysis implies that one should analyze a phenomenon through its internal contradictions and that 'development is the struggle of opposites' (Lenin, 1925). Materialism entails analyzing a phenomenon as a product of material conditions—historical, economic, and political—that shape it (Stalin, 1938). Therefore, one of the scientists' goals should be to always remain critical, and by extension, radical, as both approaches involve questioning and challenging the status quo (see Marković, 1968)[2]. In Chapter 7 (General Discussion), I apply dialectical materialism in the discussion of non-significant results from Chapter 6, their relation to the replication crisis, and the conditions under which the replication crisis emerged. I believe that taking this critical approach will eventually lead to better science, and ultimately to increased trust in scientists.

2 Readers should note that arguably radical views in the introduction and general discussion parts of the dissertation are solely mine, and should not be attributed to my supervisors or other co-authors

CHAPTER 2

SOCIAL EVALUATIONS OF SCIENTIFIC OCCUPATIONS

Science and scientists are among the key drivers of societal progress and technological developments. While research has demonstrated that science is perceived as heterogeneous, work on perceptions of scientists usually considers "scientists" as members of a homogeneous group. In the present research, we went beyond this general categorization by investigating differences in social evaluations of different types of scientists. Across four studies conducted in the UK and the US (total *N* = 1441), we discovered that members of the most frequently mentioned scientific occupations (35 and 36 respectively in each country) are seen as highly competent, relatively moral, but only moderately sociable. We also found that individuals perceive differences between scientific occupations across social dimensions, which were captured in clusters of scientific occupations. Chemists, biologists, and physicists represented the most mentioned and highly prototypical scientific occupations. Perceived prototypicality was primarily associated with competence ratings, meaning that, in the public's view, to be a scientist means to be competent. Perceptions of morality and sociability varied notably across clusters. Overall, we demonstrate that focusing only on "scientists" leads to overgeneralization, and that distinguishing between different types of scientists provides a much-needed nuanced picture of social evaluations of scientists across occupations.

This chapter is based on the following publication:
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Anri Burton: "Knowledge is only valid when it's based on morality."
Kris Kelvin: "Man is the one who renders science moral or immoral. Remember Hiroshima?"

(*Solaris*, 1972)

Contemporary societal problems, like the COVID-19 pandemic, have put both science and scientists in the spotlight. Scientific experts such as virologists and epidemiologists have increasingly been at the center of public attention, where they have been represented in various lights: from heroes who will stop the pandemic (Park & Ducharme, 2021) to cold and immoral profit-seeking agents (Hope, 2021). Given that scientists are more and more present in the media, it is surprising how little research has investigated social evaluations of scientists. This dearth of research is even more notable when considering that "scientist" is not a monolithic category: Various types of scientists can be identified even within the same scientific field (e.g., climatologists, meteorologists, and geophysicists investigating climate change). To the best of our knowledge, no research has systematically studied whether different scientific occupations elicit different evaluations, that is, whether people perceive meaningful differences between these occupational groups. In the present research, we attempted to fill this gap by investigating social evaluations of different types of scientists, and how these relate to perceptions of prototypicality. A comprehensive understanding of social perceptions of scientists would increase the understanding of previous studies (e.g., those focusing on the general category of "scientists"), as well as provide theoretical scaffolding for future studies by investigating whether the public sees scientists as a monolithic group, several groups, or even as individual scientific occupations. Finally, it would provide insights for potential interventions aimed at increasing public acceptance of science or the appeal of certain scientific careers.

What does a scientist look like in people's minds? Early research showed that scientists are stereotyped as older, middle-aged males with beards and glasses, wearing white coats, and working in a laboratory (Beardslee & O'Dowd, 1961; Mead & Métraux, 1957). Later, researchers developed a Draw-A-Scientist-Test which investigated stereotypes that children had by simply asking them to draw a scientist, and then counting how many of the seven stereotypical elements occur (e.g., lab coat, eyeglasses, facial hair; Chambers, 1983). While this test went through several changes and improvements over time (e.g., by adding characteristics such as male sex, indications of danger, indoor work; Finson et al., 1995), findings seem to be relatively stable. As a recent review showed, the scientists' image is not much different from the one found in classic research, so scientists are still stereotyped as white middle-aged or older males who wear lab coats and work indoors (Ferguson & Lezotte, 2020). Notably, however, the once pervasive idea of a deranged and evil scientist who conducts dangerous experiments has become less prominent (Ferguson & Lezotte, 2020; Haynes, 2003; Haynes, 2016).

While classic research focused on the scientist's image, more recent research investigated the social evaluations they elicit, that is, perceptions of scientists' psychological characteristics. This work is not independent of the previous line, given that the image of a scientist almost necessarily includes a perception of traits such as intelligence, brilliance, and/or genius (Mead & Métraux, 1957). Fiske and Dupree (2014) investigated perceptions of different occupations and found that scientists and researchers are seen as highly competent, but only modestly warm. Thus, scientists were classified into the cold-competent cluster that also included occupations such as lawyers and accountants. These findings were replicated and extended, showing that scientists are indeed perceived as highly competent and not very warm (Rutjens, Niehoff, et al., 2022). However, this research also found that the public perceives scientists as relatively moral. Therefore, although people view scientists as more competent than moral, they also see them as more moral than warm. Morality indeed plays an important role in the perception of scientists–even though scientists are seen as generally moral (honest, trustworthy), people still associate them with severely immoral behavior, particularly when the behavior involves moral purity violations (Rutjens & Heine, 2016). Importantly, this second line of research utilizes social evaluation models, which we also employed in the present studies.

A fundamental issue in psychology concerns the number of dimensions along which individuals organize their social evaluations. The Stereotype Content Model (SCM; Fiske et al., 2002) proposes that individuals first assess one's *warmth* (whether someone has good or ill attention), and then *competence* (whether they are able to fulfill these intentions). More recent research suggests important differences between warmth and morality (e.g., politicians are often perceived as simultaneously friendly and cunning), even arguing for the primacy of the latter (Goodwin, 2015; Leach et al., 2007). Addressing this issue, Ellemers and colleagues (Ellemers, 2017; Ellemers & Van Den Bos, 2012) developed a three-dimensional model (the Behavioral Regulation Model; BRM) containing dimensions of *competence*, *sociability* (i.e., warmth in the SCM), and *morality*. Finally, the Dual Perspective Model (DPM) (Abele et al., 2016; Abele & Wojciszke, 2014) argues that both two superordinate factors—*agency* and *communion* (i.e., competence and warmth in the SCM)—could be divided into two facets: Communion consists of warmth and morality (mirroring the BRM), while agency includes competence (whether one is capable, intelligent) and assertiveness (whether one is confident).

Another social evaluation model is the ABC model of stereotypes (Koch et al., 2016), which argues that three dimensions that emerge in spontaneous judgments are *agency* (referring more to structural position in a hierarchy, rather than competence in the sense above), *communion* (which subsumes both warmth and morality), and a very different dimension – *beliefs*. The last dimension is based along the continuum progressive-conservative, where groups that are more progressive challenge and change the status quo, whereas conservative groups prefer its maintenance. In the present research, we used the BRM, ABC, and DPM models to investigate scientists' perceptions. We used the BRM because it extends the SCM by emphasizing the role of morality. The ABC model was included for its innovative dimension of belief, which might be relevant for differentiating scientists (e.g., geneticists and nuclear physicists could challenge the status quo more than mathematicians). Finally, the DPM is relevant as its dimensional structure appears to be most appropriate according to the most recent integration of five different social evaluation models (Abele et al., 2021).

Although the research described earlier provides insights into how people view scientists in general, it remains unclear to which specific occupation(s) the generic term "scientist" refers. Nevertheless, some of the characteristics described in classic research (Beardslee & O'Dowd, 1961; Mead & Métraux, 1957) point to certain scientific occupations that might be seen as prototypical of scientists. For example, while lab coats and instruments are indicative of chemical occupations, equations are typical for physical and mathematical occupations. Seeing these occupations as prototypical of science also resonates well with the literature, as researchers used mathematicians (Haynes, 2016) or chemists (Finson, 2002) as representatives of scientists. When asked about controversial science, biologists and chemists were found to be the most representative (Suldovsky et al., 2019). Similarly, physics, biology, and medicine are perceived as more scientific than sociology and economics (Gauchat & Andrews, 2018). In general, while some occupations are mentioned more often than others, no study has systematically investigated which occupations are most prototypical of science. This is problematic given the breadth and diversity of scientific occupations. Even more importantly, the homogenization of scientists can be misleading, given that both the structure of science and public evaluations of science are found to be heterogeneous (Rutjens, Heine, et al., 2018).

Science is by no means a uniform enterprise, neither from a philosophical point of view (e.g., the difference between natural and social sciences) nor from a psychological perspective. For example, science skepticism, defined as the systematic rejection of scientific method and evidence, has different levels across domains. Even though most people would agree that smoking causes cancer (98% in France; Peretti-Watel et al., 2007), such consensus is much lower for other scientific issues (Lewandowsky et al., 2016) such as anthropogenic effects on the climate (57% in the US) (Marlon et al., 2023) or safety of genetically modified (GM) food (13% across 20 countries; Kennedy & Thigpen, 2020). Similarly, the causes and correlates of science skepticism are heterogeneous as well, meaning that skepticism in different domains stems from different antecedents. For example, climate change skepticism is best predicted by political conservatism, evolution rejection is mostly dependent on religious views, while skepticism toward GM food is best predicted by science knowledge (Drummond & Fischhoff, 2017; Rutjens, Sutton, et al., 2018).

These various strands of research converge on the notion that science is a multifaceted concept. This notion should also apply to *scientists*. Even classic research showed that stereotypes between biologists, chemists, and physicists are somewhat different, so that biologists are closest to the American ideal, while physicists engender more negative stereotypes (Beardslee & O'Dowd, 1961). More recent research shows that publicly (vs. privately) funded scientists foster more positive social evaluations (Rutjens, Niehoff, et al., 2022) and trust (Critchley, 2008). Additionally, ideology affects the perceptions of different scientists in different ways. For example, conservatives (vs. liberals) prefer scientists working in production (industrial chemists, petroleum geologists) more than impact science (epidemiologists, oceanographers) (McCright et al., 2013). Finally, people attribute different reasons for the success of individual scientists (e.g., Einstein succeeded because of his extraordinary talent, and Edison due to his efforts and perseverance), which has downstream consequences for people's own motivation to succeed in science (Hu et al., 2020; J. Schinske et al., 2015). In sum, research indicates that not only science but scientists as well should not be simply viewed as one uniform group. However, none of the research discussed here has systematically investigated these differences.

The present research had two aims. The first aim was to systematically investigate social evaluations of an extensive list of different scientific occupations. We did this by mapping occupations on social evaluation dimensions and investigating whether meaningful clusters emerge. The second aim was to identify the most prototypical scientific occupations, and investigate which social evaluation dimensions contribute to this prototypicality.

To achieve these aims, we conducted four studies utilizing quota and representative sampling (see methods for details), two in the UK (Studies 1a and 1b), and two in the US (Studies 2a and 2b). In Study 1a, we utilized a bottom-up approach and asked participants to freely list scientific occupations that came to their minds. In Study 1b, we used this list to investigate social evaluations of these occupations using the BRM and ABC models of social evaluations, and how these evaluations relate to prototypicality perceptions. Study 2a was identical to Study 1a, as we wanted to use the same bottom-up approach but in another country (US). In Study 2b, we aimed to replicate Study 1b (which involved the BRM model) and extend it by using another model (the DPM). All materials, databases, analysis scripts, and supplemental information can be found at the Open Science Framework (OSF; https://osf.io/cpjyd/?view_only=9f8ae089d0a34c1e9a8d9ea048121c5f)

Study 1a

The aims of Study 1a were to obtain a list of scientific occupations for the main study and to discover scientific occupations that are most accessible to participants.

Method

Participants

We recruited 300 UK participants using Prolific, pre-screening only participants with an approval rate of 100%. We used quota sampling, based on the demographic quotas (age and gender) from the Office for National Statistics (ONS, 2011). Our sample was balanced on gender (149 males, 149 females, 2 indicated "other") with a mean age of 42.8 years (*SD* = 14.5). Two percent of the sample had education less than high school, 31% had completed high school, 8% were students, 39% had an undergraduate degree, and 21% had a graduate degree (percentages total over 100 due to rounding). Participants were paid £0.88 (around €1 or $1.20) for their participation of approximately seven minutes.

Procedure

In this study, we utilized a bottom-up approach and asked participants to write down all scientific occupations that came to their minds during five minutes. We preferred this approach over utilizing an existing list for several reasons. First, existing lists of scientific occupations differ notably from one another as they were compiled based on divergent inclusion criteria. Rather than arbitrarily selecting one such list, which might introduce bias in our investigation, we decided to adopt a bottom-up approach to generate our own list. Second, we were interested in how the public sees scientists. Therefore, we sought to include only scientific disciplines that participants can spontaneously think of. This approach ensured that the occupations that ended up on our list are familiar to participants, so that rating them on various social evaluation dimensions is a meaningful task. As an added benefit, by using a bottom-up approach we obtained counts that allowed us to discover the three most salient occupations.

Participants had 25 boxes they could fill out. However, we neither set a minimum nor maximum of occupations they had to name, so as not to encourage consulting other sources of information. The number of boxes was based on a small pilot in which three psychology researchers managed to fill out around 20 occupations in five minutes. Therefore, participants had only one task of coming up with scientific occupations. After signing the consent form, they were presented a page instructing them to write down all scientific occupations they could think of, without consulting any other sources of information such as the Internet. Next, participants were presented with the boxes and the 5-minute timer. When five minutes passed, the page automatically closed. On the final page, participants were thanked and redirected to the submission page.

Results and Discussion

Before analyzing the data, we took several steps in preprocessing to account for idiosyncrasies in responding (e.g., correcting spelling mistakes, capitalizing first letter entries, etc.). All of these steps are elaborated on in the Supplement.

Based on the pre-processed list, we calculated the entry frequency for each scientific occupation. The final list contained 35 scientific occupations that had more than 15 counts (see the second column of Supplementary Table 1). As the table shows, the list is dominated by natural science occupations (nine out of the top ten). The most frequently mentioned occupations were *chemists*, *biologists*, and *physicists*. Interestingly, the list also includes several occupations that do not belong to natural sciences (e.g., *psychologists*, *archeologists*), with most of them in the lower part of the table (e.g., *anthropologists*, *sociologists*). Given that the list obtained in this study contained the most accessible and familiar occupations, we used it in Study 1b in which we investigated social evaluations of these occupations.

Study 1b

This study aimed to map scientific occupations that were produced in Study 1a, using fundamental dimensions of social evaluations. This approach also allowed us to investigate whether meaningful clusters of scientific occupations emerge based on social evaluations, that is, whether or not all scientific occupations are perceived as belonging to the same category. Additionally, we wanted to see which occupations are seen as most prototypical of scientists, and which social evaluation dimensions contribute to this prototypicality.

Method

Participants

We recruited 482 UK participants using Prolific, allowing only participants with an approval rate of 95% to take part in the study. This number of participants was based on a calculation that each occupation should have 80 ratings (each participant rated six occupations, see procedure). Same as in the previous study, we used quota sampling, based on the demographic quotas. Participants were paid £1.50 (around €1.75 or $2) for their participation of approximately eleven minutes.

Before data analysis, we excluded inattentive respondents (*n* = 4) and speeders, that is, respondents whose completion time was twice faster than the median of 562 seconds (*n* = 9). We also excluded 58 more participants as outliers (see Outliers calculation). This resulted in the final sample of 411 participants (206 males, 204 females, 1 indicated "other"), with a mean age of 43.3 (SD = 14.2). One percent of the sample had education less than high school, 33% had completed high school, 7% were students, 40% had an undergraduate degree, and 19% had a graduate degree.

Outliers calculation

Regarding the outliers, we first excluded univariate outliers on the prototypicality measure for each occupation using median absolute deviation (MAD). Therefore, we first tested outliers for prototypicality scores for chemists (*n* = 4 based on the cut-off of 35), then biologists (*n* = 1 based on the cut-off of 30), and so on for each of the 34 occupations that had prototypicality ratings. This resulted in the exclusion of 50 participants. Next, we tested for multivariate outliers (Mahalanobis distance) on each social evaluation item (25 in total) for each occupation. That is, we checked for multivariate outliers in responding to the perceptions of "scientist", then "researcher", and so on. Based on this strategy, we excluded eight more participants.

Materials and procedure

Occupations. Our final list used for Study 1b included 36 occupations (see Supplementary Table 1). In addition to the list with which participants from Study 1a would come up, we also planned to use generic terms of "scientist" and "researcher". However, since the list from Study 1a already contained the term "researcher", we only added the term "scientist" to the 35-occupations list, resulting in 36 occupations to be rated. To prevent fatigue, each participant was presented with six randomly selected occupations and asked to rate them on the following measures.

Measures. After reporting their demographics, participants were presented with six scientific occupations which they rated on two groups of social evaluation measures (based on the BRM and ABC models) and prototypicality. The presentation order of the group of social evaluation measures was randomized. After completing all measures, participants were asked to honestly indicate how attentive they were, with a note that it would not affect their payment, only our analyses (1 = *not at all attentive* to 5 = *extremely attentive*)

Competence, Sociability, and Morality. All three fundamental dimensions from the BRM model were measured using three items. Participants answered to what extent they felt that an average [scientific occupation] was "competent", "intelligent", "skilled" (Competence), "likable", "warm", "friendly" (Sociability), and "honest", "sincere", "trustworthy" (Morality) (Leach et al., 2007). All nine items were presented in random order. Answers were given on a seven-point Likert scale (1 = *not at all* to 7 = *extremely*). The scores for each dimension were calculated by taking the mean ratings of three respective items.

Agency, Beliefs, and Communion. To measure the dimensions of the ABC model, we used a seven-point bipolar scale (-3 to 3), with the following anchors for Agency: "powerless-powerful", "dominated-dominating", "low status-high status", "poor-wealthy", "unconfident-confident", "unassertive-competitive". Beliefs were measured with the adjectives "religious-science oriented", "conventional-alternative", "conservative-liberal". Communion was measured using the anchors "untrustworthy-trustworthy", "dishonest-sincere", "repellent-likable", "threatening-benevolent", "cold-warm", "egoistic-altruistic".

Prototypicality. To measure the prototypicality of each occupation, we asked participants to rate to what extent members of a given scientific occupation were good examples of scientists. Participants answered using the slider from 0 = *not at all*, to 100 = *extremely*. The question of prototypicality was not presented for generic occupational terms of "scientist" and "researcher", and was always presented after the social evaluation questions.

Reliabilities. Since each occupation had its own assessments of social dimensions, there were 36 reliability scores for each of the social dimensions measured above (216 scores in total). As for the BRM model, all measures showed good reliabilities with median Cronbach's alpha values of α = .88 for Competence (range .77-.94), α = .92 for Sociability (range .87-.95), and α = .91 for Morality (range .79-.95). On the other hand, reliabilities of ABC measures were slightly lower: Agency's median α = .83 (range .72-.90), Communion's median α = .83 (range: .65-.91), while the reliability of Beliefs measure was poor, median α = .55 (range: .23-.79). Given the low reliability of the Beliefs scale, using this measure for analyses would not be valid, which is why we do not report analyses based on the ABC model.

Results and Discussion

Prototypicality and counts

We first investigated whether occupations' prototypicality scores (also given in Supplementary Table 1) from Study 1b are correlated with counts from Study 1a. High correlations would indicate that the most prototypical occupations came first to people's minds. On the other hand, low or no correlation would indicate that participants did not have the most prototypical occupations on their minds, suggesting that the list is not exclusive of less prototypical occupations, and thus representative to some extent. A correlation size of $r(32) = .360$, $p = .036$, suggests that latter is the case. This is even more evident when the correlation is calculated after leaving out the three occupations with the highest counts (chemist, biologist, physicist), $r(30) = .178$, $p = .330$.

Clusters of occupations

To test for clustering, we first had to calculate dimension ratings for each occupation. Since not every participant rated each occupation, we did not use the mean ratings, but wanted to control for idiosyncrasies[36]. We estimated means from a mixed model which included random intercept for participants ($ICC_{competence} = .27$, $ICC_{sociability} = .39$, $ICC_{morality} = .44$). Ratings for the BRM dimensions for each occupation are given in Supplementary Table 1. Means suggest that scientific occupations are judged to be highly competent ($M = 5.88$), moderately sociable ($M = 4.61$) and relatively moral ($M = 5.20$). Differences between all dimensions were significant, *t*s > 11.27 $p_{bonf} < .001$. Correlations between dimensions across occupations are presented in Table 1.

To determine the number of clusters based on perceptions of competence, sociability, and morality, we first investigated the plot of within-cluster sums of squares using hierarchical clustering as a partitioning function. This indicated that any number of clusters between 2 and 6 is viable. Next, using the NbClust package in R (using Euclidian distance to compute dissimilarity matrix and Ward method as cluster analysis method), we investigated which of the two-to-six-cluster solution is most appropriate. The NbClust package uses 30 indices to determine which proposed number of clusters is the best according to the majority of indices. In the present study, NbClust showed that 10 indices suggested a 6-cluster solution. We performed cluster analysis using hierarchical clustering as an algorithm (Euclidian distance and Ward method). The 3D graph is not feasible to include in an article, which is why we present the six-cluster solution here: https://rpubs.com/vukashg/861145. To present the clusters on a 2D graph, we collapsed sociability and morality into one dimension given that many models consider them to be subdimensions of a higher-order factor named warmth (Fiske et al., 2002) or communion (Abele et al., 2016) (Figure 1). We named the clusters according to the overlapping content of the respective occupations; however, in some cases, an occupation would better fit into a different cluster. Therefore, these names should be viewed as relatively arbitrary but nonetheless helpful in interpretation, rather than as reflecting the inherent structure of scientific occupations.

The figure shows several patterns. Most notably, the generic category "scientist" is found among physical and mathematical occupations, which are, together with biomedical occupations, rated as the most competent. It is also noteworthy that there is an overlap between these occupations, as illustrated by the membership of "astronomer" which was classified as a biomedical occupation. Another two clearly defined clusters are occupations concerned with wildlife (most sociable and moral) and those concerned with computer science (averagely competent and less sociable relative to other occupations). The cluster in the center of the graph covers the earth and social sciences (average on all dimensions), while the final cluster contains occupations that do not seem to have anything in common content-wise, but are seen as less competent compared to other occupations. Interestingly, it also contains the term "researcher", suggesting its different perception from the "scientist" which has a higher competence score. Importantly, almost identical results are obtained when we used *k*-means clustering to determine cluster membership, with the only difference being "astrophysicist" which is classified as a biomedical occupation (supporting the notion of conceptual overlap between two clusters). We also probed the stability of the 6-cluster solution by using different outlier strategy and calculation of dimensions scores. This returned very similar results, indicating the stability of the findings.

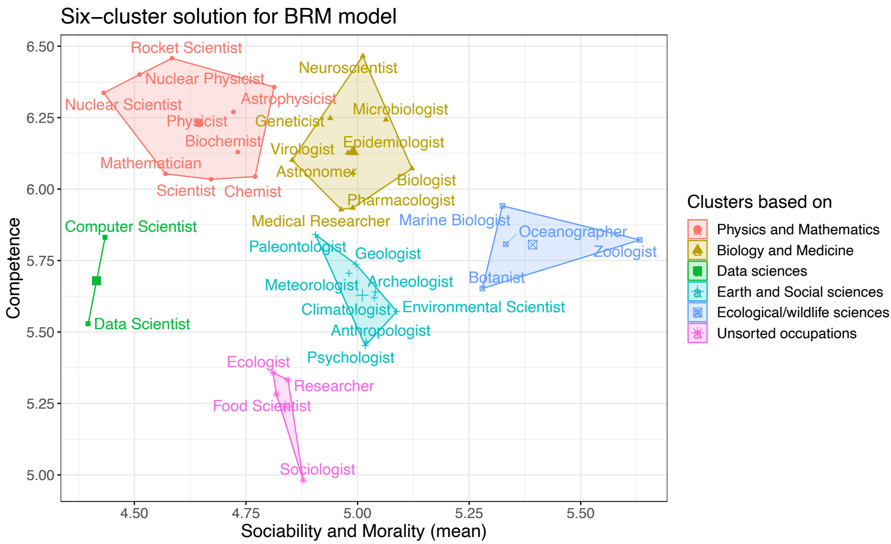

Figure 1. Six clusters of scientific occupations based on the ratings of competence, sociability, and morality. For the 2D representation, we collapsed sociability and morality because many models consider them subdimensions of a higher-order factor (named warmth; Fiske et al., 2002 or communion; Abele et al., 2016). Lines represent cluster borders, with each cluster having its own color and symbol. Cluster centroids are represented with a large symbol in the cluster center.

Social evaluation dimensions and Prototypicality

We next investigated which social dimensions contribute to prototypicality perceptions. Rating an occupation as more prototypical of scientists was associated with perceptions of higher competence, lower sociability, and higher morality (Table 1). Next, we included three social evaluation dimensions in linear regression as predictors of prototypicality. The model was significant, $F(3,30) = 37.190$, $p <.001$, $adj\ R^2 = .77$, showing that only higher levels of competence contributed to the perception of prototypicality, $t = 5.015$, $p <.001$, with no effects of sociability or morality (ts < .389, ps > .70).

Table 1. Correlations between social evaluations and prototypicality

	Competence	Sociability	Morality
Competence			
Sociability	-.466**		
Morality	.299†	.624***	
Prototypicality	.877***	-.296†	.374*

Note. Correlations with prototypicality did not include generic occupations of "scientist" and "researcher". † p <.10· * p < 0.05· ** p < 0.01· *** p<.001

In sum, Study 1b showed that scientists are perceived as highly competent, relatively moral, and moderately sociable. Yet, people distinguish between different types of scientists along these social dimensions, which results in six clusters of scientific occupations that vary in the extent to which they are perceived as competent, sociable, and moral. Finally, the most prototypical occupations are those rated as the most competent.

Study 2a

Our list of scientific occupations obtained in Study 1a was based on a UK sample, leaving a possibility the list is context-dependent (e.g., on a sample and/or country characteristics). In Study 2a, we aimed to test to what extent a different sample from a different country would produce a similar list of occupations.

Using Prolific and its representative sample feature, we recruited 303 participants in the US (147 males, 153 females, 3 indicated "other"; $M_{age} = 44.9$, $SD = 16.6$). Less than one percent of participants had education lower than high school (0.3%), 31% completed high school, 13% were students, 31% had an undergraduate degree, and 25% had a graduate degree. The procedure was identical to Study 1a, and data pre-processing and processing followed the same logic (see Supplement).

Results were highly similar to those obtained in the UK: Among occupations with 15 and more counts (36 in total), all occupations from the UK list, except "pharmacologist", were present in the US list. On the other hand, two additional occupations ("statistician" and "hydrologist") were featured in the list generated by the U.S. participants (Supplementary Table 1). This overlap suggests that the list is generalizable with occupations of *chemist*, *biologist*, and *physicist* again forming the top three (see https://osf.io/cpjyd/?view_only=9f8ae089d0a34c1e9a8d9ea048121c5f for tables from Studies 1a and 2a where occupations are sorted by counts of each study). We used this list to investigate social evaluations of scientists in Study 2b.

Study 2b

Study 2b had the same aims as Study 1b. However, instead of the ABC model (which showed poor reliability), we used the DPM, which includes a competence-assertiveness distinction (as compared to a single competence dimension in the BRM model). Besides mapping social evaluations of different scientific occupations, we again examined which dimensions contribute to prototypicality.

Method

Participants

We recruited 495 US participants using Prolific's representative sample feature. Participants were paid £1.80

(around €2.15 or $2.40) for their participation of approximately twelve minutes. Before data analysis, we excluded four inattentive respondents and 15 speeders (completion time twice faster than the median 722 seconds). We also excluded 49 more participants as outliers (see Outliers calculation). This resulted in the final sample of 427 participants (225 males, 198 females, 4 indicated "other"), with a mean age of 45.9 (SD = 16.3). One percent of the sample had education less than high school, 27% had completed high school, 10% were students, 36% had an undergraduate degree, and 26% had a graduate degree.

Outliers calculation

We calculated the number of outliers using the same outlier strategy as in Study 1b (MAD for univariate outliers on prototypicality and Mahalanobis distance for all other items). However, MAD returned 89 participants as outliers, which we deemed too big a proportion of the sample. For this reason, we switched to using three standard deviations from the mean as a univariate outlier strategy (excluding 43 participants), and Mahalanobis distance for multivariate outliers on each social evaluation item, as well as variables of trust and distance (excluding 6 participants). No data analyses were performed before outlier exclusion.

Materials and procedure

We used the same approach as in Study 1b. That is, we added "scientist" and "researcher" to the list, and had participants rate only six randomly selected occupations. The same measures of the BRM model and the prototypicality were used. New measures included the DPM model dimensions (we also measured psychological distance and trust toward each occupation; however, this was part of another research project, and therefore we do not report results for these variables here).

Competence, Assertiveness, Warmth, Morality. To measure the dimensions of the DPM model, we used a seven-point bipolar scale (-3 to 3), with opposite anchors for each dimension (Abele et al., 2016; Abele & Hauke, 2020). Each dimension was measured using five items. To measure Competence, we used anchors such as "incapable-capable", and Assertiveness was measured using pairs like "unconfident-confident". Warmth was measured using anchors such as "unfriendly-friendly", while Morality had pairs like "unjust-just". The scores were calculated as means of items belonging to the respective dimensions.

Reliabilities. For each of the social dimensions above, there were 37 reliability scores (259 scores in total). As for the BRM model, all measures showed good reliabilities with median Cronbach's alpha values of α = .89 for Competence (range .69-.95), α = .92 for Sociability (range .86-.96), and α = .89 for Morality (range .78-.93). Reliabilities of DPM measures were similar: Competence's median α = .91 (range: .78-.95), Assertiveness' median α = .87 (range: .72-.93), Warmth's median α = .92 (range .88-.95), and Morality's median α = .88 (range: .77-.93).

Results and Discussion

Prototypicality and counts

As in the first study, prototypicality scores from Study 2a had low correlations with counts from Study 2b, $r(33)$ = .236 and -.038, $ps > .17$ (respective correlation sizes when all occupations are included and when the three occupations with the highest counts are left out). Again, these indicate that the list is not exclusive of less prototypical occupations, and thus representative to some extent.

BRM model

We fully report the results for the BRM model in the Supplement. In short, we replicated findings from Study 1b: We discovered the same clusters, while only competence ratings contributed to prototypicality. We next wanted to see whether clustering changes when a different model of social evaluations is used. Additionally, given that the DPM model distinguishes between two facets of competence, we could investigate whether effects on prototypicality involve competence (i.e., ability, capability) and/or assertiveness (i.e., ambition, confidence). Below, we summarize the results of the analyses on the DPM model dimensions (see the supplement for full results).

DPM model

We used the same approach in determining the number of clusters as in Study 2. NbClust showed that most indices (8) suggested the 5-cluster solution. Cluster memberships for this solution based on HCA and K-means are given in Figure 2. Apart from several idiosyncrasies such as "incorrect" classification (in terms of cluster content) of "zoologist" and "anthropologist" in HCA, and "geologist" in *K*-means, there is another important thing to note. Cluster analysis based on the BRM and DPM yielded very similar clusters in terms of their content. The only major difference is that the DPM had a 5-, instead of a 6-cluster solution. This occurred due to the merging of the BRM's unsorted occupations with earth and social science occupations, which is in line with the cluster's content. When a 5-cluster solution is imposed on the BRM model, unsorted occupations merge with earth and social science occupations, which is in line both with the cluster's content and results from the DPM model. On the other hand, imposing a 6-cluster solution on the DPM model does not provide the 6-cluster solution of the BRM model, suggesting its low stability across models. Overall, with some differences depending on the method and social dimensions model used, we believe that these data, as well as their interpretation, point to a five-cluster solution (Physics and Mathematics, Biology and Medicine, Data sciences, Earth and Social sciences, Ecological/wild-life sciences).

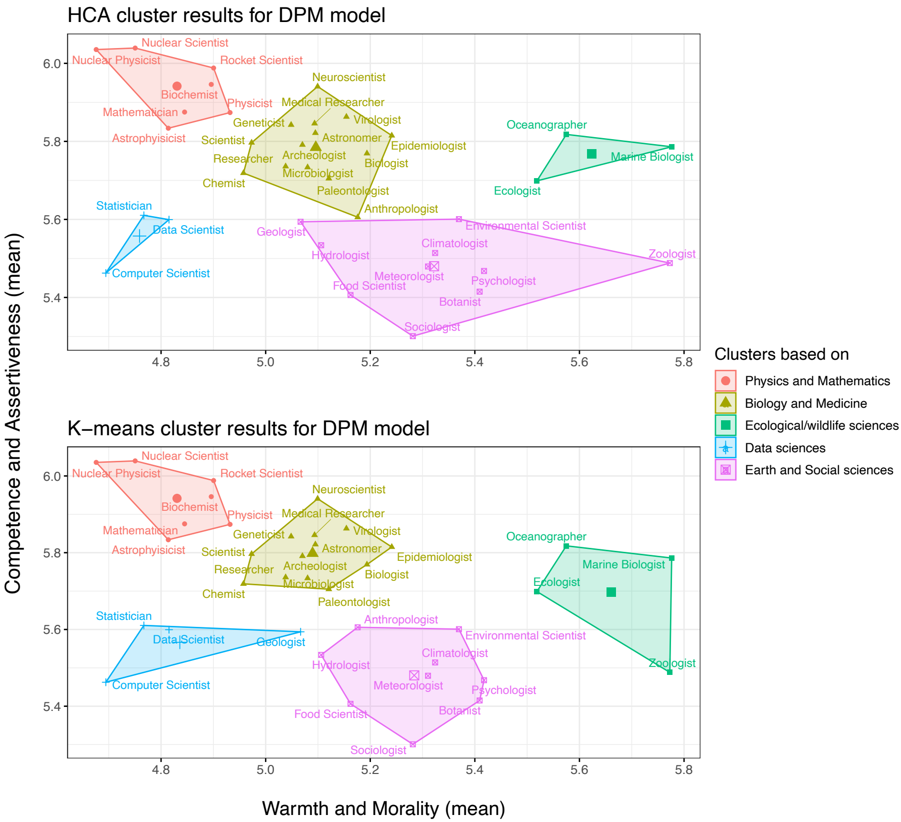

Figure 2. Five-cluster solution in Study 2b when classification is conducted using Hierarchical clustering (top) and K-means clustering (bottom). To present the clusters on a 2D graph, we calculated means of competence and assertiveness (subdimensions of agency), and warmth and morality (subdimensions of communion) (Abele et al., 2016)

Social evaluation dimensions (DPM) and Prototypicality.

We next investigated which social dimensions contribute to the perception of prototypicality when included in one model. Linear regression with four social evaluations as predictors showed that the model was significant, $F(4, 30) = 20.45$, $p < .001$, $adj\ R^2 = .70$. Higher levels of competence contributed to prototypicality ratings ($t = 3.612$, $p < .01$), while warmth ($t = 1.231$, $p = .23$), morality ($t = .111$, $p = .912$), and assertiveness did not ($t = .868$, $p = .39$).

General Discussion

In the present research, we systematically investigated social evaluations of scientists and their consequences for perceived prototypicality. We found that scientists working in the most frequently mentioned scientific occupations are generally seen as highly competent, relatively moral, and only moderately sociable. However, we also discovered different clusters of scientific occupations, based on participants' perceptions in terms of social evaluations. The defining characteristic of scientists is perceived to be competence (ability), as this was the only social evaluation dimension that contributed to prototypicality. Highly prototypical scientific occupations that most commonly come to mind are chemists, biologists, and physicists, making them the most representative occupations in science. However, different clusters of scientific occupations also varied notably in perceptions of sociability and morality. This variation could have consequences for science communication. Consider a data scientist and a social scientist communicating climate science to the public. Whereas the data scientist might benefit from a message frame that bolsters their perceived warmth, a message frame that stresses competence might help the social scientist more. By building on various social evaluation models, the current findings provide a theoretically informed way to understand the *heterogeneity of scientists* and use this understanding to improve science communication.

In general, our results are in line with previous research which found that scientists are seen as highly competent, relatively moral, but only moderately warm (Fiske & Dupree, 2014; Rutjens, Niehoff, et al., 2022). The key contribution of the current work is that people make meaningful differences between different types of scientists. This is in line not only with the findings on the heterogeneity of science (Rutjens, Heine, et al., 2018), but also with research showing that different types of scientists elicit different perceptions (Critchley, 2008; J. Schinske et al., 2015). One important contribution of our approach is that we systematically compared multiple occupational groups of scientists, allowing for a detailed study of this heterogeneity.

An obvious question that arises concerns the number of clusters that can be formed. While we discovered five of them, we believe that there is no single answer to this question, for several reasons. Firstly, the number probably depends on social evaluation models, as evidenced by somewhat different cluster solutions when the BRM vs. DPM model is used. Secondly, it also likely depends on the country (or sample) where ratings are generated, so results might be different in more dissimilar countries (socio-politically or culturally). Although our findings from UK and US largely converged, this is not surprising given the similarities between these two countries. After all, it is the Western culture (e.g., literature and movies), from where the idea of the brilliant, mad scientists emerged (Haynes, 2003). Finally, cluster analyses can be subjective, so the number of clusters may partially depend on analytical decisions. In sum, our findings are mainly descriptive, and the consequences and causes of these social evaluations are yet to be studied.

If there are differences between different scientific occupations, what do people think of when asked about "scientists"? Our research suggests that the general public thinks about the physical and biomedical sciences, which is a cluster that was found to always include the general term "scientist". Scientists working in the areas of earth, social, and data sciences were seen as somewhat less competent than the prototypical group of occupations. On the other hand, ecological/wildlife sciences are seen as too sociable and moral to be within the strictly scientific group. Within the physical and biomedical sciences, three occupations specifically—physicists, chemists, and biologists—were most often mentioned as examples of scientists. This is in line with much of the previous work on scientists' evaluations and stereotypes (Beardslee & O'Dowd, 1961; Finson et al., 1995, p. 199; Suldovsky et al., 2019), but it also illustrates that employing other occupations as substitutions for the general term "scientists" might be less appropriate (e.g., mathematicians; Haynes, 2016).

The current research is not without limitations. Firstly, our samples of scientific occupations might not be exhaustive because they included a limited number of occupations. Secondly, we did not ask participants if they knew the occupations they were rating in Studies 1b and 2b. However, occupation lists, which were highly similar in the UK and the US, were obtained using a bottom-up approach which ensured that the occupations we included are recognizable as they were repeatedly mentioned. This also underscores the trade-off between the exhaustiveness (number) and familiarity of added occupations: Many scientific occupations that, in principle, could be added might be unknown to the general public (e.g., herpetologists). In addition, while one general occupation could hypothetically be split up into many more specific occupations, the difference between them will be perceived only if people are (very) familiar with the occupations. Our studies showed this was the case for prominent scientific occupations (e.g., two subordinate categories of physicists, nuclear- and astro- were also included), but not others (e.g., psychologists were only mentioned as a general occupation).

Whereas we focused on social evaluations as one aspect of perceptions of scientists, future research could employ other types of perceptions of scientists (e.g., stereotypes relating to their gender, age, or ethnicity; Chambers, 1983; Ferguson & Lezotte, 2020; Finson et al., 1995) or other traits that are not necessarily part of the social evaluation models (e.g., masculinity or creativity) and investigate which characteristics are most prominently associated with prototypicality, complementing our findings. Another possible line of research for future studies concerns the causes of social evaluations of scientists. A plausible candidate would be the (mis)match between actual competencies and social evaluations, as the former could be causing the latter (for example, see He et al., 2019). It is also conceivable that social evaluations of scientists only partially overlap with actual competencies, however, in which case subsequent investigations could seek to uncover alternative sources of such evaluations. Lastly, social evaluations are likely to shape trust in scientists. As suggested, a perceived lack of warmth (which encompasses sociability and morality) contributes to lower trust[10]. Future research should investigate the relative impact of these perceptions (and their interplay) on trust in scientists. Furthermore, taking into account the current findings, this should be done across different scientific occupations. More specifically, distrust towards various occupations may stem from various aspects of social perceptions. For instance, it could be that distrust of virologists is mainly due to a perceived lack of competence ("they don't know anything about the virus"), while distrust in geneticists may be shaped primarily by a perceived lack of morality ("they are playing God") (Delhove et al., 2020). In short, disentangling the effects of different social evaluations on trust in different types of scientists is an important future research direction.

Conclusion

Scientists—an umbrella term that, for the general public, primarily refers to chemists, biologists, and physicists—foster positive perceptions in general, with competence standing out as their most prototypical trait. Although at first blush these positive evaluations of scientists are good news for scientists and science advocates, the current data also show that these perceptions are not uniform, as people differentially evaluate different scientific occupations. Although the causes and consequences of these different evaluations are still unexplored, they demonstrate that "scientists" are not a homogenous group, at least in the public eye. Acknowledging the complexity of social evaluations of scientists is an important step in better understanding perceptions of scientists and science, and how these shape public acceptance of science.

CHAPTER 3

HOW SOCIAL EVALUATIONS SHAPE TRUST IN 45 TYPES OF SCIENTISTS

Science can offer solutions to a wide range of societal problems. Key to capitalizing on such solutions is the public's trust and willingness to grant influence to scientists in shaping policy. However, previous research on determinants of trust is limited and does not factor in the diversity of scientific occupations. The present study (*N*=2,780; U.S. participants) investigated how four well-established dimensions of social evaluations (competence, assertiveness, morality, warmth) shape trust in 45 types of scientists (from agronomists to zoologists). Trust in most scientists was relatively high but varied considerably across occupations. Perceptions of morality and competence emerged as the most important antecedents of trust, in turn predicting the willingness to grant scientists influence in managing societal problems. Importantly, the contribution of morality (but not competence) varied across occupations: Morality was most strongly associated with trust in scientists who work on contentious and polarized issues (e.g., climatologists). Therefore, the diversity of scientific occupations must be taken into account to more precisely map trust, which is important for understanding when scientific solutions find their way to policy.

This chapter is based on the following publication:
Gligorić, V., Van Kleef, G. & Rutjens, B. (2024). How Social Evaluations Shape Trust in 45 Types of Scientists. *Plos One, 19(4), e0299621.* https://doi.org/10.1371/journal.pone.0299621

Scientists can offer valuable insights and possible solutions when faced with pressing environmental and societal problems such as climate change or the COVID-19 pandemic. However, trust in scientists is brittle. For example, during the COVID-19 pandemic trust in science and scientists has been documented to have decreased in several countries, including France, Italy, and the US (Algan et al., 2021; Kennedy, et al., 2022). But also before the pandemic trust levels left much to be desired: In 2018, only 18% of the world population reported high levels of trust in scientists (Wellcome Global Monitor, 2019). Given that trust in scientists is one of the key predictors of positive attitudes and compliance with science-based recommendations (e.g., vaccination, Algan et al., 2021 or pro-environmental behavior; Cologna & Siegrist, 2020; Motta, 2018), insights into how trust in scientists is shaped and can be enhanced are crucial. However, the current understanding of trust in scientists is hampered by the implicit assumption that all scientific occupations are the same. This state of affairs hinders the successful implementation of science-based solutions to societal challenges. In the present research, we address this problem by investigating how trust is shaped by social evaluations across 45 scientific occupations, as well as how these social evaluations subsequently shape willingness to grant scientists influence in managing societal problems.

Diversity of scientific occupations

Science is not a monolithic enterprise: It consists of a plethora of disciplines that each comes with its own goals, values, and approaches. It is conceivable, then, that perceptions of scientists and trust in scientists differ across scientific occupations. Indeed, previous research shows that the term "scientist" is an overgeneralization. In a systematic investigation of social evaluations of more than 30 scientific occupations in the US and the UK, Gligorić and colleagues (2022) found that people perceive meaningful differences between different scientific occupations. For example, sociologists were regarded as less competent than neuroscientists, whereas zoologists and related occupations were seen as the most moral and sociable. These differences in social evaluations could be empirically captured in clusters (e.g., biomedical scientists, data scientists). Similarly, Altenmüller and colleagues (2024) showed that scientific occupations also differ in perceptions along the ideological line of liberalism-conservatism, so that some occupations (e.g., sociologists, climate scientists) are seen as more liberal than others (e.g., mathematicians, chemists). Trust, too, varies across different types of scientists: For example, people hold more positive perceptions of publicly (vs. privately) funded scientists (Critchley, 2008), and some scientists work on issues that are caught in the crosshairs of heavily politicised public debate (e.g., climate science, vaccination), which can trigger science scepticism (Rutjens, Sutton, et al., 2018).

Crucially, how this diversity translates to trust in scientists is to date unknown. This is because most research investigating scientist perceptions has focused on the generic term "scientists". Some exceptions are disparate studies of one or two specific groups or categories, such as scientists working on genetic modification (GM) (Besley et al., 2021), chemists and biologists (Suldovsky et al., 2019), and mathematicians (Haynes, 2016). To date, however, no systematic comparison of trust in different types of scientists has been conducted. This is problematic because it remains unknown whether interventions aimed at increasing trust should be tailored to specific (groups of) scientists or scientists in general.

Trust in Scientists

Social evaluations as antecedents of trust

What are the factors that contribute to trust in scientists? Some researchers point to the importance of social evaluations. Notably, Fiske and Dupree (2014) suggested that even though scientists are seen as competent, their perceived lack of warmth might contribute to lower trust. This work is based on the two-dimensional Stereotype Content Model (SCM; Fiske et al., 2002), which posits two social evaluation dimensions – *competence* and *warmth*. Although SCM is one of the best-known social evaluation models, other models proposed different structures of social judgment, arguing for separation of morality and warmth (e.g., politicians can be perceived as friendly, but immoral; Abele et al., 2016; Ellemers, 2017; Leach et al., 2007), separation of competence (capability) and assertiveness (confidence) (Abele et al., 2016), or even adding a new dimension (conservative-progressive beliefs) (Koch et al., 2016). In a recent adversarial collaboration, researchers who posited five different social evaluation models attempted to integrate these models (Abele et al., 2021; Ellemers et al., 2020; Koch et al., 2021). Their integration suggested that further division of the Big Two factors (Agency/Vertical dimension and Communion/Horizontal dimension) into four facets (competence and assertiveness; morality and warmth) is the most appropriate structure of social judgment (Abele et al., 2021; Ellemers et al., 2020; Koch et al., 2021). Such distinctions showed to be useful for understanding evaluations of scientists as well, given that research has shown that scientists are not only seen as very competent (intelligent, smart), but are also perceived as more moral than warm, as well as more competent than assertive (Gligorić et al., 2022; Rutjens, Niehoff, et al., 2022). However, although social evaluation models are a promising path to increasing understanding of trust in scientists (Fiske

& Dupree, 2014), to our knowledge, no research has directly tested how social evaluations of groups subsequently relate to trust. In other words, work so far leaves the question of how well-established social evaluations of scientists shape levels of trust in them. Additionally, as mentioned before, it is unknown whether the role of social evaluations in trust varies across occupations.

Another, somewhat related, strand of research on trust (in scientists) comes from organizational psychology, which suggests that trust is composed of three components: ability (skill, expertise), benevolence (self-interest vs societal benefits), and integrity (fairness and honesty) (Mayer et al., 1995). Trust in scientists could be, in principle, somewhat different as laypeople are unable to understand different scientific information without specialized knowledge in that area. Yet, the three-component model of trust has also shown to be applicable within the context of scientists: Hendriks and colleagues (2015) found that scientists were evaluated on these three dimensions. More recently, it has been suggested that the factor of "openness" should be added as a fourth component of trust in scientists (Besley et al., 2021). However, due to high intercorrelations between components, neither study tested the relative contribution of these dimensions to trust. These intercorrelations are expected (and inevitable) given that they are seen as trust *components* (parts of trust), rather than factors influencing trust. With this in mind, the current work focused on social evaluations as predictors, because they 1) are more clearly conceptualized in the literature, 2) show lower intercorrelations, and 3) potentially *shape* trust, rather than merely representing *components* of trust. Importantly, we did not focus solely on trust ratings, but we also included the consequence of trust, which we operationalized using a novel influence granting task (see pilot studies).

The present study

In the present study, we investigated trust in many different groups of scientists. Specifically, we tested whether and how four theoretical social evaluation dimensions (competence, assertiveness, morality, warmth; Abele et al., 2021; Abele & Wojciszke, 2014) contribute to trust across 45 different scientific occupations. Moreover, we examined how trust in turn shapes the willingness to grant scientists influence on the management of complex societal problems, by including a novel influence granting task (details about pilot studies conducted to develop this task can be found in the supplement). Incorporating this task enabled us to investigate not only the influence of social evaluations on trust perceptions, but also to assess the downstream consequences of these perceptions in a more ecologically valid way. The study materials, data, and the analysis code can be found at https://osf.io/d5zcj, while the study was pre-registered at https://osf.io/j6xm9.

Method

Participants

As pre-registered, we aimed to collect data from 2813 participants. This sample size was determined based on the notion that correlations stabilize at around 250 participants (Schönbrodt & Perugini, 2013). Since each participant rated four (out of 45) occupations (see procedure), we needed 2813 participants (=250*45/4) so that each occupation would obtain ratings from approximately 250 participants. To account for anticipated exclusions (see below), we sampled 3246 participants from Prolific, selecting only US participants whose minimum approval rate was 95/100. Participation took around 10 minutes, and participants were paid £1.05 (approx. $1.16 or €1.20). As pre-registered, we excluded participants who failed an attention check question (*n* = 334), speeders (twice faster than the median of 610 seconds; *n* = 82), and multivariate outliers (Mahalanobis distance on each item of the dependent variable, *n* = 50), which left us with a final sample of *N* = 2780 (1333 men, 1382 women, 65 indicated "other"; M_{age} = 39.03, SD_{age} = 14.93). Regarding education, 0.7% indicated education less than high school, 25.3% had completed high school, 12.7% were students, 42.3% had an undergraduate degree, and 19.1% had a graduate degree. The sample was slightly liberal (*M* = 3.07; *SD* = 1.76; range 1 – 7) and somewhat religious (*M* = 3.03; *SD* = 2.09; range 1 – 7). No analyses were performed before data exclusion.

Procedure and materials

Ethical approval was obtained at the authors' university. We report all measures used in the study. After reading the information letter and signing the consent form, participants reported their demographics, political orientation, and religiosity. Next, each participant was asked to rate four scientific occupations on several attributes. The four occupations were randomly selected out of 45 occupations. The list of 45 scientific occupations was obtained from the previous study in which US participants were asked to generate as many scientific occupations as they could (Gligorić et al., 2022). After rating one scientific occupation, participants moved to the next one, until they had rated four.

First, participants rated an occupation on four social evaluation dimensions which were presented on four separate pages (the order of dimensions was randomized). The four dimensions were competence, assertiveness, morality, and warmth (Abele et al., 2021). Each dimension was measured with five items on a 7-point (from -3 to 3) bipolar scale (Abele et al., 2016; Abele & Hauke, 2020). Examples of items for competence included pairs such as "incompetent – competent" and "unintelligent – intelligent", and items for assertiveness included pairs such as "has no leadership skills at all – has leadership skills" and "unconfident – confident". Morality was assessed with pairs such as "unjust – just" and "unfair – fair", while warmth included pairs like "cold – warm" and "uncaring – caring". Reliabilities for all four dimensions were high: Median Cronbach's alphas were α = .92 (range .80 – .95), α = .87 (range .83 – .91), α =.93 (range .88 – .96), and α =.94 (range .93 – .96) for competence, assertiveness, morality, and warmth respectively. All items measuring each dimension, as well as their intercorrelations, are given in the supplement (S1 Fig).

After rating an occupation on the social evaluation scales, trust was measured using the following item: "How much do you trust [occupation]?" (1 = *do not trust at all* to 7 = *trust completely*) (Algan et al., 2021). We opted for this approach to measure trust for several reasons. First, various large-scale research studies have used this operationalization (Algan et al., 2021; Wellcome Global Monitor, 2019) predicts a range of behaviors (Cologna et al., 2022; Han, 2022) and allows participants to construct their own meaning of trust, rather than researchers imposing theirs. Second, a one-item measure has been shown to function well as a substitute for a multi-item measure of trust (Castro et al., 2023). Third, our pilot studies, which included both one-item and a more specific four-item (McCright et al., 2013) measures of trust, indicate that these correlate strongly (median Pearson's r = .74 across different occupations and pilot studies). Finally, a single-item measure is cost-effective, which was of importance given the large number of participants and occupations in the study.

Next, participants completed the influence granting task (IGT)[3]—a novel task that we designed to measure the willing-

3 Before conducing the main study, we conducted three pilot studies (N = 100 in each study) to pre-test the influence granting task. We report all pilot studies in detail in the online supplement.

ness to grant scientists influence on managing societal problems. We presented participants with the following scenario:

> Imagine there is a pressing problem in your country that is affecting every citizen. You have the complete power to make a decision about how to solve the problem. This problem is very complex and, therefore, to solve it, the help and advice of various types of scientists would be useful. If you were to make a final decision, how strongly would you value the input of the following parties? Note that points must sum up to 100.

Participants were then instructed to use sliders to distribute 100 points of decision power to different parties. The points had to total 100 (constant sum type of question), and participants distributed them to seven different parties which were shown in a randomized order: community leaders, politicians, citizens, friends, family, themselves, and the scientific occupation at hand. Given that we wanted to allow for comparisons of effects between different scientific occupations, we developed one scenario for all occupations. The rationale for this task was that granting influence can be understood as one of the key trusting behaviors, in that people are more willing to confer decision-making power to individuals or institutions they trust (Besley & Tiffany, 2023; Mayer et al., 1995; Rousseau et al., 1998; Schoorman et al., 2007). On average (across all scientific occupations), participants distributed the points in the following descending order: scientists (25.5), citizens (18.1), community leaders (16.9), themselves (16.6), friends (8.0), politicians (7.5), family (7.3).

After rating four occupations, participants were presented with an attention check question which was similar to the IGT and was phrased in the following way: "Imagine there is a pressing problem in your country that is affecting every citizen. Note that this question is an attention-check question. Please select the option *myself* and move it [the slider] to the maximum." Next, participants were asked to report how attentive they were (1 = *not very attentive* to 5 = *extremely attentive*). Failing either of the attention checks warranted exclusion (for the second question, answering "not very attentive" was considered an attention check failure). Finally, we asked participants to indicate if they knew all occupations they were asked to rate (2465 reported they knew all occupations, 315 indicated they did not). The results remained unchanged when analyses were conducted with data from only participants who reported knowing all occupations (n = 2465). Note that testing the robustness of results after excluding participants who did not know occupations was not pre-registered.

Results

All reported analyses were pre-registered unless stated otherwise. Before answering our research questions on the relationship between social evaluations and trust, we first calculated ratings of competence, assertiveness, morality, warmth[4], trust, and IGT for each occupation. Ratings were estimated from a mixed model which included a random intercept for participants because each participant rated only 4 (out of 45) occupations. The table of ratings by occupation is given in Table 1. Overall, scientists evoked positive perceptions given that all social evaluations and trust ratings were above the mid-point of the scales (though note that political scientists and economists evoked noticeably lower ratings of morality and trust compared to other occupations).

4 As per a reviewer's suggestion, we compared the fit of two models of social evaluations (non-preregistered analyses): one with the four-factor (the one we currently use) and one with the two-factor (agency/communion) solution. Only the four-factor solution showed good fit (CFI = 0.946, TLI = .937, RMSEA = .077, SRMR = .052, AIC = 444328, BIC = 444811), but not the two-factor one (CFI = 0.748, TLI = .717, RMSEA = .163, SRMR = .140, AIC = 483346, BIC = 483792). Comparing the models showed that the four-factor solution was significantly better ($x2diff(5) = 9592.5$, $p < .001$).

Table 1. Social evaluations, trust, and IGT ratings of scientific occupations in the study with standard errors in the brackets

Occupation	Competence	Assertiveness	Morality	Warmth	Trust	IGT
Agronomist	5.79 (0.04)	5.08 (0.05)	5.48 (0.05)	5.04 (0.06)	4.99 (0.06)	23.89 (0.93)
Anthropologist	5.96 (0.04)	5.33 (0.05)	5.54 (0.05)	5.18 (0.06)	5.08 (0.06)	23.30 (0.95)
Archeologist	5.96 (0.04)	5.47 (0.05)	5.48 (0.05)	5.04 (0.06)	5.21 (0.06)	19.83 (0.93)
Astronomer	6.14 (0.04)	5.44 (0.05)	5.54 (0.05)	4.97 (0.06)	5.36 (0.06)	24.30 (0.95)
Astrophysicist	6.39 (0.04)	5.70 (0.05)	5.53 (0.05)	4.49 (0.06)	5.41 (0.06)	29.42 (0.96)
Biochemist	6.30 (0.05)	5.44 (0.05)	5.47 (0.05)	4.52 (0.06)	5.19 (0.06)	28.55 (0.97)
Biologist	6.13 (0.04)	5.40 (0.05)	5.64 (0.05)	5.13 (0.06)	5.35 (0.06)	27.98 (0.96)
Botanist	5.90 (0.04)	4.98 (0.05)	5.69 (0.05)	5.57 (0.06)	5.23 (0.06)	20.17 (0.93)
Chemist	6.29 (0.04)	5.54 (0.05)	5.50 (0.05)	4.50 (0.06)	5.30 (0.06)	28.39 (0.95)
Climatologist	5.77 (0.04)	5.40 (0.05)	5.44 (0.05)	5.15 (0.06)	5.04 (0.06)	28.29 (0.96)
Computer scientist	6.26 (0.04)	5.21 (0.05)	5.24 (0.05)	4.08 (0.06)	5.05 (0.06)	24.86 (0.95)
Data scientist	6.13 (0.04)	5.24 (0.05)	5.34 (0.05)	4.24 (0.06)	5.02 (0.06)	31.96 (0.95)
Ecologist	5.94 (0.04)	5.41 (0.05)	5.70 (0.05)	5.55 (0.06)	5.27 (0.06)	29.26 (0.94)
Economist	5.70 (0.04)	5.42 (0.05)	4.68 (0.05)	4.04 (0.06)	4.28 (0.06)	24.14 (0.95)
Entomologist	5.88 (0.04)	5.07 (0.05)	5.45 (0.05)	4.94 (0.06)	5.04 (0.06)	18.73 (0.93)
Environmental scientist	5.84 (0.04)	5.55 (0.05)	5.71 (0.05)	5.43 (0.06)	5.28 (0.06)	32.60 (0.94)
Epidemiologist	6.12 (0.04)	5.61 (0.05)	5.59 (0.05)	5.00 (0.06)	5.34 (0.06)	33.61 (0.95)
Food scientist	5.75 (0.04)	5.06 (0.05)	5.11 (0.05)	4.88 (0.06)	4.74 (0.06)	19.96 (0.94)
Geneticist	6.09 (0.04)	5.42 (0.05)	5.35 (0.05)	4.71 (0.06)	5.07 (0.06)	24.56 (0.96)
Geographer	5.88 (0.04)	5.11 (0.05)	5.55 (0.05)	4.93 (0.06)	5.27 (0.06)	20.71 (0.95)
Geologist	6.00 (0.04)	5.30 (0.05)	5.61 (0.05)	4.95 (0.06)	5.25 (0.06)	24.09 (0.95)
Hydrologist	5.91 (0.04)	5.19 (0.05)	5.48 (0.05)	4.93 (0.06)	5.08 (0.06)	22.16 (0.96)

Immunologist	6.14 (0.04)	5.49 (0.05)	5.63 (0.05)	5.04 (0.06)	5.35 (0.06)	30.77 (0.95)
Marine biologist	6.21 (0.04)	5.59 (0.05)	5.88 (0.05)	5.81 (0.06)	5.54 (0.06)	24.81 (0.94)
Mathematician	6.33 (0.04)	5.40 (0.05)	5.48 (0.05)	4.22 (0.06)	5.27 (0.06)	26.35 (0.96)
Medical researcher	6.17 (0.04)	5.64 (0.05)	5.59 (0.05)	5.01 (0.06)	5.26 (0.06)	34.54 (0.94)
Meteorologist	5.66 (0.04)	5.26 (0.05)	5.33 (0.05)	5.25 (0.06)	4.85 (0.06)	19.85 (0.93)
Microbiologist	6.24 (0.04)	5.39 (0.05)	5.57 (0.05)	4.67 (0.06)	5.36 (0.06)	28.55 (0.95)
Neuroscientist	6.39 (0.04)	5.90 (0.05)	5.67 (0.05)	4.72 (0.06)	5.53 (0.06)	29.88 (0.94)
Nuclear physicist	6.44 (0.04)	5.83 (0.05)	5.39 (0.05)	4.23 (0.06)	5.22 (0.06)	27.53 (0.96)
Nuclear scientist	6.32 (0.04)	5.69 (0.05)	5.35 (0.05)	4.25 (0.06)	5.14 (0.06)	27.06 (0.94)
Oceanographer	6.07 (0.04)	5.42 (0.05)	5.72 (0.05)	5.47 (0.06)	5.39 (0.06)	23.49 (0.96)
Paleontologist	5.95 (0.04)	5.31 (0.05)	5.56 (0.05)	5.02 (0.06)	5.19 (0.06)	20.08 (0.94)
Pharmacologist	5.90 (0.04)	5.27 (0.05)	5.28 (0.05)	4.72 (0.06)	4.97 (0.06)	21.88 (0.93)
Physicist	6.34 (0.04)	5.59 (0.05)	5.45 (0.05)	4.29 (0.06)	5.33 (0.06)	28.62 (0.95)
Physiologist	5.92 (0.04)	5.47 (0.05)	5.49 (0.05)	5.11 (0.06)	5.13 (0.06)	25.74 (0.96)
Political scientist	5.26 (0.04)	5.32 (0.05)	4.30 (0.05)	4.10 (0.06)	3.71 (0.06)	18.42 (0.93)
Psychologist	5.76 (0.04)	5.47 (0.05)	5.56 (0.05)	5.48 (0.06)	4.89 (0.06)	22.58 (0.93)
Rocket scientist	6.51 (0.04)	5.92 (0.05)	5.51 (0.05)	4.43 (0.06)	5.38 (0.06)	28.04 (0.93)
Seismologist	6.02 (0.05)	5.38 (0.05)	5.58 (0.05)	4.79 (0.06)	5.23 (0.06)	24.21 (0.98)
Sociologist	5.54 (0.04)	5.19 (0.05)	5.40 (0.05)	5.32 (0.06)	4.67 (0.06)	25.08 (0.94)
Statistician	6.04 (0.04)	5.31 (0.05)	5.38 (0.05)	4.10 (0.06)	5.01 (0.06)	26.72 (0.95)
Virologist	6.09 (0.04)	5.46 (0.05)	5.50 (0.05)	4.73 (0.06)	5.13 (0.06)	31.36 (0.95)
Volcanologist	6.01 (0.04)	5.43 (0.05)	5.41 (0.05)	4.86 (0.06)	5.24 (0.06)	23.07 (0.95)
Zoologist	6.00 (0.04)	5.48 (0.05)	5.93 (0.05)	6.09 (0.06)	5.48 (0.06)	21.68 (0.93)

Note. Means were estimated from a mixed model with a random intercept for participants.

Social evaluations predicting trust and influence granting

Since participants rated different occupations (ratings were nested in participants and occupations), multilevel analyses were required. Before conducting analyses, we performed mean-centering within clusters (occupations), to disaggregate between and within effects, and focused only on the latter. We also standardized all variables to facilitate the interpretation of the coefficients and enable comparing effects in predicting trust and influence granting. The correlation between the variables is given in Table 2.

Table 2. Correlations between scientists' evaluation variables, trust, and influence granting (IGT)

	1.	2.	3.	4.	5.
1. Competence					
2. Assertiveness	.651				
3. Morality	.672	.622			
4. Warmth	.423	.482	.637		
5. Trust	.525	.442	.640	.434	
6. IGT	.226	.218	.236	.141	.328

Note. All correlations are significant at the $p < .001$ level. Due to data transformation, degrees of freedom for correlations are $df = 11118$ (2780 participants x 4 occupations = 11120)

We ran a multilevel model to investigate how social evaluations relate to trust. Because trust levels could be different for different participants and different occupations, we first ran a model with a random intercept for participants and occupations, and fixed effects for social evaluation measures. The results are given in Table 3 (left). There are several things to note. First, morality seems to play the most important role in shaping trust perceptions, followed by competence. Assertiveness and warmth also contributed, but to a smaller extent. Regarding random effects, random intercepts suggest that trust levels varied across participants and across occupations. The full random intercept model (AIC = 21329) showed better fit than the models without a random intercept for either participants or occupations (AIC = 24065, LRT(1) = 2738.3, p < .001 and AIC = 23312, LRT(1) = 1984.8, p < .001 respectively), indicating that trust levels were indeed different across participants and occupations.

Table 3. Multilevel model (with random intercept for participants and occupations) in which social evaluation measures predict trust and IGT (influence granting) scores.

	Trust		IGT	
	Fixed effects			
	β (Standard error)	t value	β (Standard error)	t value
Competence	.19 (.01)	20.53***	.10 (.01)	10.72***
Assertiveness	.05 (.01)	5.54***	.08(.01)	8.99***
Morality	.44 (.01)	45.34***	.14 (.01)	13.88***
Warmth	.08 (.01)	9.73***	.01 (.01)	1.64
	Random effects			
$\tau_{00\ participant}$	.24		.63	
$\tau_{00\ occupation}$	.07		.03	
ICC	.53		.72	
Marginal R^2 / Conditional R^2	.44/ .74		.09/ .74	

Note. *** p <.001, τ_{00} = intercept variance, ICC = Intraclass correlation

As a next step, we aimed to test whether the effect of social evaluation dimensions (competence, assertiveness, morality, and warmth) predicting trust varied by occupation. We did so by creating a model that allowed slopes for each of the social evaluation dimensions to vary across occupations. Fixed effects remained relatively unchanged, with variances of slopes being .001 for competence, .000 for assertiveness, .009 for morality, and .003 for warmth. Comparing models with and without random effects for each social evaluations dimension showed that the effects of competence and assertiveness on trust did not vary across occupations (LRTs(5) < 9.02, *p*s > .10), while the effect of morality (LRT(5) = 69.43, $p < .001$) and warmth (LRT(5) = 20.85, $p < .001$) did. A visual representation of the effects of social dimensions predicting trust across occupations is provided in Figure 1 (A and B). In short, results suggest that the effects of competence and assertiveness predicting trust did not vary across scientific occupations, whereas the effects of morality and warmth did.

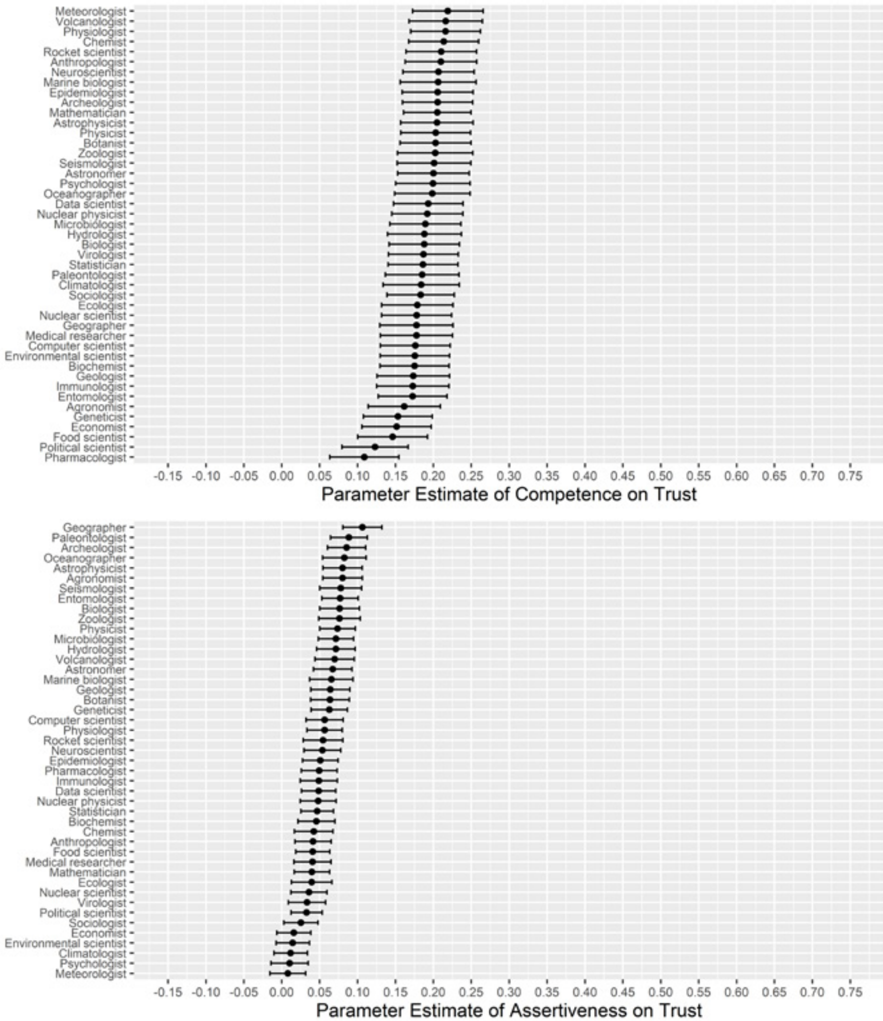

Figure 1A. The estimates (beta coefficients, with 95% confidence intervals) of competence and assertiveness predicting trust for all 45 scientific occupations. The estimates are uniform across different occupations.

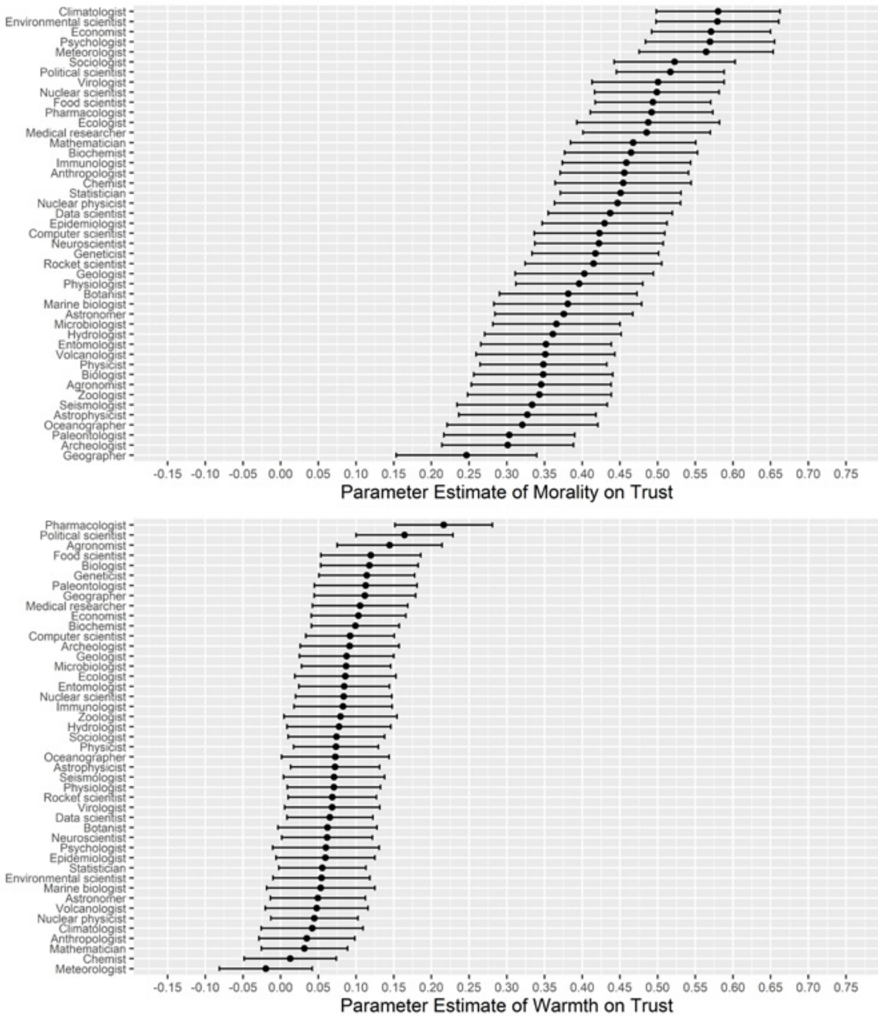

Figure 1B. The estimates (beta coefficients, with 95% confidence intervals) of morality and warmth predicting trust for all 45 scientific occupations. The estimates vary across different occupations.

Next, we conducted the same analysis with the IGT as the dependent variable. Again, morality and competence were found to be more important than warmth and assertiveness, although the difference between their respective importance is noticeably smaller compared to the effects predicting trust (Table 3, right). As with trust, model comparisons indicated that IGT levels varied across participants and occupations: A full random intercept model (AIC = 21330) showed a better fit than models without either a random intercept for participants or occupations (AIC = 30367, LRT(1) = 7049.1, $p < .001$ and AIC = 24182, LRT(1) = 864.6 , $p < .001$ respectively).

To investigate the random effects of social evaluation dimensions predicting IGT, we applied the same strategy as for trust. Again, fixed coefficients remained the same, with variances of slopes being .002 for competence, .002 for assertiveness, .002 for morality, and .002 for warmth. Comparing models with and without random effects for each social evaluations dimension indicated that the effects of competence (LRT(5) = 12.8, $p = .03$), assertiveness (LRT(5) = 17.0, $p < .01$), and warmth on IGT (LRT(5) = 12.5, $p = .03$), but not morality (LRT(5) = 10.0, $p = .07$) varied across occupations. Given the low variances and marginal *p* values, these results did not decisively show whether including random effects is warranted. We, therefore, investigated the AIC of the models when each of the random slopes was dropped. These models had either equal or higher AIC than the baseline model with no random slopes (AIC = 23271). For this reason, we opted for selecting the simpler model, i.e., without random effects. A visual representation of the effects of social evaluations predicting IGT across occupations, which is provided in the supplement (S2A and S2B Figures), also supported this decision. In short, these analyses show that the impact of social evaluation dimensions (competence, assertiveness, morality, warmth) on influence granting did not depend on occupation, unlike what was observed for trust ratings. This suggests that, for example, perceptions of morality have the same impact on willingness to grant scientists influence, regardless of the scientific occupation in question. Note that all analyses above retained the same pattern when the morality dimension was calculated excluding the "trustworthy" adjective due to semantic overlap (fully reported in the supplement).

Trust as a mediator of the effect of social evaluations on influence granting

Finally, we tested if trust mediates the effect of social evaluations predicting influence granting. To do so, we conducted a multilevel mediation analysis. This analysis allowed us to test whether trust mediates the relationship on average (ignoring different occupations), and how this indirect effect varies across different occupations. The coefficients were estimated from two regression models (first: social evaluations predicting trust; second: social evaluations and trust predicting IGT) which included a random intercept for participants and occupations and fixed effects of social evaluations. The significance of indirect effects (all significant, $p < .001$) was tested using bootstrapping (estimating the model 1000 times). Effects averaged across occupations are given in Figure 2. As evident from the figure, the effects of competence, assertiveness, and morality were partially mediated by trust, while warmth did not have a total effect in the first place. Mediation proportions (the ratio of the total effect that is accounted by the mediating variable) of competence, assertiveness, and morality effects were 42%, 14%, and 73% respectively. Random effects by occupation can be found in the supplement.

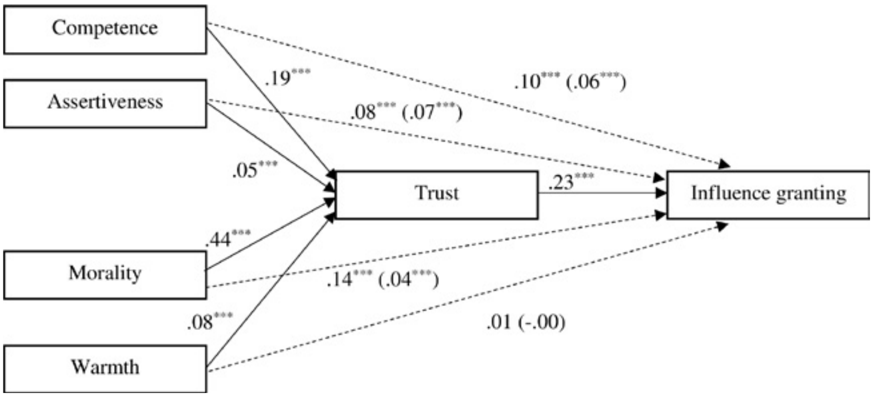

Figure 2. The effect of social evaluations predicting influence granting via trust. The model is averaged across occupations and participants with random intercepts for both factors. Trust partially mediated the effects of competence, assertiveness and morality. Significant paths are marked with three asterisks (***p < .001). Direct effects are given within brackets.

We ran all the analyses above (non-preregistered) using only the big two factors – agency (calculated as an average of competence and assertiveness) and communion (calculated as an average of warmth and morality). This showed that both big factors contributed to predicting trust which mediated the effect on influence granting (S3 and S4 Figures). Importantly, comparing the results of analyses with two vs. four factors allowed us to discern which parts of the agency and communion contribute to trust (competence and morality) and which do not (assertiveness and warmth).

Discussion

Research on trust in scientists—arguably a key prerequisite for public acceptance of science-based solutions—is limited because it routinely treats scientific occupations as homogenous. The present study is, to our knowledge, the first to systematically investigate the antecedents of trust in scientists across a wide range of science domains. More specifically, we investigated how social evaluations shape trust as well as the willingness to grant scientists influence in managing societal problems. We found that trust in scientists was relatively high, with all occupations scoring above the mid-point. However, some scientists were trusted more than others. We discovered that perceptions of competence and morality play a prominent role in shaping trust ratings, more so than perceptions of assertiveness and warmth. Importantly, whereas the effect of competence was uniform, the effect of morality varied across occupations – morality was more strongly associated with trust in occupations working on contentious, publicly debated topics (see below).

The prominent role of competence and morality in trust suggests that trust in scientists has two requirements: Although a scientist must be knowledgeable and competent, this competence must be paired with good intentions (i.e., the scientist needs to be perceived as moral). Both ingredients are necessary to build a trustworthy scientist: Scientists would not be seen as scientists if they were perceived as incompetent (Fiske & Dupree, 2014; Gligorić et al., 2022; Rutjens, Niehoff, et al., 2022), while morality is arguably the most important predictor of trust (Besley et al., 2021; Hendriks et al., 2015). Whereas Fiske and Dupre (2014) suggested that the perception of warmth (in terms of the two-dimensional SCM) is important for trust in scientists, our study advances this notion by showing that this particularly applies to morality, and not warmth.

It is also noteworthy that competence (vs. assertiveness) and morality (vs. warmth) as strongest predictors are more stable and central to one's character as they refer to perception how people are (vs. how they behave/seem) (Abele & Hauke, 2020).

Trust in scientists is likely different from trust in other social and occupational categories. A key defining characteristic of scientists is competence (Gligorić et al., 2022) and much of the work that scientists do is not fully comprehensible to laypeople, who therefore will have to rely on scientists' competence *and* their good intentions. However, trust in other groups might show different patterns. Indeed, research conducted within the SCM framework shows that trust in negotiators (Kong, 2015) and strangers (Kong, 2018) is determined by warmth, but not competence. Similarly, perceived morality (vs competence) is more important in cases such as group acceptance and rejection (Van Der Lee et al., 2017), and group evaluations (Leach et al., 2007). Overall, this suggests that competence will contribute to trust when it is particularly relevant for an outcome, as is the case with scientists (e.g., discovering a drug to combat cancer depends on medical researchers' skills and knowledge).

Importantly, our study provides evidence that not all social evaluations shape trust in the same way for different occupations. Whereas competence similarly shaped trust regardless of scientific occupation, morality did not. Why would perceptions of morality have a weaker effect on trust for some occupations, but a stronger effect for others? This might be because certain groups of scientists work on more contentious and polarized issues. For instance, some of the occupations for which morality most strongly influenced trust were those in climate science and politico-economic research. This finding aligns with the idea that many science attitudes are rooted in ideologies, identities, and other motivational factors (Hornsey, 2020; Rutjens, Heine, et al., 2018). Additionally, some branches of science involve larger moral implications, as evidenced by public discussions about various scientific topics. This certainly applies to climate science (Dunlap et al., 2016; Hoffman, 2011), nuclear physics (Teller, 1998), political science, and—especially since 2020—virology (Mønsted & Lehmann, 2022). Whenever science is seen as especially relevant to people's lives, the perceived morality of the scientists involved arguably matters more, which is what the current data seem to support.

It is, however, important to note two differences when using social evaluations to predict trust perceptions, as compared to predicting the Influence Granting Task. First, the effect sizes were stronger when predicting trust perceptions. Second, for trust perceptions (but not IGT), the effect of morality perceptions varied across scientific occupations. We believe these differences emerged because social evaluations more closely matched trust perceptions in that both can be seen as attitudinal measures, whereas the IGT is a more behavioral measure (behavioral willingness). Another likely reason is common-method variance: seven-point scales were used to measure social evaluations and trust perceptions, but not for responses on the IGT. Finally, in responding to the IGT, factors other than trust might have influenced the responses (e.g., certain personality traits could drive participants more towards the option "myself"; individuals that have stronger ties with family could prefer the family option, etc.).

Limitations, future research, and conclusion

Our study is not without limitations. Firstly, our measure of trust perception is short (one item) and might have seemed somewhat general to participants. Nevertheless, this approach to measuring trust is relatively common in research on trust in scientists (Algan et al., 2021; Wellcome Global Monitor, 2019) as it provides a cost-effective way to capture key perceptions. Future research could put more focus on what trust in scientists entails, as well as on finding valid ways to investigate its consequences. Similarly, the utilized influence-granting measure may have come across as somewhat artificial, as the problem was unnamed, and participants were offered to grant influence to only one type of scientist. Therefore, participants might have had more specific problems in mind (e.g., climate change, COVID-19) when responding. However, it would be very difficult to come up with particular scenarios appropriate for each scientific occupation, especially given potential confounds. By keeping the phrasing of the question identical, we avoided this problem and were able to make comparisons across different occupations. Future research might benefit from utilizing a measure gauging the consequences of trust that is further improved on ecological validity, for example by assessing real-world behavior in specific domains. Another limitation of the study is that it utilized US participants, so the generalizability of the roles of competence and morality remains to be tested. Testing whether these results apply to other countries could be one avenue for future research. Finally, given the correlational nature of our study, a fruitful next step would be to experimentally assess the (relative) impact of competence and morality on trust and its consequences across scientific occupations, which would also pave the way for potential interventions (e.g., emphasizing scientists' good intentions in science communication).

In conclusion, the current work shows that trust in scientists varies considerably across occupations. Across 45 scientific occupations, trust was largely based on how competent and moral people perceived a scientist to be. The importance of morality was, however, not uniform across domains. For example, morality was not as important for trust in geographers as it was for trust in pharmacologists. These findings demonstrate that it is important to consider the diversity of scientific occupations when investigating trust and its contributing factors and the willingness to grant scientists influence in engaging with societal problems and policymaking.

CHAPTER 4

STEREOTYPES AND SOCIAL EVALUATIONS OF SCIENTISTS ARE RELATED TO DIFFERENT ANTECEDENTS AND OUTCOMES

Research on scientist perceptions tends to focus on either stereotypes (white, male) or social evaluations (competent but cold), sometimes yielding incongruent conclusions (e.g., scientists are simultaneously seen as moral and immoral). Across two preregistered correlational studies (*N*=1091), we address this issue by simultaneously assessing stereotypes and social evaluations and their association with two key outcomes: trust in scientists and science career appeal. We find that stereotypes and social evaluations are distinct types of perceptions – they correlate slightly, stem from different worldviews, and predict partially different outcomes. While western enculturation and religiosity predict stereotypes, right-wing political ideology negatively relates to social evaluations. Stereotypes are associated with lower science career appeal among stereotype-incongruent individuals, while social evaluations predict more trust in scientists and higher science career appeal. This work thus sheds light on the psychological pathways to trust in scientists, as well as on the perceived appeal of becoming a scientist.

This chapter is based on the following publication:
Gligorić, V., Clerc, R., Arkensteijn, G., Van Kleef, G. & Rutjens, B. (2024). Stereotypes and Social Evaluations of Scientists Have Different Antecedents and Consequences. *Public Understanding of Science.* https://doi.org/10.1177/09636625241232

The COVID-19 pandemic has taken a toll on scientists. Not only did trust in scientists decrease in many countries (Algan et al., 2021; Kennedy et al., 2022), but the pandemic also affected scientists in a more personally significant manner: 38% of surveyed scientists who published on COVID-19 experienced harassment ranging from insults to death threats (O'Grady, 2022). While scientists are often praised for their positive qualities such as intelligence, they also trigger negative stereotypes. Stereotypes of scientists include not only social ineptness (Ferguson & Lezotte, 2020) but also images of mad geniuses who threaten the world (Haynes, 2003) or perpetrators of various immoral acts such as human cloning (Reis & Galvão, 2004) and even serial murder (Rutjens & Heine, 2016). Considering the existence of these negative perceptions in the context of crises like the COVID-19 pandemic, it is perhaps not very surprising that some scientists are subject to harassment. However, research on the perceptions of scientists and their predictors and outcomes is scarce. Theoretical gaps in how scientist perceptions are structured could be one of the reasons for diverging conclusions stemming from research on stereotypes and evaluations (e.g., scientists are simultaneously stereotyped as dangerous and perceived as moral). Additionally, this lack of systematically obtained insights into scientist perceptions obstructs the development of evidence-based interventions aimed at two key outcomes: public trust in scientists, and interest in pursuing a career in science. Gauging this interest among groups that do not conform to the stereotype of scientists (e.g., white, male) directly relates to the important question of how to diversify science.

In the present research, we combined two lines of research on scientist perceptions – (1) stereotypes of scientists and (2) social evaluations of scientists. Teasing these two types of perceptions apart, we investigated their respective antecedents (worldviews) and outcomes (trust and science career appeal). In doing so, we aimed to enhance understanding of scientist perceptions, and open avenues for the development of precise evidence-based interventions that aim to increase trust in science and diversity among scientists.

First, we briefly review two research lines on scientist perceptions. Then, we discuss antecedents of these perceptions and focus on the five most prominent worldview variables identified in previous work. Subsequently, we review research on two of the arguably most important outcomes of public perceptions of scientists: trust in scientists and perceived science career appeal. If stereotypes and social evaluations are equivalent, they should show an overlap (i.e., high correlation), and share antecedents and outcomes. If the opposite is true, there should be little overlap (i.e., low correlation), and they should have different antecedents and outcomes. Figure 1 depicts an overview of the conceptual model.

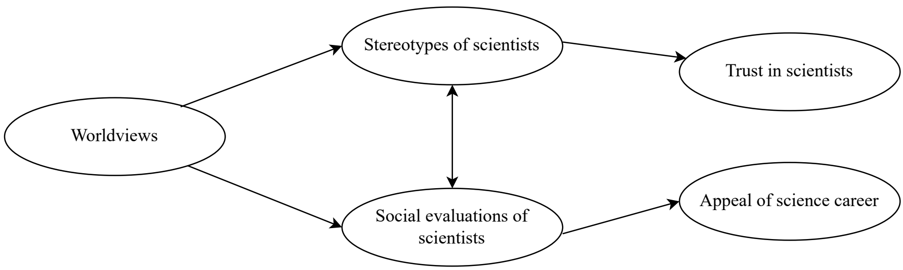

Figure 1. Conceptual model of the present research investigating the structure of scientist perceptions, their antecedents, and their outcomes.

Two Parallel Research Lines On Scientist Perceptions: Stereotypes And Social Evaluations

Stereotypes About Scientists

The importance of scientist perceptions was recognized early, when seminal research investigated how people (mostly children or students) see scientists. For example, Mead and Metraux (1957) asked students to complete statements about what they think a scientist is. Chambers (1983) devised the draw-a-scientist task, counting the number of stereotypical attributes drawn (e.g., lab coat). Generally, this research shows that scientists are stereotyped as intelligent, socially inept, and performing dangerous experiments (e.g., Beardslee & O'Dowd, 1961; Finson et al., 1995; Sala De Gómezgil, 1975). Further research has documented the "mad" scientist stereotype, where many scientists in popular—Western—culture are portrayed as crazy and dangerous (Basalla, 1976; Haynes, 2003). A recent review of work on the image of scientists finds support for these seminal observations (Ferguson & Lezotte, 2020), although the "mad" scientist stereotype has become less prominent (Haynes, 2016).

Overall, research suggests that 'scientist' evokes an image of an extremely smart, but not very social and even potentially dangerous, middle-aged-to-old, white, bearded man, who is wearing glasses and works in a laboratory filled with books and instruments. This image is quite specific, rich, and detailed, and may be modeled after various widely-known scientists such as Einstein, Newton, and Bell (Miele, 2014; Narayan et al., 2009; Rubin et al., 2003). More recently, with the development of social evaluation models, these information-rich stereotypes have been reduced to more systematic but also two-dimensional social evaluations.

Social Evaluations Of Scientists

The stereotype content model (SCM; Fiske et al., 2002) suggests that stereotypes about social categories can be reduced to two dimensions: warmth (whether someone has good or bad intentions) and competence (whether someone is able to achieve those intentions). Other models underscore the importance of other dimensions (e.g., the difference between warmth and morality; Leach et al., 2007; Ellemers, 2017). The most recent integration of five models of social evaluations agrees on two dimensions of which each has two sub-dimensions (Abele et al., 2021). These include *competence* (intelligence/capability) and *assertiveness* (confidence/dominance) which comprise the agency dimension, and *morality* (honesty/fairness) and *warmth* (friendliness/care) which comprise the communion dimension (Abele & Wojciszke, 2014; Abele et al., 2016). Research on scientist evaluations that employed these models yielded consistent results: Scientists are seen as extremely competent (which is seen as their prototypical trait), very moral, and moderately warm (Fiske & Dupree, 2014; Fujiwara et al., 2022; Gligorić et al., 2022; Rutjens et al., 2022). Though this work somewhat overlaps with research on scientist stereotypes (e.g., scientists as brilliant), social evaluations are not as detailed but stem from reductionist techniques used for analyzing perceptions of various groups. That is, a stereotypical image includes characteristics that are not part of social evaluations (e.g., gender, various attributes such as books). While some of these characteristics can signal social evaluations (e.g., gender stereotypes of scientists as men could signal competence and coldness; McPherson et al., 2022), these are not equivalent. What is more, these two research lines also point to different conclusions: Whereas the "mad and dangerous" stereotype emerged from research on stereotypes, work on social evaluations suggests that scientists are evaluated as relatively moral. However, differences or similarities between these two lines of inquiry have never been investigated. Equally strikingly, research on antecedents of scientist perceptions is scarce, and it is therefore unclear why people differ in perceptions in the first place.

Antecedents: Where Do Scientist Perceptions Come From?

A better understanding of scientist perceptions and the potential differences between stereotypes and social evaluations depends on knowing where these perceptions stem from. While some studies on scientist perceptions focused on socio-demographic variables (e.g., age, gender, education; Losh, 2010), (Besley, 2015) systematically investigated a large number of predictors including experience with science such as museum visits and science knowledge. He discovered that science knowledge and taking science courses--but not experiences like museum visits--were the most important predictors (though see Thomson et al., 2019 who found that museum visits were associated with *more* stereotyping). However, it was acknowledged that "relatively small amounts of variance were explained by the constructed models" (p.12, Besley, 2015). Although this study did not find much evidence for the effects of media exposure, other studies suggest that media consumption may influence how scientists are perceived (e.g., Steinke et al., 2007; Tan et al., 2017).

While other work also recognizes the importance of certain worldviews in scientist perceptions (e.g., political ideology; Hardy & Tallapragada, 2021), the role of various worldviews has not been systematically explored in one study. This is surprising given that worldviews help shape attitudes toward science and scientific findings (Hornsey, 2020): Liberals have more positive attitudes toward science than conservatives (e.g., Blank & Shaw, 2015; Gauchat, 2012), while religion and science can be seen as two opposing ways of explaining existential questions, and so some religious people have less positive perceptions of scientists (Beauchamp & Rios, 2020) and are more skeptical about certain scientific discoveries, such as evolution (Ecklund et al., 2017) or COVID-19 vaccines (Tippins et al., 2023). Like religiosity, spirituality can also be in contradiction with science as it relies on intuitive and subjective experiences in determining truth (Hanegraaff, 2018; Lindeman et al., 2019), and it is a consistent predictor of vaccine skepticism and low faith in science (Rutjens & Van Der Lee, 2020). Moreover, the relationship between a conspiratorial worldview and science attitudes has been well documented, so that individuals prone to conspiracy theories tend to reject scientific findings (Lewandowsky et al., 2013; Van Der Linden, 2015; also see "conspirituality", where a conspiratorial mindset is merged with spirituality, Halafoff et al., 2022). Finally, as discussed earlier, the stereotype of the "mad" scientist is deeply embedded in western culture, which means that the extent to which one is encultured in Western society could influence perceptions of scientists (Haynes, 2003; see Farland-Smith, 2009). Overall, although it is clear that worldviews play important role in science attitudes, systematic research on their precise role in scientist perceptions is lacking. Additionally, their relative importance has not been tested. Based on the aforementioned work, we selected five worldview variables: political ideology, religiosity, spirituality, conspiracy mentality, and western enculturation. We next turn to the two of the most obvious outcomes of scientist perceptions – trust in scientists, and the science career appeal.

Outcomes: What Is The Role Of Scientist Perceptions?

How people perceive scientists can have far-reaching consequences. Arguably, one important consequence is trust in scientists, which is crucial in securing public buy-in regarding various science-based policies. In other words, meeting a certain threshold of public trust in scientists facilitates the acceptance of policies such as vaccination programs and sustainable consumption patterns (Algan et al., 2021; Motta, 2018). Whereas research on how stereotypes relate to trust is scarce, studies on the role of social evaluations of scientists are more numerous, arguing that social evaluations are components of trust (Besley et al., 2021; Fiske & Dupree, 2014; Hendriks et al., 2015).

On the other hand, research on how stereotypes (but not social evaluations) relate to the willingness to pursue a scientific career is ampler. If a stereotypical scientist is perceived as a white middle-aged-to-old, man, this could form a barrier for people who do not conform to this stereotype to consider a career in science themselves. Multiple studies supported this notion, many of which focus on gender and ethnicity (e.g., Cundiff et al., 2013; Hurtado et al., 2009; Lane et al., 2012; Master, 2021; Nosek et al., 2009; J. Schinske et al., 2015; J. N. Schinske et al., 2016; Sharp et al., 2022).

The Present Research

The primary aim of the present research was to explore how the two research lines identified earlier relate to each other. Improving and honing understanding of perceptions of scientists is key in the wake of societal problems in which scientists play a crucial—and sometimes very public—role (e.g., the COVID-19 pandemic, climate change) (KNAW, 2022). To understand the relationship between stereotypes and scientist evaluations, we investigated their relationship with five worldview predictors (political ideology, religiosity, spirituality, conspiracy mentality, western enculturation), and two outcomes (trust in scientists and science career appeal). We conducted two preregistered studies. Study 1 (online convenience sample; N = 532) focused on worldviews as predictors of scientist perceptions (stereotypes and evaluations) and trust in scientists as the outcome variable. Study 2 (online Prolific sample, *N* = 559) served as a replication and extension which added a measure of science career appeal. To investigate the role of stereotypes in more detail in Study 2, we used quota sampling in order to obtain two subsamples—one congruent and one incongruent with the scientist stereotype (middle-aged-to-old, white male). All materials, data, and analysis scripts for R are disclosed at the Open Science Framework (https://osf.io/b3qt5). Pre-registration for Study 1 is available on https://osf.io/q2x67 and for Study 2 on https://osf.io/7wk4e. It is important to note that our research was conducted using non-representative samples from different countries and utilized different sampling strategies, which means that the generalizability of the findings remains to be tested (though note that it has been shown that psychological effects depend more on the relationships between the variables that are studied than on the sample or setting; Klein et al., 2018).

Study 1

Method

Sample

For Study 1, we aimed for a minimum of 250 participants, which is required for correlations to stabilize (Schönbrodt & Perugini, 2013). The sampling strategy included convenience and snowball sampling (e.g., Reddit), which resulted in 586 participants. After excluding the participants who failed the attention check (had not selected the instructed option; $n = 28$), completed the survey faster than five minutes ($n = 4$), or were outliers on Mahalanobis distance on all measured variables ($n = 20$), 532 participants remained. No analyses were performed before data exclusion. The sample ($M_{age} = 29.22$, $SD = 10.82$) was relatively balanced in gender (50.3% female, 43.4% male, 6.3% other). Given the recruitment strategy, the sample was diverse in terms of country origin, with the majority being from the United States (41%), followed by the Netherlands (18%), the United Kingdom (10%), Canada (6%) and Germany (5%), whereas the rest indicated other countries. Most participants were highly educated (56.6%) as they had an undergraduate or graduate degree. The rest included individuals who had less education than high/secondary school (1.5%), completed high/secondary school (12.2%), and students (29.7%).

Procedure and Materials

The study was approved by the Ethical Review Board of the University of Amsterdam. Study 1 consisted of an online survey programmed in Qualtrics. After giving their consent to participate, participants indicated their age, gender, educational level, and country of origin. Next, they completed five worldview measures (randomized order) and measures about scientists (evaluations, stereotypes, and trust; randomized order). Besides the measures of worldviews and perceptions of scientists, the survey also contained measures of epistemic motivations, which were a part of another project and will therefore not be mentioned further. The survey took about 12 minutes to complete.

Political ideology was measured using two items. One item measured political ideology on social issues and the other measured political ideology on economic issues (1 = *left-wing*, 5 = *center*, 9 = *right-wing*). Both questions were provided with examples of what social issues (e.g., minority rights, gender equality) and economic issues (planned vs. free-market economy) entail, as well as an explanation for what it means to be left-wing or right-wing (Gligorić et al., 2021). The correlation between the two items was high, $r = .66$.

Religiosity was measured using the 5-item Centrality of Religiosity Scale (CRS-5) (Huber & Huber, 2012). The scale included items such as "To what extent do you believe that God or something divine exists?" and "How often do you take part in religious services?". The answers were given using a five-point scale (label phrasing depended on the question). The CRS-5 had good reliability (α = .85).

Spirituality was measured with two items: participants indicated to what extent they consider themselves to be a spiritual person and to what extent other individuals consider them to be a spiritual person, using a seven-point Likert scale (1 = *not at all*, 7 = *very much*) (Rutjens & Van der Lee, 2020). The correlation between the two items was high, r = .83.

Conspiratorial mentality was measured with the seven-item subscale "Conspiracy Theory Ideation" (CTI) of the Conspiracy Mentality Scale (CMS) (Stojanov & Halberstadt, 2019). Participants indicated their agreement with statements such as "The government or covert organizations are responsible for events that are unusual or unexplained" using a seven-point Likert scale (1 = *strongly disagree*, 7 = *strongly agree*). The scale had good reliability (α = .83).

Western enculturation was measured by adapting the Acculturation, Habits, and Interests Multicultural Scale for Adolescents (AHIMSA) (Unger et al., 2002). In the present study, the eight statements from the original AHIMSA were presented with each of them ending with "western culture". The statements (e.g., "The people I fit in with best are from Western culture.") were rated using a five-point Likert scale (1 = *strongly disagree*, 5 = *strongly agree*). The scale had good reliability (α = .80).

Stereotypes of scientists. To measure the extent to which individuals endorsed stereotypes of scientists, we selected the most prominent attributes of the scientist stereotypes. This selection was made from the meta-analysis of the Draw-A-Scientist Checklist (Ferguson & Lezotte, 2020), a checklist developed to identify how stereotypical people's drawings of scientists are (Chambers, 1983; Finson et al., 1995). From this checklist, we took the 10 characteristics that are perceived to be the most stereotypical of scientists, in descending order: male sex, Caucasian/white, symbols of research (e.g., microscope), indoor work, middle-aged-to-old, lab coat, eyeglasses, symbols of knowledge (e.g., books), technology, facial hair. Participants were asked to judge how accurately these attributes reflected their image of scientists (1 = *not accurate at all* to 5 = *extremely accurate*). Higher scores indicated a more stereotypical perception. Apart from the stereotypical attributes, we added 5 distractor attributes, that were not part of the analysis (e.g., bicycle riders, musical instruments). The scale showed good reliability, α = .82.

Social evaluations of scientists. Participants reported their social evaluations of scientists, which were based on four dimensions of the Dual Perspective Model (DPM; Abele & Wojciszke, 2014). All dimensions were rated using a seven-point bipolar scale (-3 to 3) with adjectives belonging to each dimension (Abele et al., 2016; Abele & Hauke, 2020). Dimensions included competence (e.g., *little capable* to *very capable*), assertiveness (e.g., *not at all self-confident* to *very self-confident*), morality (e.g., *little fair* to *very fair*), and warmth (e.g., *little caring* to *very caring*). The reliabilities of all four measures (Cronbach's α) were good: for competence, assertiveness, warmth, and morality, they were .83, .69, .81, and .83 respectively.

Trust in scientists was measured using the four-item General Trust in Scientists Index (McCright et al., 2013). Using a five-point Likert scale (1 = *completely distrust* to 5 = *completely trust*), participants answered to what extent they distrust or trust scientists (e.g., to "create knowledge that is unbiased and accurate"). The scale showed good reliability (α = .82).

Results and Discussion

Correlations between measures of worldviews, scientist stereotypes, social evaluations, and trust are provided in Table 1. There are several things to note. Firstly, worldview variables are not highly inter-correlated (except religiosity and spirituality), which is suitable for testing the relative importance of predictors in scientist perceptions. Secondly, social evaluation measures show medium to high intercorrelations, suggesting a general positive evaluation. However, these evaluations have small correlations with stereotypes (warmth correlates negatively, which is in line with the stereotype). Most interestingly, not stereotypes, but social evaluations are related to trust in scientists.

Table 1.
Correlation between worldviews and scientist measures (stereotypes, evaluations, and trust)

	1	2	3	4	5	6	7	8	9	10
1. Political Ideology										
2. Religiosity	.28**									
3. Spirituality	.19**	.74**								
4. CM	.10*	.11*	.15**							
5. West. Cult.	-.05	-.10*	-.10*	-.07						
6. Stereotypes	.03	.13**	.06	.13**	.13**					
7. Competence	-.21**	-.07	-.04	-.05	.08	.18**				
8. Assertiveness	-.05	-.01	.04	.05	.00	.12**	.56**			
9. Morality	-.21**	-.13**	-.09*	-.11*	.08	.11**	.66**	.53**		
10. Warmth	-.17**	-.14**	-.11*	-.08	-.05	-.11*	.29**	.38**	.58**	
11. Trust	-.34**	-.21**	-.15**	-.26**	.09*	-.00	.36**	.22**	.48**	.28**

Note. $^{**}p < .01$, $^{*}p < .05$. CM = Conspiracy mentality; West. Cult. = Western enculturation

Next, we conducted a path analysis (fully saturated model), in which we investigated how worldviews predict stereotypes and scientist evaluations, subsequently predicting trust. Results are displayed in Figure 2. There are three important things to note. Firstly, stereotypes of scientists have different predictors than social evaluations. While religiosity and western enculturation predict stereotypes, political ideology does not, and the opposite is true for social evaluations (note that the only common predictor is conspiracy mentality). Secondly, political ideology is the most important worldview variable in predicting scientist evaluations (more right-wing participants perceived scientists as less competent, moral, and warm). Finally, echoing the zero-order correlations, not stereotypes, but social evaluations (only morality) are related to trust in scientists.

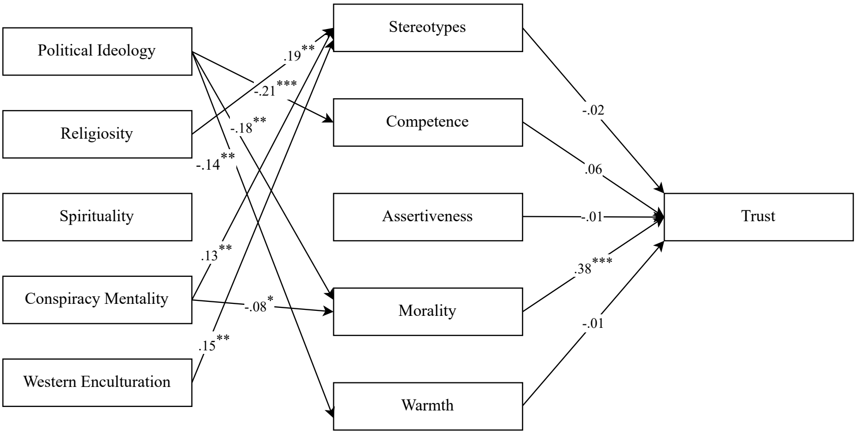

Figure 2. Path analysis of worldview's predicting scientist stereotypes and evaluations, which then predict trust. For readability, we present only significant paths from worldviews on stereotypes and evaluations. ***p < .001, **p < .01, *p < .05.

Study 2

Study 1 showed that stereotypes and social evaluations of scientists have different predictors: Religiosity and western enculturation were associated with more stereotyping, while right-wing political ideology predicted more negative social evaluations. We also found that social evaluations—not stereotypes—are related to trust in scientists (all had positive zero-order correlations; though only morality was significant when all evaluations were entered). In Study

2, we aimed to replicate these findings utilizing a different sample and extend them in two ways. First, we added a behavioral measure of trust. Second, we aimed to explore how scientist stereotypes and social evaluations relate to the science career appeal. We were specifically interested in testing whether scientist-stereotype-incongruent people (young, non-white, non-men) who endorse a stereotypical image of scientists (middle-aged-to-old, white men) would indicate work in science to be unappealing; while scientist-stereotype-congruent people (middle-aged-to-old, white men) who endorse a stereotypical image of scientists would report to perceive work in science as highly appealing.

Method

Sample

We recruited 600 participants from the Prolific US since we aimed to have 200 participants in each group (stereotype-congruent, incongruent, and mixed). This was based on the required minimum sample (191) to detect the correlation of r =.2 (α = .05, power = .80). We excluded participants who failed an attention check question (n = 4), completed the survey too fast (4 minutes; n = 16), and multivariate outliers (n = 21). No analyses were performed before data exclusion. The final sample was made of 559 participants (238 men, 313 women, and 8 indicated "other"; M_{age} = 38.9, SD = 15.5). Regarding education, 0.5% indicated education less than high/secondary school, 25.9% had completed high/secondary school, 12.7% were students, 45.4% had an undergraduate degree and 15.4% had a graduate degree. Regarding ethnicity, most participants identified as either White/Caucasian (64.6%), Asian (17.2%) or Black/African-American (9.3%).

Materials

After signing the consent form, participants reported their demographics. Next, they completed the same worldview measures (political ideology, religiosity, spirituality, conspiracy mentality, western enculturation) from Study 1 in a randomized order. Next, participants completed the block of measures that included social evaluations from the DPM model, stereotype scale, and trust in scientists (Study 1). All scales showed good reliability (αs ⩾ .83). Compared to Study 1, we also calculated scores on stereotypes of scientists only focusing on demographics, i.e., to what extent participants stereotype a scientist as an old, white male. Participants also completed additional measures in Study 2 – another measure of trust and measures related to the science career.

Trusting behavior: Influence granting task (IGT). We also measured trust in scientists using a task in which participants were presented with a pressing problem that is affecting every citizen, and which would require the help and advice of various scientists. Participants had 100 points of decision power to distribute across seven different parties offered, which also included scientists. Granting the decision-power to scientists indicated higher levels of trust in scientists. We developed and piloted this measure for a different project (Gligorić, Van Kleef, et al., 2024), for more information please see https://osf.io/d5zcj/.

In the final set, participants answered questions about a career in science. They first responded if they have *ever worked as a scientist* for at least 3 months (80 yes and 479 no), and whether they *currently work as a scientist* (24 yes and 535 no). Next, they answered a 5-item scale measuring how *appealing a science career* seems to them (five-point bipolar scale; e.g., *boring – interesting*) (Tyler-Wood et al., 2010). Finally, those participants who responded they did not work as a scientist, completed another scale of interest in working as a scientist (*aspirations of working as a scientist*). Participants were asked to imagine themselves in a position before making a career choice when answering questions. They indicated agreement with six statements (e.g., “I would like to work in a career involving science”) using a five-point scale (1 = *fully disagree* to 5 = *fully agree*). We constructed this measure by taking three items from both aspirations in science (DeWitt et al., 2013) and orientation towards a future in science (Hampden-Thompson & Bennett, 2013). Both appeal and aspiration scales showed high reliabilities (α = .91 and .96 respectively).

Results and Discussion

Correlations between used measures are given in Table 2. Replicating the results of Study 1, worldview variables are not highly inter-correlated, while social evaluation measures are again highly correlated, suggesting a general positive evaluation. Again, scientist stereotypes show relatively low correlations with social evaluations (though warmth was not correlated). Finally, mirroring the results of Study 1, while stereotypes are not reliably related to trust (two significant correlations out of four, opposite signs), more positive scientist evaluations are related to higher trust in scientists (all eight correlations).

Table 2.
Correlations between worldviews (first set of variables), scientist stereotypes (second set), scientist evaluations (third set), and science career (fourth set) measures

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. Political Ideology																
2. Religiosity	.40**															
3. Spirituality	.27**	.78**														
4. Conspiracy Mentality	.25**	.27**	.30**													
5. West. Culture	.15**	.06	.07	-.07												
6. Sci. Stereotypes	.03	.10*	.07	.08	.08*											
7. Sci. Stereotypes Dem.	.08	.12**	.07	.11*	.08	.81**										
8. Competence	-.30**	-.02	-.04	-.16**	.03	.25**	.13**									
9. Assertiveness	-.19**	.09*	.04	-.03	-.05	.25**	.16**	.73**								
10. Morality	-.35**	-.11*	-.12**	-.22**	.02	.15**	.07	.76**	.73**							
11. Warmth	-.22**	.01	-.01	-.11**	-.05	-.03	-.02	.49**	.59**	.71**						
12. Scientist Trust	-.49**	-.26**	-.25**	-.38**	.04	.12**	-.00	.55**	.42**	.65**	.38**					
13. Scientist Trust Task	-.27**	-.28**	-.30**	-.28**	.01	-.07	-.10*	.22**	.13**	.29**	.17**	.45**				
14. Ever W. Scientist	-.12**	-.03	-.01	.01	-.07	-.07	-.08	-.03	-.04	.03	.06	.06	.04			
15. Current W. Scientist	-.09*	-.05	-.02	-.04	-.04	-.02	-.05	.02	-.02	.01	-.02	.05	.01	.52**		
16. Appeal Sci. Career	-.13**	-.07	-.06	-.10*	.06	-.08	-.11**	.28**	.21**	.31**	.27**	.38**	.26**	.18**	.11*	
17. Aspirations W. Sci	-.04	-.04	-.03	-.05	.06	-.12**	-.12**	.06	-.00	.12**	.13**	.19**	.18**	.24**	NA	.65**

Note. * $p < .05$. ** $p < .01$. Sci. Stereotypes = Scientist Stereotypes; Sci. Stereotypes Dem = Demographic Scientists Stereotypes; Ever W. Scientist = Ever worked as a scientist; Current W. Scientist = Currently working as a scientist; Aspirations W. Sci = Aspirations to work as a scientist; Correlations with aspirations to work as a scientist are given only for those who were not working as scientists (n = 535), because the question was not presented to those currently working as scientists. For the same reason, there is no correlation with currently working as a scientist.

To investigate these relationships in more detail, we conducted a path analysis (fully saturated model) in which we investigated how worldviews predict stereotypes and scientist evaluations, which then predict trust and science career appeal. The results are summarized in Figure 3. Several results deserve attention. First, as in Study 1, stereotypes of scientists are predicted by religiosity and western enculturation, rather than other worldviews. In contrast, political ideology is the most important predictor of scientist evaluations: right-wing individuals perceive scientists as less competent, assertive, moral, and warm. Secondly, not stereotypes of scientists, but social evaluations (especially morality) predict trust. Thirdly, both stereotypes and social evaluations predict the science career appeal. To investigate how stereotypes predict science career appeal, we ran the same path model for two sub-samples: stereotype incongruent (young, i.e., 30 years old and younger, non-white, non-men; *n* = 166) and congruent (40 or more years old white men; *n* = 187). The effect of stereotypes on the science career appeal was driven by the stereotype incongruent sample, and there was no effect of stereotypes in the stereotype congruent sub-sample.

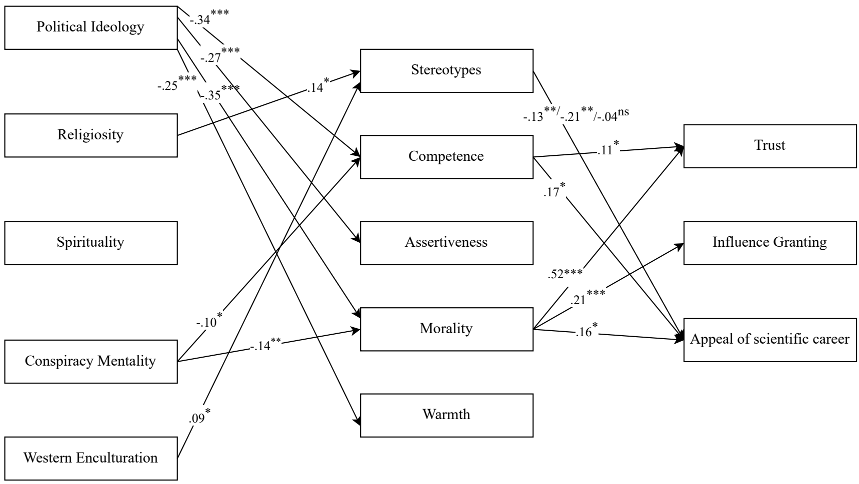

Figure 3. Path analysis of worldviews predicting scientist stereotypes and evaluations, which in turn predict trust and science career appeal. Only significant paths are displayed[5]. We provide values of three effects of stereotypes on the science career appeal; (1) for the whole sample, (2) for the stereotype-incongruent sub-sample, and (3) for the stereotype-congruent sub-sample. Calculating stereotypes by only focusing on three demographic features (to what extent have an image of a scientist as an old, white, male) yielded almost identical results. $^{***}p < .001$, $^{**}p < .01$, $^{*}p < .05$.

General Discussion

The current work integrates two research lines on scientist perceptions: stereotypes and social evaluations. Across two studies, we found that stereotypes and social evaluations of scientists are two different types of perceptions that are generated by different worldviews: Stereotypes emerge from religiosity and western enculturation, while right-wing political ideology and to a lesser extent conspiracy mentality pre-

5 Religiosity had a significant positive effect on all scientist evaluation variables. However, given that it has a positive zero-order only with assertiveness and zero or negative correlations with other dimensions, this suggests a suppressor effect, which is why we do not report the effects in the figure

dict negative social evaluations of scientists. They are also associated with relatively different outcomes – while stereotypes are unrelated to trust in scientists, more positive social evaluations (competence and morality) are associated with more trust in scientists. Additionally, both less stereotyping and more positive social evaluations independently contributed to the increased science career appeal.

Scientist Perceptions: Stereotypes And Social Evaluations

The current work reveals interesting dynamics between stereotypes and evaluations. We previously noted that social evaluation models result from a reduction of multiple traits that groups are perceived to possess (Fiske et al., 2002). As such, social evaluations proved useful in understanding both the science career appeal and trust in scientists. However, due to relatively low overlap with stereotypes, focusing only on evaluations can underestimate the complexity of social perceptions, at least when it comes to perceptions of scientists. The present study demonstrates that a better understanding of scientist perceptions requires it to be taken in its detailedness.

Worldviews Shaping Scientist Perceptions

While some previous research investigated contributors to scientist perceptions (e.g., experience with science, media exposure; Besley, 2015), it did not investigate the role of a key antecedent of science attitudes – worldviews (Hornsey, 2020; Rutjens, Heine, et al., 2018). While the relevance of political ideology has been recognized previously (Agley, 2020; Blank & Shaw, 2015; Gauchat, 2012), we demonstrate that it has a most prominent role over and beyond other worldviews. Several reasons for this association have been put forward: the first is that scientists, who challenge the status quo, threaten the conservative worldview with discoveries and changes they inevitably bring (Gauchat, 2012; Nisbet et al., 2015). Another reason is that conservatives perceive (certain) scientists as advancing liberal values, therefore distrusting liberal *scientists*, and not the scientific method per se (Cofnas et al., 2018; Mann & Schleifer, 2020). The current studies corroborate that political ideology is an important driver of social evaluations of scientists.

The role of conspiracy mentality in science attitudes has started getting more attention (Rutjens & Većkalov, 2022), especially in light of the COVID-19 pandemic during which various conspiracy theories surged (Imhoff & Lamberty, 2020; Pertwee et al., 2022). Scientists are suitable target candidates for conspiracy theories – they are often perceived as an elitist group that works relatively isolated (Douglas et al., 2019; Rutjens, Heine, et al., 2018).

The Role of Scientist Perceptions in Trust and Career Appeal

Discovering that social evaluations (competence and morality primarily) predict trust in scientists is in line with various trust models that assume the central role of social evaluations in trust (Besley et al., 2021; Hendriks et al., 2015; Mayer et al., 1995). However, we are aware of only one other study that directly tested the role of social evaluations on trust in scientists, which also observed a prominent role of competence and morality (Gligorić, Van Kleef, et al., 2024). It is interesting that stereotypes were not found to be reliably related to trust, which can be explained by the fact that stereotypes include positive, negative, and neutral traits.

Science career appeal, on the other hand, was found to be predicted by scientist stereotypes as well as social evaluations. The effect of stereotyping emerged only for individuals who do not conform to the scientist stereotype (i.e., young, non-white, non-male), but not for those who do. This finding has obvious practical implications: to increase the science career appeal, a two-pronged approach might work. One route could focus on improving social evaluations of scientists (e.g., Zahry & Besley, 2019, 2021), while the other route would include the countering of stereotypes—particularly when targeting individuals who are dissimilar from the scientist stereotype.

Limitations, Future Research, and Conclusion

Some limitations of the current research need to be mentioned. Firstly, some measures were short, consisting of only two items per scale (e.g., political ideology, spirituality). However, their respective items showed high intercorrelations, and the relationships were consistent across the two studies. Moreover, these measures have been well-validated in previous research. Secondly, both studies were correlational, so causal inferences cannot be made. Although the direction of effects is conceptually plausible (e.g., it is more logical that worldviews affect scientist evaluations rather than vice versa) and based on other research (e.g., the role of evaluations in trust), future research should test them experimentally. Given the significant role of perceptions of morality (also see Bender et al., 2016), future research should focus particularly on this dimension. Future research should clarify paradoxical perceptions of scientists as moral, with the evil/mad stereotype of scientists who are capable of severely immoral deeds. Finally, our research was conducted using non-representative (and predominantly US) samples, so the generalizability of the findings remains to be tested.

In conclusion, we found that different perceptions of scientists (stereotypes and evaluations) are associated with different antecedents and outcomes. Future research should acknowledge the complexity of scientist perceptions by distinguishing between stereotypes and social evaluations of scientists. This will not only help to further inform ways to increase trust in scientists, but also provide insights into ways to encourage people to pursue a science career, especially those who come from backgrounds that do not mesh with the scientist stereotype.

CHAPTER 5

WHO HARASSES SCIENTISTS? THE ROLE OF WORLDVIEWS, RADICALIZATION RISK FACTORS, AND PERSONALITY IN VIOLENT BEHAVIOR TOWARD SCIENTISTS

Anti-science movements brought more than public distrust in science. Perhaps even more worryingly, these movements are also associated with instances of harassment of – and violence against – scientists. However, virtually nothing is known about individuals likely to harass or harm scientists. Across two pre-registered studies (total N=749), we investigated the role of worldviews (e.g., political ideology, conspiracy mentality, science cynicism), radicalization risk factors (relative deprivation and threat), and personality traits and how these relate to harassment of scientists (both attitudes and behavior). We found that science cynicism–the perception that scientists are incompetent and corrupt–drives approval of scientists' harassment (attitudes), as well as harmful behavior (e.g., refusing to donate money, not signing a petition). Additionally, perceiving scientists as threatening, as well as dark personality traits (psychopathy and narcissism), contributed to approving scientists' harassment. Overall, the present research takes a first step in identifying predictors of the willingness to harm scientists.

This chapter is based on the following manuscript:
Gligorić, V., Reinhardt., C., Nieuwenhuijzen, E., Castro, J.O., Feddes, A., Van Kleef, G. & Rutjens, B. (2024). Who harasses scientists? The role of worldviews, radicalization risk factors, and personality. *Manuscript under review.*

When a Dutch virologist, who was a prominent member of the governmental COVID-19 management team during the pandemic, walked into a museum in Amsterdam, she barely escaped an angry mob. Although seemingly an extreme example, her case is not an exception: as much as 38% of scientists who worked on pandemic-related research faced different forms of harassment (from personal insults and doxing to wishes of harm or death, O'Grady, 2022), while 15% received death threats (Nogrady, 2021). Noting that a large number of scientists faced such extreme and harmful behavior—and even suffered physical attacks (Nogrady, 2021)—it is clearly important to explore the factors driving it. However, to our knowledge, no research so far has done so. The present work aims to fill this gap by examining which individuals are more likely to engage in harassing scientists. Drawing on previous research on science attitudes which showed that various worldviews (e.g., religiosity, conservatism) are key predictors of negative attitudes toward science and scientists (Hornsey, 2020; Lewandowsky et al., 2013; Rutjens et al., 2022), we investigate the role of the following worldviews: religiosity, spirituality, political ideology, conspiracy mentality, science populism, and science cynicism. Additionally, we draw on the radicalization literature (Doosje et al., 2016) and investigate the role of relative deprivation and threat as radicalization risk factors. In Study 2, we extend this approach by including personality factors, specifically the dark triad (narcissism, Machiavellianism, and psychopathy). Besides measuring attitudes toward scientist harassment, we also include behavioral measures of aggression and violence toward scientists. In the next sections, we provide a brief background to each of these factors.

Worldviews shape negative science attitudes

Even though research has not specifically investigated which individuals are prone to violence against scientists, examining general attitudes toward science might unveil potential factors influencing such tendencies. Particularly prevalent since the COVID-19 pandemic, anti-science attitudes and skepticism towards science have been increasing over the past decades (Algan et al., 2021; Gauchat, 2012; Rothmund et al., 2022; Wynne, 2006). Mistrust in science, and ultimately the dismissal of scientific evidence, can occur when science does not align with a person's worldview or ideologies (Hornsey, 2020). One such worldview could be religion, as it offers competing explanations for many phenomena (e.g., the origin of Earth and life, evolution, afterlife; Blancke et al., 2012; Farias, 2013). Indeed, research has found that believing in God, as well as higher religiosity overall, are associated with more negative attitudes to, and less trust in, science and scientists (e.g., Gligorić, Clerc, et al., 2024; McPhetres & Zuckerman, 2018; Tippins et al., 2023). Besides religion, spirituality is another driver of negative science attitudes, as it has been shown to predict lower faith in science and vaccination skepticism (e.g., Zarzeczna et al., 2023). Although there is a relation between spirituality and religiosity (many religious people will also identify as spiritual), research generally focuses on post-Christian spirituality and so-called spiritual-but-not-religious believers (e.g., Houtman & Aupers, 2007). Therefore, we treat these two worldviews separately.

Not only religiosity and spirituality are related to distrust in science and scientists. Conservative ideology seems to be in conflict with (at least some) science, given that political conservatives show lower faith in science (Azevedo & Jost, 2021), increasing distrust (Gauchat, 2012), and more anti-science attitudes (Mooney, 2012). Additionally, most scientists are liberal-leaning and as such perceived by some to push liberal values in science (Cofnas et al., 2018). Conservatives' distrust particularly translates to specific areas of science, most prominently climate change (Hornsey et al., 2016) or COVID-19

(Kerr et al., 2021; Kossowska et al., 2021). Recently, Gligorić, Van Kleef and Rutjens (2024) found that, in the US, conservatives (vs liberals) showed lower trust in 43 out of 45 studied scientific occupations (e.g., biologists, climatologists, sociologists). Overall, research suggests that political conservatives have more negative attitudes toward science and scientists.

While most science attitude research has focused on religious and spiritual belief, science knowledge, and political ideology (Rutjens et al., 2018), recent research has started to investigate the influence of distrusting worldviews, which are not necessarily related to religious or political ideology. Most notably, COVID-19 brought an exponential increase in conspiracy theories. For example, various studies found that the prevalence of most COVID-19 conspiracy theories (e.g., the virus originated from a laboratory or was created by big pharmaceutical companies, or that it was made to produce destabilization) is over 20% (Fotakis & Simou, 2023). These explanations challenge the official and evidence-based ones, questioning the origin of the virus, its prevention, and treatment. Thus, it is not surprising that belief in conspiracy theories is one of the most important drivers of refusing to engage in COVID-19 protective behaviors (Allington et al., 2021), and one of the strongest predictors of skepticism toward COVID-19 vaccines (Jennings et al., 2021), as well as childhood vaccines (Hornsey et al., 2016). More generally, conspiracy beliefs about how those in power (including scientists) have malevolent goals contribute to science rejection (Lewandowsky et al., 2013; Rutjens & Većkalov, 2022).

Mistrust in scientists does not necessarily have to come in the form of conspiracy theories, i.e., narratives challenging official explanations. Populism–a view that distinguishes between corrupt elite groups (i.e., establishment) and good-hearted ordinary people–could also be a contributing factor, given that scientists can be seen as a part of the establishment (e.g., Bellolio, 2022). Specific to science, researchers developed the concept of "science-related populism" as a distinct variant of populism. In the view of science populists, a powerful elite of academics stands against the ordinary people; the elite decides (in a biased way) what will be studied and funded (research agenda), as well as what constitutes the truth (knowledge). On the contrary, what ordinary people consider to be important and true (using common sense) is excluded from this decision-making (Mede, Schäfer, & Füchslin, 2021; Mede & Schäfer, 2020). Indeed, individuals who hold science-populist attitudes have more negative attitudes toward science and scientists (e.g., lower trust in science, scientists, science coverage, and impact of science; Mede et al., 2021); also see Merkley, 2020). Interestingly, populism and conspiratorial worldview share dispositional distrust as their central characteristic (Thielmann & Hilbig, 2023), and are both related to cynicism (Papaioannou et al., 2023) – a view that others such as groups and institutions are immoral, unreliable, and corrupt. In general, cynicism views human nature as inherently bad and motivated by self-interests (Neumann & Zaki, 2023), which could also impact the perception of scientists. In sum, conspiracy mentality, science-populism, and science cynicism center around distrust of institutions and academics and thus shape negative attitudes toward science.

Although the worldviews above relate to negative attitudes toward science and scientists, attitudes alone would not likely lead to harassment of scientists, which ranges from insults to vandalism and death threats (O'Grady, 2022; Nogrady, 2021). However, besides relating to negative attitudes toward science, some of the worldviews above also relate to violence. Notably, right-wing ideology and conservatism are associated with violence-favoring attitudes and aggressive behavior (Adorno et al., 1950; Van Hiel et al., 2020). Similarly, populism (Uysal et al., 2023) and cynicism (Kirk & Papachristos, 2011) have been found to be associated with violence. Conspiracy mentality is another well-established driver of violence, as it was found to predict support and intention to engage in violence (Imhoff et al., 2021; Jolley & Paterson, 2020; Šrol et al., 2022). In sum, the worldviews above have been associated with both negative attitudes toward science/scientists and a (general) propensity to violence, making them potential drivers of scientists' harassment. Importantly, given that harassment of scientists can be seen as an example of radical and extremist behavior, we next turn to literature on radicalization.

Risk factors of radicalization: Relative deprivation and threat perception

Radicalization is defined as a process through which people become increasingly motivated to use violent means against members of an out-group or symbolic targets to achieve behavioral change and political goals (Doosje et al., 2016). Radicalization frameworks could be useful to understand why some individuals would harass scientists, although there are noteworthy differences between the prototypical radicalization of political and religious groups and anti-science movements (e.g., absence of clear ingroup identity or coherent ideology). Since radicalization is a complex and multi-faceted issue, we selected those drivers of radicalization that are pertinent in the case of scientists' harassment. Thus, we focused on *risk factors*, as one of the three different categories as root drivers of radicalization (other being trigger factors and psychological needs; Reiter et al., 2021). Risk factors represent contextual forces or states that make individuals more prone to radicalization (compared to trigger factors which are discrete events, e.g., the death of a family member; Macdougall et al., 2018; Reiter et al., 2021).

Wolfowicz and colleagues (2020) identified as many as 52 risk factors for radical attitudes, noting that factors regarding national and/or religious identity, and collective relative deprivation were found to be most commonly identified as predictors of radicalization. Relative deprivation (which can be felt at the individual or collective level) refers to perceiving or feeling treated less well (as an individual or as a group) than what is considered just and deserved. In the present research, we focused on relative deprivation (individual and collective; Doosje et al., 2013) considering that people may feel deprived as a consequence of the behavior of an out-group (scientists).

Apart from relative deprivation, we identified threat perception—one of the strongest risk factors that affect radicalization (Doosje et al., 2013; Wolfowicz et al., 2020)—as a potential driver of aggressive tendencies toward scientists. These threat perceptions can be realistic (relating to resources or physical safety) or symbolic (relating to values; Stephan & Stephan, 2000). Indeed, many scientific areas can be seen as threatening (e.g., nuclear energy, climate change), both physically (possibilities of injuries or death) and symbolically (e.g., less freedom to respond to dangers). This was, for example, the case with the COVID-19 outbreak which was perceived as a realistic and symbolic threat (Kachanoff et al., 2021). However, in the case of harassment of scientists, it is not the societal problem (e.g., virus outbreak, climate change) that is perceived as threatening, but scientists' proposed solutions (e.g., vaccination, regulation of economy). Therefore, science and scientists can be seen as threatening one's physical and economic safety, or values such as freedom (Chinn et al., 2024; Kahan et al., 2011). Such threat perception could then fuel radical behavior toward scientists such as harassment.

The present research

In the present research, we aimed to identify predictors of scientists' harassment by focusing on three groups of predictors – worldviews (religiosity, spirituality, political ideology, science populism, science cynicism, and conspiracy mentality; Studies 1 and 2), risk factors for radicalization (individual and collective relative deprivation, symbolic and realistic threat; Studies 1 and 2), and the three dark triad personalities (narcissism, Machiavellianism, and psychopathy; Study 2). To measure scientists' harassment, we included attitudes toward different forms of harassment of scientists (e.g., insults, death threats; Studies 1 and 2), and three different behavioral variables. In Study 1, we used the Voodoo Doll Task (DeWall et al., 2013) in which participants expressed their aggression by clicking on a doll representing a stereotypical scientist. In Study 2, we asked participants: 1) to donate money to the cause of protecting scientists against harassment and 2) to sign an online petition with the same goal. Materials, data, and analysis code are available at the Open Science Framework (https://osf.io/7rzce/?view_only=957180de7bcc4d0c88dedc2219e52816). Preregistration for Study 1 is available on https://osf.io/q2x67/?view_only=88f68b5093d04dbc8d9e9e0f249559d2, while preregistration for Study 2 can be found on https://osf.io/gcu6h/?view_only=6b1a346e88b94579a8cc7ce1475a49c9.

Study 1

Methods

Participants

We set the minimum sample size at 250, which is needed for correlations of $r = .20$ to stabilize (Schönbrodt & Perugini, 2013). However, we aimed to collect as many participants as possible to get more precise estimates. In total, 457 participants were recruited through social networks such as Instagram, Reddit, and Facebook to complete the study and earn the possibility to win a 15 euro gift card in return. After excluding 18 speeders (completion time at least twice as fast as the median) and 26 outliers (six multivariate on all independent and dependent variables and 20 univariate on behavioral dependent variable), we were left with the total sample of N = 413 (281 males, M_{age} = 35.5). The majority of the participants were from either the United States (45.5%) or the Netherlands (37.3%). Regarding education, 1.2% indicated not having completed high/secondary school, 18.9% had completed high/secondary school, 15% were currently studying, 38.3% had an undergraduate degree and 26.6% had a graduate degree.

Materials and procedure

After reading the information letter and giving their consent, participants reported socio-demographic characteristics (country, sex, age, education). Next, participants completed the following scales in the order presented here (see the OSF for the complete questionnaire).

Political ideology. Political ideology was measured with two items: participants indicated their ideology on social issues (e.g., minority rights, gender equality) and economic issues (planned vs. free-market economy) respectively on a scale from *left-wing* (1) to *right-wing* (9) (Gligorić et al., 2021). The two items were "Please indicate your ideological stance on social issues (e.g. minority rights, gender equality). People on the left tend to change the traditional and cultural norms, while people on the right tend to preserve them." and "Please indicate your ideological stance on economic issues (planned vs. free-market economy). People on the left prefer state/public ownership and equal wealth distribution, while people on the right prefer private ownership and individual responsibility." Items correlated strongly, r = .67.

Religiosity. Religiosity was measured using the Centrality of Religiosity Scale (Huber & Huber, 2012) which contains 5 items such as "How often do you think about religious issues?" and "To what extent do you believe that God or something divine exists?". Items were rated on a 5-point Likert scale ranging from *never* (1) to *very often* (5), or *not at all* (1) to *very much so* (5). The scale showed good reliability (α = .88).

Spirituality. Spirituality was measured using two items: participants indicated what extent they consider themselves to be a spiritual person and to what extent other individuals consider them to be a spiritual person on a scale from *not at all* (1) to *completely* (7) (Rutjens & Van der Lee, 2020). Items showed a high correlation, r = .80.

Conspiracy mentality. Conspiracy mentality was measured using the six[6] items from the subscale *Conspiracy Theory Ideation* (CTI) that contained items such as "The government or covert organizations are responsible for events that are unusual or unexplained" and "Many so called "coincidences" are in fact clues as to how things really happened" (Stojanov & Halberstadt, 2019). Items were rated using a 7-point Likert scale ranging from *strongly disagree* (1) to *strongly agree* (7). The scale had a good reliability (α = .88).

Science populism. Science populism was measured using six items (e.g., "We should rely more on common sense and less on scientific studies"; "People like me should be involved in decisions about the topics scientists research") of the SciPop Scale rated on a 5-point Likert scale ranging from *fully disagree* (1) to *fully agree* (5) (Mede et al., 2021). The scale showed acceptable reliability (α = .76).

Science cynicism. Science cynicism was measured using four items of the Political Cynicism Scale (Brants et al., 2010) which was adapted to "scientists" (instead of "politicians"). The scale included items such as "It is easier to become a scientist thanks to academic friends than because of competence", "Scientists are mainly focused on their own interests", and "Scien-

6 The original scale has 7 items, however, due to a programming mistake we did not include the seventh item in the scale (which had the lowest factor loading in the original subscale: "Events on the news may not have actually happened"). This applies to both studies.

tists do not understand what is happening in society". Ratings were given on a 5-point Likert scale ranging from *fully disagree* (1) to *fully agree* (5). The scale showed good reliability (α = .81).

Relative deprivation. To measure **individual relative deprivation**, participants rated their agreement with six items (e.g., "I don't think I get as many chances as others in [country]"; "It makes me angry when I think of how I am treated compared to others"; Doosje et al., 2013). **Collective relative deprivation** was measured in a similar way using an adapted six-item scale ("If I compare people like me with other groups in [country], I have the feeling that we are being treated unfairly"; "I believe people like me are discriminated against in [country]") (Doosje et al., 2013). All items were rated on a 5-point Likert scale ranging from *totally disagree* (1) to *totally agree* (5). Both scales showed good reliability (both αs = .86). However, given the very high intercorrelation between the two scales (r = .87), we calculated one score of **relative deprivation** (α = .93), and further used it as one scale.

Threat. To measure **symbolic threat**, participants were asked to indicate the extent to which scientists are a threat to five symbolic issues (e.g., "values and traditions of [country]", and "the rights and freedoms of the population of [country]"). Similarly, **realistic threat** was measured by asking about the perception of scientists as a threat to another five issues (e.g., to "personal health", to "personal financial stability"; Kachanoff et al., 2021). Items were answered on a 4-point scale ranging from *not a threat* (1) to *major threat* (4). Both scales showed high reliability (respectively α = .91 and α = .92). Given the very high intercorrelation between the two scales (r = .84), we calculated one score of threat (α = .95), and treated it as one construct.

Attitudes towards scientist harassment. To measure harassment attitudes, we presented participants with 10 behaviors of scientists' harassment such as insults, physical threats or intimidation, online intimidation, or death threats

(O'Grady, 2022), and asked participants to indicate whether they disapprove or approve of these behaviors. Items were rated on a 5-point Likert scale ranging from *total disapproval* (1) to *total approval* (5). The scale showed good reliability (α = .85).

Voodoo Doll Task. Finally, to measure aggressive behavior toward scientists, we adapted the Voodoo Doll Task (DeWall et al., 2013), which includes the presentation of a voodoo doll as a target on which participants can click to "release negative energy". We developed the scientist voodoo doll inspired by the image of a stereotypical scientist (Ferguson & Lezotte, 2020) which included an old-age male with a lab coat and equipment (Figure 1). Participants were given the following instructions: "Because some aspects of this study can be experienced as negative, you now have the possibility to release this negative energy. To do so, you can insert pins into the scientist voodoo doll by clicking on it. Each click represents a pin. You can insert any number of pins that you want (even zero). Once you are done, please click the continue button." A higher number of pins (clicks) indicated more aggressive behavior.

Figure 1. Voodoo doll scientists to which participants inserted pins by clicking on it.

Results

Table 1 contains means, standard deviations, and intercorrelations of variables. The correlations indicate that attitudes toward harassment were related to all worldviews and radicalization factors: right-wing ideology, religiosity, spirituality, conspiracy mentality, science populism and cynicism, feelings of relative deprivation and threat were all related to more approving attitudes toward harassment of scientists. Notably, these correlations varied substantially, from $r = .25$ to .64 (spirituality and threat perception respectively). The behavioral measure of aggressive behavior (voodoo pins) had significant positive correlations with five variables (conspiracy mentality, science cynicism, relative deprivation, threat, attitudes toward harassment), but these were noticeably lower (*r*s ranging from .11 to .18). Interestingly, it showed a relatively low correlation with attitudes ($r = .11$), indicating low convergent validity.

Table 1. Means, standard deviations and intercorrelations between variables

	M	SD	1	2	3	4	5	6	7	8	9
1 Political ideology	4.03	2.07									
2 Religiosity	1.99	1.00	.28***								
3 Spirituality	2.63	1.67	.18***	.73***							
4 Conspiracy Mentality	3.26	1.39	.33***	.34***	.34***						
5 Science Populism	2.11	0.82	.46***	.29***	.27***	.59***					
6 Science Cynicism	2.40	0.93	.54***	.30***	.27***	.56***	.68***				
7 Relative Deprivation	2.25	0.89	.13**	.19***	.15**	.37***	.35***	.35***			
8 Threat	1.42	0.69	.50***	.30***	.27***	.58***	.64***	.64***	.31***		
9 Scientist Harassment	1.41	0.49	.39***	.28***	.25***	.55***	.59***	.60***	.31***	.64***	
10 Voodoo Pins	3.09	3.75	.05	.09	.07	.18***	.09	.15**	.11*	.17***	.11*

Note. Correlations between predictor and outcome variables. * indicates $p < .05$, ** $p < .01$, *** $p < .001$.

Next, we wanted to assess the predictors' relative importance in attitudes toward scientists' harassment and aggressive behavior (voodoo pins) by conducting two multiple linear regression analyses. We entered worldviews and radicalization factors as predictors. The results are provided in Table 2. For both dependent variables, the models were significant. Regarding attitudes toward scientists' harassment, perception of threat arose as the strongest predictor, followed by distrusting worldviews (conspiracy mentality, science populism and science cynicism). As for the aggressive behavior (voodoo pins), even though the whole model was significant, no individual predictors were significant (also note the small R^2).

Table 2. Worldviews and risk factors predicting attitudes toward scientist harassment and behavioral aggression (voodoo pins)

	Scientist Harassment			Voodoo Pins		
Model (DV and fit)	$F(8,404) = 51.97$, $p < .001$; $R^2 = .507$ (adjusted $R^2 = .497$)			$F(8,404) = 2.74$, $p = .006$; $R^2 = .052$ (adjusted $R^2 = .033$)		
Predictor	β	t	p	β	t	p
Political Ideology	0.00	0.06	.951	-0.06	-0.96	.339
Religiosity	0.04	0.82	.410	0.06	0.78	.437
Spirituality	-0.02	-0.42	.677	-0.04	-0.51	.611
Conspiracy Mentality	**0.16**	**3.28**	**.001**	0.13	1.96	.050
Science Populism	**0.14**	**2.71**	**.007**	-0.12	-1.67	.095
Science Cynicism	**0.19**	**3.47**	**.001**	0.08	1.13	.260
Relative Deprivation	0.03	0.79	.432	0.04	0.73	.463
Threat	**0.32**	**6.13**	**< .001**	0.13	1.78	.077

Note. Significant predictors are in bold.

Study 2

Study 1 showed that distrusting worldviews (conspiracy mentality, science populism and cynicism), and perceptions of threat can fuel approving attitudes toward harassment of scientists. Therefore, both worldviews and radicalization factors seem to play a role. However, not everyone with a given worldview or radicalization factors engages in extreme attitudes or behaviors. Additionally, these factors are more related to outlooks on society and the world (e.g., how it should look or how it is perceived), which does not account for individual (personality) factors. In Study 2, we also explored the role of personality, by including the most obvious candidate for extremely negative and violent attitudes – the dark triad – which refers to a constellation of three interrelated negative personality traits: (subclinical) narcissism, Machiavellianism, and (subclinical) psychopathy (Muris et al., 2017; Paulhus & Williams, 2002). The trait of narcissism is characterized by pursuing gratification from egotistical admiration of the individual's attributes. Machiavellianism refers to a deceitful and manipulative trait that entails the focus on self-interest with no regard for others. Psychopathy is characterized by anti-social behavior, a lack of empathy and remorse, and impulsiveness. The core of these three traits (which was also proposed to reflect the term "evil"; Book et al., 2015) seems to be low agreeableness (Pailing et al., 2014), and manipulation and callousness (Jones & Figueredo, 2013). Therefore, it is no surprise that a strong body of research showed that all three traits predict aggression and violence (Barlett, 2016; Jones & Neria, 2015; Muris et al., 2017; Pailing et al., 2014).

Methods

Participants

Based on the power analysis (power analysis: $r = .15$; power = 80%, α = .05), we set to collect data from 343 participants. We recruited 359 participants from Prolific US who completed the study in return for £1.00 (approximately $1.26; note that Prolific is a UK platform that uses sterling pounds as a currency). After excluding 17 speeders (completion time at least twice as fast as the median) and 6 multivariate outliers on independent and dependent variables, we were left with $N = 336$ (155 males, $M_{age} = 42.5$). Regarding education, 2.1% indicated not having completed high/secondary school, 42.6% had completed high/secondary school, 4.5% were currently studying, 37.2% had an undergraduate degree and 13.7% had a graduate degree.

Materials

Questions about socio-demographics, worldviews, and risk factors of radicalization were identical to Study 1. All scales showed good or acceptable reliability: political ideology (correlation between two items $r = .72$), religiosity (α = .90), spirituality (correlation between two items $r = .84$), conspiracy mentality (α = .91), science populism (α = .83), science cynicism (α = .86), and attitudes towards scientist harassment (α = .88). As in Study 1, due to the very high correlation between collective and relative deprivation ($r = .88$), and symbolic and realistic threat ($r = .84$), we calculated one measure of relative deprivation (α = .95) and threat (α = .96).

Instead of the Voodoo Doll Task which showed low convergent validity (correlation of $r = .11$ with attitudes), we used two different behavioral measures. We asked participants to sign the **petition** against the harassment of scientists, providing them with the petition link (https://www.ipetitions.com/petition/stop-harassment-of-scientists; the petition outlook can also be found in Supplement), and asking them to fill out their first and last name, and email address. For the **donation**, we offered a bonus payment of £1.00 to participants, which they could distribute (between 0 and 100 pence) to themselves or donate to the Union of Concerned Scientists (www.ucsusa.org), which is a non-profit organization that also deals with the protection of scientists from harassment. Out of a total of £359 offered as a bonus, participants opted to donate 69.79£, which we transferred to the Union of Concerned Scientists.

Dark Triad. To measure the three dark personality traits, we used the Dirty Dozen Scale (Jonason & Webster, 2010). Participants indicated how much they agreed with statements like "I tend to want others to admire me", "I tend to want others to pay attention to me" (**narcissism**), "I tend to manipulate others to get my way", "I have used deceit or lied to get my way" (**Machiavellianism**), and "I tend to lack remorse", "I tend to be callous or insensitive" (**psychopathy**). Answers were given using a 5-point Likert scale ranging from *strongly disagree* (1) to *strongly agree* (5). Each of the three subscales included four items and showed good (narcissism: α = .84, Machiavellianism: α = .85) or acceptable reliability (psychopathy: α = .76).

Results

Table 3 contains means, standard deviations, and inter-correlations of variables. Similarly to Study 1, attitudes toward harassment were related to all worldviews and radicalization factors (except, however, for religiosity and spirituality). Again, there was variation in correlation effect sizes, ranging between -.04 and .40 (for spirituality and threat perception respectively). Regarding the donation behavior, it followed the same pattern of relations with worldviews and risk factors as attitudes – it correlated with all of them, except religiosity and spirituality (note the negative sign as less donating suggested more negative behavior). Petition behavior was only correlated with political ideology and science cynicism (again, note the negative sign), the only two predictors associated with both behavioral variables. Surprisingly, behavioral measures showed no significant correlations with attitudes.

The dark triad was an extension of the first study. All three dark personality traits showed a positive relation to approving attitudes toward harassment. However, they either had no relations or were (somewhat unexpectedly) positively related to the two behavioral variables.

Table 3. Means, standard deviations and intercorrelations between variables

	M	SD	1	2	3	4	5	6	7	8	9	10	11	12	13
1 Political ideology	5.15	2.18													
2 Religiosity	2.88	1.16	.35***												
3 Spirituality	4.00	1.88	.22***	.81***											
4 Conspiracy Mentality	4.07	1.34	.27***	.22***	.24***										
5 Science Populism	2.71	0.92	.42***	.33***	.30***	.45***									
6 Science Cynicism	2.66	0.95	.53***	.23***	.17**	.45***	.65***								
7 Relative Deprivation	2.78	0.95	-.11	-.02	.01	.20***	.24***	.19***							
8 Threat	1.64	0.80	.41***	.29***	.23***	.43***	.57***	.61***	.21***						
9 Psychopathy	1.95	0.74	-.06	-.28***	-.28***	.02	.00	.12*	.24***	.04					
10 Machiavellianism	1.95	0.88	-.08	-.03	-.07	.09	.03	.03	.23***	.06	.53***				
11 Narcissism	2.18	0.90	-.03	.09	.05	.11*	.09	.05	.10	.07	.30***	.51***			
12 Scientist Harassment	1.40	0.51	.19***	.03	-.04	.21***	.30***	.39***	.23***	.40***	.27***	.22***	.29***		
13 Donation	19.61	31.53	-.22***	.00	.01	-.21***	-.23***	-.28***	-.12*	-.16**	-.08	-.04	-.01	-.08	
14 Petition	0.18	0.39	-.16**	-.01	.05	.05	-.07	-.14**	.06	-.10	.07	.18**	.15**	.00	.17**

Note. $^{*}p < .05$, $^{**}p < .01$, $^{***}p < .001$

Like in Study 1, we assessed predictors' relative importance for attitudes toward scientists' harassment and donation behavior by conducting multiple linear regression analyses, while for the signing of the petition, we conducted logistic linear regression given that the dependent variable was binary (signed or not). We entered worldviews, radicalization risk factors, and dark triad personality variables as predictors (Table 4). For all three dependent variables, the overall models were significant. Larger science cynicism and threat perception were associated with more approving attitudes toward harassment. Dark triad also played a role, as psychopathy and narcissism were also associated with more harassment-approving attitudes. Regarding the behavioral variables, only political ideology predicted donation (right-wing individuals donated less), while none of the predictors was associated with signing the petition (even though the overall model was significant). For this reason, zero-order correlations are more informative, which indicate that science cynicism is the only consistent predictor of both behavioral outcomes.

Table 4. Worldviews and risk factors predicting attitudes toward scientist harassment, donation and petition behavior

	Scientist Harassment			Donation			Petition		
Model (DV and fit)	$F(11,324) = 12.87$, $p < .001$; $R^2 = .304$ (adj $R^2 = .280$)			$F(11,324) = 3.98$, $p <$ .001; $R^2 = .120$ (adjusted $R2$ = .090)			X^2 (324) = 30.713, p = .001; McFadden $R^2 = .096$; Cox & Snell $R^2 = .087$		
Predictor	β	t	p	β	t	p	β	z	p
Political Ideology	0.02	0.33	.740	**-0.16**	**-2.35**	**.019**	-0.28	-1.43	.152
Religiosity	0.03	0.32	.748	0.11	1.12	.264	-0.18	-0.67	.502
Spirituality	-0.13	-1.61	.107	0.01	0.11	.915	0.35	1.38	.167
Conspiracy Mentality	-0.02	-0.41	.681	-0.11	-1.74	.083	0.34	1.84	.065
Science Populism	0.03	0.38	.704	-0.07	-0.99	.323	-0.04	-0.17	.864
Science Cynicism	**0.19**	**2.58**	**.010**	-0.16.	-1.92	.056	-0.33	-1.36	.173
Relative Deprivation	0.10	1.85	.066	-0.08	-1.34	.182	0.04	0.24	.808
Threat	**0.25**	**4.01**	**< .001**	0.08	1.07	.286	-0.25	-1.11	.266
Psychopathy	**0.13**	**2.11**	**.036**	-0.01.	-0.16	.870	-0.00	-0.01	.989
Machiavellianism	-0.01	-0.10	.917	-0.02	-0.26	.796	0.35	1.81	.071
Narcissism	**0.22**	**3.99**	**< .001**	0.01	0.21	.831	0.23	1.32	.186

Note. Significant predictors are in bold.

Discussion

In the past several years, perhaps especially during the COVID-19 pandemic, scientists were faced with different forms of harassment, from death threats to lynching attempts (O'Grady, 2022; Nogrady, 2021). But who are the individuals that engage in such behavior toward scientists? The present research probed worldviews (religiosity, spirituality, political ideology, conspiracy mentality, science populism, and cynicism), risk factors of radicalization (relative deprivation and threat), and personality (dark triad) as potential drivers of scientist harassment. Across two studies, we found that distrusting worldviews (conspiracy mentality, science populism and science cynicism), political ideology, and perception of threat are associated with more approving attitudes toward scientists' harassment. Assessing their relative importance, we found that science cynicism and perception of threat consistently predict attitudes. Additionally, Study 2 illuminated the role of dark personality traits, as psychopathy and narcissism also contributed to approving attitudes toward harassment. Explaining actual behavior turned out to be more challenging – only science cynicism was associated with negative behavior consistently (for all three behaviors across two studies). However, assessing the relative importance of the other predictors in behaviors did not yield conclusive results: while the overall regression models explained variance, there was no consistent pattern of the role of individual predictors.

In sum, viewing scientists as incompetent and corrupt (science cynicism) drives scientist harassment (both attitudes and behavior). Additionally, the perception of scientists as a threat, narcissism, and psychopathy contributed to approving scientists' harassment.

Who approves of scientists' harassment?

The role of worldviews

Previous research has shown that worldviews such as political or religious ideology are related to science skepticism or mistrust of science (e.g., Hornsey, 2020; Rutjens et al., 2018). While some of the worldviews also relate to different forms of violence (e.g., right-wing ideology, Van Hiel et al., 2020; conspiracy mentality, Imhoff et al., 2021), it has been virtually unknown whether any of the worldviews contribute to the harassment of scientists. We found that most of the worldviews identified as driving negative attitudes toward science and scientists (Gligorić, Clerc, et al., 2024; Rutjens et al., 2018) also apply to harassment: right-wing ideology and distrusting worldviews (conspiracy mentality, science populism, and cynicism) were consistently associated with approving harassment of scientists. However, for religiosity and spirituality, this was only the case in Study 1 but not in Study 2. Given that the credo of most religions is not to harm (e.g., Exodus 20:13) or that religion can even play a protective factor against violent behavior (e.g., Salas-Wright et al., 2014), it is not surprising that religiosity is not necessarily related to more approving attitudes of scientists' harassment even though they generally relate to more negative attitudes toward science and scientists.

Assessing relative importance showed that science cynicism emerged as the most prominent predictor of attitudes and behaviors. What makes cynicism a main driver of scientist harassment? As with conspiracy mentality and populism, at the core of cynicism lies fundamental distrust predominantly aimed at elites and the establishment (which scientists are seen as a part of). Cynical individuals doubt scientists' motives, competence, and morality, thus creating a fertile ground for scientists' harassment. However, we note that the measures of populism and cynicism we used specifically referred to scientists, unlike conspiracy mentality (which contained generalized statements). Therefore, it is difficult (and possibly premature) to tease apart which of the three distrusting worldviews plays a more important role, especially since novel research indicates that they are more similar than previously thought (Papaioannou et al., 2022; Thielmann & Hillbig, 2023). Indeed, we found a high intercorrelation between the three distrusting worldviews (*r*s ranging between .45 and .68 across two studies), suggesting their conceptual overlap. Overall, it is interesting that trust or distrust – which hitherto has been mostly studied as an outcome in science attitudes research (e.g., Algan et al., 2021; Altenmüller et al., 2024; Gligorić, Van Kleef, et al., 2024) – has its own outcomes, dangerous in its own regard.

Harassment of scientists as a form of radicalization: risk factors

Building upon radicalization frameworks (Doosje et al., 2013; Macdougall et al., 2018; Reiter et al., 2021; Wolfowicz et al., 2020) which suggested that risk factors of relative deprivation and threat are one of the crucial drivers of radicalization, we used this approach to understand the harassment of scientists. Both risk factors were associated with more approval of scientists' harassment, although the perception of threat consistently emerged as more prominent when we assessed their relative importance.

Even though it is understandable that areas in which scientists work (e.g., virology, climate change, nuclear energy) can be perceived as threatening, why would someone perceive scientists as such? First, it is true that although scientists work to prevent certain threats (e.g., COVID-19, climate crisis), some of their work also produces new threats (e.g., nuclear weapons and nuclear energy; Ho et al., 2019). Secondly, some research, such as the development of novel technologies (e.g., bioengineering, AI), can also be perceived as threatening (e.g., Chinn et al., 2024; Kieslich et al., 2021). Lastly, as mentioned earlier, certain individuals could perceive the very solutions that scientists propose as threatening, restricting their financial and personal freedom (Hornsey, 2020; Kachanoff et al., 2021). These include propositions of structural changes in the economy, lifestyle changes to combat climate change, or mandatory mask-wearing, and physical distancing in COVID-19. All this also fits within negative stereotypes of "mad" or dangerous scientists, who have the capability and intention to cause harm to the world (e.g., Haynes, 2003, Rutjens & Heine, 2016). Overall, the current approach suggests that investigating scientists' harassment as a radicalization phenomenon is promising for understanding why people engage in such behavior. Future research could also look into other factors of radicalization: for example, blaming the death of a family member on scientists (e.g., due to the perceived inability to contain COVID-19) could be a trigger factor.

Personality factors

Previous research found that dark triad personality is related to aggression and violence (Barlett, 2016; Jones & Neria, 2015; Muris et al., 2017; Pailing et al., 2014). The current results are in line with these findings as dark triad personality was associated with approving attitudes toward harassment of scientists. Although we focused on the dark triad as the most obvious candidate, it would also be beneficial to see whether basic personality traits (e.g., the big five) might play a role. It would particularly be interesting to see the role of (low) agreeableness, which has been suggested to lie at the center of the dark triad personality (Stead & Fekken, 2014, but also see Moshagen et al., 2020). In this vein, reactance (tendency to react against perceived restrictions) was found to be one of the strongest predictors of rejecting scientific evidence (e.g., vaccination; Hornsey et al., 2018). Therefore, this basic disagreement as a reaction to any restriction could play an important role in negative attitudes toward scientists more generally, and consequently drive individuals to harm scientists.

Attitudes toward scientists' harassment and behavior

Although attitudes and behavior of scientists' harassment had similar predictors (e.g., conspiracy mentality, science cynicism, deprivation and threat in Study 1, political ideology and science cynicism in Study 2), there was a noticeable issue. Attitudes and behaviors correlated slightly in Study 1 ($r = .11$) or not at all in Study 2 ($r = .08$ and .00), while the correlation between the two behaviors in Study 2 was also not high ($r = .17$). There are different potential explanations for these low/absent correlations. First, it is well-known that attitudes are only one of the drivers of behavior (e.g., Ajzen, 1991). Secondly, the relationship between attitudes and behavior is stronger when they correspond in terms of generality versus specificity. Given that the behavioral measures were more specific than the attitudes scale, this could have caused lower correlations. Finally, measuring violent (i.e., anti-social) behaviors is likely influenced by social desirability (e.g., Sugarman & Hotaling, 1997). Future research on harassment of scientists should dedicate attention to how dependent variables are operationalized (e.g., multiple measures of attitudes), and how issues such as social desirability or generality and specificity of dependent variables can be overcome.

Conclusion

Even though scientists usually work on solutions to societal problems, they simultaneously experience harassment that can be as extreme as death threats and physical attacks. Drawing on the literature on science attitudes, radicalization, and personality, the present research is, to the best of our knowledge, the first to identify factors associated with scientist harassment. We discovered that harassment of scientists likely stems from feelings of cynicism (distrust) and threat, as well as from dark personality traits. Thus, the current research helps understand not only which individuals are more likely to harass scientists, but also what can be potentially done to curb it. Highlighting reasons why scientists should be trusted – and not threatened by – seems like the most promising way to counter such extremely negative behavior.

CHAPTER 6

POLITICAL IDEOLOGY AND TRUST IN SCIENTISTS

Trust in scientists is a key predictor of compliance with science-based solutions to societal challenges. Although liberals in the US generally trust scientists more than conservatives do, it is not clear how these ideological differences vary across different scientific occupations and whether they can be mitigated. The present registered report (*N* = 7,800, US participants) demonstrated that even though the strength of the relationship between political ideology and trust varies across scientific occupations, liberals (compared to conservatives) show higher trust in most scientists. Moreover, following motivational accounts of scientist distrust, the study comprehensively tested five theoretically grounded intervention strategies to improve conservatives' trust in scientists. None of the interventions were successful, suggesting that trust in scientists reflects relatively stable attitudes that require more elaborate and time-intensive interventions. We conclude by discussing more systemic factors surrounding scientists' work (e.g., replication crisis, commercialization of science) which might negatively impact trust in scientists.

This chapter is based on the following manuscript:
Gligorić, V., Van Kleef, G. & Rutjens, B. (2024). Political ideology and trust in scientists: detecting and bridging the gap. *Registered report (Stage 1) accepted in principle, Stage 2 under review. Nature Human Behavior.*

Although science is often at the forefront of solving pressing issues, trust in scientists is fragile. During the COVID-19 pandemic, trust in scientists decreased in certain countries such as France, Italy, and the US (Algan et al., 2021). However, this decline in trust in scientists is not limited to the pandemic: Large segments of the public—most notably political conservatives in the US—have long been documented to report a declining trust in science and scientists (Gauchat, 2012; Li & Qian, 2022). The ideological gap between conservatives and liberals in trust in scientists is problematic because it breeds polarization (Van Bavel, 2020) and hinders the success of scientific solutions, especially when strong public consensus and coordinated action are needed (e.g., climate change, Funk & Kennedy, 2016; vaccination, Funk & Gramlich, 2021). The current study had two aims. First, it aimed to establish how the ideological gap varies across different scientific occupations. Second, it tested five theoretically informed interventions that were developed to increase conservatives' trust in scientists so as to reduce the ideological gap.

How is political ideology related to trust in scientists? Research finds that, in general, liberals in the United States have more favorable attitudes toward scientists than conservatives (Blank & Shaw, 2015; Gauchat, 2012). This divide in trust along ideological lines is particularly pronounced for certain issues. For example, more liberals (70%) than conservatives (15%) trust that scientists provide full and accurate information about the causes of climate change (Funk & Kennedy, 2016). Similarly, ideology seems to be a key predictor of a wide range of health behaviors and policy preferences regarding COVID-19, so that liberals espouse more health-protective practices (Gadarian et al., 2021). Importantly, liberals have been shown to be more likely than conservatives to have received the COVID-19 vaccine (86% vs. 60%) (Funk & Gramlich, 2021). Ideological division in vaccination uptake has had grave consequences: It was shown that, after COVID-19 vaccine was available, excess mortality was higher among Republicans than Democrats in the US (Wallace et al., 2023). Even though healthy skepticism in science is important and, in some cases, certainly justified, high trust is desirable in cases of a strong scientific consensus, especially when distrust has negative societal and health consequences (Rutjens & Hornsey, 2024).

What is the reason behind the ideological gap in trust in scientists? According to motivational accounts of science rejection (Hornsey, 2020; Hornsey & Fielding, 2017; Kahan, 2010), individuals may be inclined to reject scientific findings that contradict their underlying ideologies and worldviews. In this regard, conservatives may be more likely to distrust scientists because scientific solutions—such as those proposed to combat climate change—may be seen as restricting the free market, which goes against conservative ideology and interests. Additionally, science often challenges the status quo, which may threaten conservatives' sense of stability and system justification tendencies (Hornsey & Fielding, 2017; Nisbet et al., 2015). Recent research indeed shows that worldviews, more so than education or science literacy, play an important role in determining whether an individual accepts or rejects scientific findings and science-based recommendations (Hornsey, 2020; Rutjens, Sengupta, et al., 2022).

Nevertheless, the ideological gap might be more nuanced. For example, research suggests that conservatives may distrust scientists who they perceive as promoting liberal values, rather than rejecting the scientific method itself (Cofnas et al., 2018; Mann & Schleifer, 2020). According to the Anti-Reflexivity Thesis, whether liberals or conservatives trust scientists depends on the specific scientific occupation involved; that is, the relationship between political ideology and trust in scientists disappears or even reverses depending on the scientific field (Dunlap, 2014; McCright et al., 2013). Specifically, research shows that liberals tend to trust scientists working in fields that examine the negative effects of economic production, such as climate and environmental scientists, public health scientists, and oceanographers, while conservatives tend to trust scientists working in production science, such as petroleum geologists and industrial chemists, in which there is more focus on increasing economic productivity (McCright et al., 2013). Therefore, it seems that liberals and conservatives alike would trust scientists more when the scientists' work is aligned with their ideological beliefs (e.g., conservatives might trust economists more) (Altenmüller et al., 2024).

The first goal was to investigate the relationship between political ideology and trust in scientists. The literature reviewed does not provide a clear consensus on how political ideology and trust in scientists are related, particularly in terms of how this relationship may differ across scientific occupations. As scientific occupations are diverse (Altenmüller et al., 2024; Gligorić et al., 2022) and political ideology influences trust in scientists differently depending on the scientific field (Dunlap, 2014; McCright et al., 2013), it is important to systematically examine how the relationship between political ideology and trust in scientists varies by scientific occupation. The study was conducted in the US, which one may argue is an outlier in terms of the substantial impact of political ideology on social issues (Hornsey et al., 2018). However, it is noteworthy that conservatives indicated less faith in science in a sample drawn from 24 (Rutjens, Sengupta, et al., 2022) countries, as well as less trust in scientists in a sample including 66 countries (Cologna et al., 2024).

Drawing on the foregoing arguments and the results of a pilot study (see below), we hypothesized that:

H1: There is a relationship between political ideology and trust in scientists, with liberals showing higher overall trust in scientists than conservatives.

H2: The strength of this relationship depends on the scientific occupation in question.

The second goal was to test whether it is possible to bridge the ideological divide and increase conservatives' trust in scientists by attempting to align their perceived values, benefits, authorities, norms, and intergroup similarities. According to the motivational accounts of science rejection discussed earlier, worldviews and ideologies (rather than a lack of science knowledge or education) are driving distrust in scientists (Hornsey, 2020; Rutjens, Heine, et al., 2018). More specifically, conservatives might exhibit lower trust because they perceive scientists to have or advance different (liberal) values (Cofnas et al., 2018; Mann & Schleifer, 2020) and/or because conservative individuals have vested interests (e.g., proposed scientific solutions to a problem are personally costly) (Hornsey & Fielding, 2017). Following this set of reasons, to increase trust, interventions should emphasize that the work of scientists can be well aligned with conservative values and worldviews. Similarly, according to the intergroup literature on how liberals and conservatives evaluate ingroup and outgroup members, the attitudes and behaviors of ingroup members serve as a model for one's own (Brandt, 2017; Frimer et al., 2014). When conservatives observe that many fellow conservatives do not trust scientists (i.e., a descriptive norm; Nyborg et al., 2016), that influential or respected conservatives also distrust scientists (source credibility; Esposo et al., 2013; Fielding et al., 2020), or that conservatives are underrepresented in the scientific community (intergroup similarity, Brandt, 2017; Frimer et al., 2014), this would contribute to a decreased trust in scientists. In this case, to increase trust, interventions should aim to show that other conservatives—the majority of conservatives or prominent conservative representatives—do signal trust in scientists and/or actively engage in scientific research.

In this vein, a recent review (Hornsey & Lewandowsky, 2022) systematized various strategies for reducing climate change skepticism, such as using value-based frames and leveraging climate-friendly actors within the conservative movement. However, although these approaches are promising, two issues emerged. First, some of the reviewed studies were underpowered, and higher-powered replications failed to replicate the original findings (Crawford, 2018). Second, recent research has demonstrated it is challenging to improve conservatives' attitudes toward science-based solutions. Notably, in an "intervention tournament", researchers designed seven different frames (e.g., patriotic duty, economy revival) to increase Republicans' intentions to comply with mask-wearing (Gelfand et al., 2022). However, there was no evidence that any of the interventions increased these intentions. Similarly, a recent preregistered study found no evidence that framing environmental messages in line with conservatives' moral values promoted pro-environmental intentions and behavior (Kim et al., 2023). These findings suggest that changing deep-rooted attitudes about science and scientists is challenging. Indeed, interventions such as consensus messaging or misinformation debunking have yielded small meta-analytic effect sizes (respectively g = 0.12, Van Stekelenburg et al., 2022; and d = 0.19, Chan & Albarracín, 2023).

In sum, based on work so far, the key questions of whether and how conservatives' attitudes towards scientists and science-based policies can be improved remain open. Based on the aforementioned motivational accounts of science rejection, the present research put five strategies aimed at improving conservatives' trust in scientists to a high-powered test (N = 7 800). These strategies are not mutually exclusive but likely partially overlap: This is to be expected given that the overarching goal of interventions based on motivational accounts would be to align conservatives' perceptions of scientists with conservative ideology, by reducing the perceived mismatch between the two groups. Four of the strategies – increasing appeal through value-based frames, co-benefits, leveraging science-friendly actors within the conservative movement (source credibility), and establishing norms – are based on a recent toolkit for addressing climate scepticism (Hornsey & Lewandowsky, 2022). In addition, following research on ideological polarization and perceived ideological similarity (Brandt, 2017; Frimer et al., 2014; Koch et al., 2016), we developed a fifth strategy (conservatives as scientists). Here the target group's (scientists) ideology is presented to be in line with the perceiver's ideology (both are conservatives), reducing the motivation to reject science based on perceived ideological dissimilarities. Based on the above, we posited the following hypotheses:

H3a: Using value-based frames to appeal to conservatives increases their trust in scientists (Value-based frames).

H3b: Using co-benefits frames to appeal to conservatives increases their trust in scientists (Co-benefits frames).

H3c: Highlighting that respectable conservatives trust scientists increases conservatives' trust in scientists (Source credibility).

H3d: Highlighting that many conservatives trust scientists increases conservatives' trust in scientists (Descriptive norms: confidence in scientists).

H3f: Highlighting that many conservatives work in science increases conservatives' trust in scientists (Descriptive norms: conservatives as scientists).

We further aimed to assess potential boundary conditions. That is, a particular intervention may not have the desired effect (or we may not be able to detect that effect; type II error) because some participants may not perceive their political identity as strong or intervention text as believable. Therefore, we additionally investigated the effectiveness of the interventions by testing the moderating effect of the strength of political identity (H4a-f) and testing whether interventions were effective for participants who rated the believability as moderate or higher (H5a-f).

Before running the main study, we conducted two pilot studies (both are reported in the supplement). Pilot Study 1 tested the relationship between political ideology and trust in 45 types of scientists. It showed that conservatives have lower overall trust in scientists than liberals, scoring lower (point estimate) on trust for 43 out of the 45 occupations. Moreover, the relationship between ideology and trust in scientists varied across scientific disciplines, in that conservatives showed particularly lower trust in scientists working in the fields of climate change, medical, and social sciences (Figure S1). Thus, even though it might be important to also investigate ways to increase liberals' trust, we considered it a priority to first test interventions to increase conservatives' trust in scientists. In Pilot Study 2, we developed and tested the validity of theory-based interventions that aim to increase conservatives' trust in scientists. In the main study, we will test the effectiveness of these interventions by presenting conservatives with one of the five interventions designed to increase their trust in scientists. All materials, data, and analysis code for pilot studies and the main study are available at the Open Science Framework (https://osf.io/n63mz/?view_only=3ea95b52620e4e1f8f8e85ab9ecca2da). First stage of the registered report is available on the same link.

Methods

Before taking part in the study, informed consent was obtained from all participants. Data collection and analysis was not performed blind to the conditions of the experiments.

Ethics information

Ethics approval for pilot studies (SP-15169 and FMG-1665) and the main study (FMG-8652) was obtained from the Institutional Review Board at the University of Amsterdam.

Participants

We recruited 7 800 participants from the US, using Cint recruitment company. For correlations to stabilize, 250 observations per occupation are needed (Schönbrodt & Perugini, 2013). Given that we measured trust in 35 different scientific occupations, we needed 8750 observations (=250*35). Each participant rated four scientific occupations, thus we needed 2188 participants (8750:4 = 2187.5) to ensure stable correlations between political ideology and trust for all occupations, as in Figure S1. This number of 2188 participants was required for liberals and conservatives combined. Therefore, we aimed to recruit 1094 liberal participants. We planned to recruit 6564 conservative participants because we had six conditions for conservative participants (control and five strategies to increase trust; 6 x 1094 = 6564). In total, this required 7658 participants. We planned to oversample by recruiting a total of N = 7 800, to account for the possibility of a mismatch between the selection filter for recruitment and self-reported ideology in the study.

We ensured a diverse sample in terms of gender (50.3% men, 49.5% women, 0.2% participants who indicated other gender), age (M = 41.98; SD = 16.1), and education (6.3% did not complete high school; 28.8% completed high school; 14.5% were undergraduate students; 26.1% completed undergraduate degree; 3.2% were postgraduate students; 21.0% had a postgraduate degree) (a representative sample was not possible because the majority of the participants will be conservatives). The resulting sample size allowed us to detect an effect size of d = .15, with 95% power and α = .05, for each of the interventions. The effect size of d = .15 is lower than what is considered a small (but not yet trivial) effect size in psychological literature (d = .20; Cohen, 2016), which is the smallest effect size of theoretical interest. Therefore, failing to detect the effect would indicate that these interventions are either ineffective or too weak (i.e., trivial) to be of use in the real world.

To ensure high data quality, we used Qualtrics options to prevent multiple responses from the same respondents and added a Captcha verification question to prevent bots. Regarding exclusions, we removed all responses flagged as possibly bots (who might have passed Captcha) by the Qualtrics bot detection filter (Q_RecaptchaScore < 0.5), participants who failed the attention check question at the end of the survey, as well as participants who withdraw their participation at the end of the survey (see below). We exported data only when the targeted number of participants (N = 7,800) was achieved *after* filtering out low-quality responses (potential bots and attention check fails).

Design and materials

After providing consent to participate in the research, participants provided socio-demographic information (gender, age, education). Next, they indicated their political ideology on a 10-point scale (1 = *Extremely Liberal* to 10 = *Extremely Conservative*) and the strength of their political identification ("I identify with my political group", 1 = *fully disagree* to 7 = *fully agree*) (Postmes et al., 2013). Based on their self-reported ideology, participants were classified as either liberal (1-5) or conservative (6-10) (Castano et al., 2011; Jasper & Ansted, 2008; Schwartzman et al., 2023).

The purpose of dichotomization was to assign participants to conditions, while analyses were performed using the continuous scale. Other possibilities included removing political moderates and presenting the interventions only to more extreme conservatives (e.g., responses 8 to 10). However, a consequence of this would be that we would not know whether and how interventions work for moderate conservatives. To eliminate the possibility of oversampling moderates (i.e., those answering 6 or 7), we set quotas such that conservatives are sampled in a balanced way (i.e., so that each of the 6-10 answering points is covered by at least 10% of all conservative participants).

Both liberals and conservatives next completed the same measures on trust in scientists (see materials). However, only conservatives were subsequently assigned to a control group or one of the five intervention conditions. Therefore, the study employed a between-subject design (each conservative participant was assigned to one of six conditions) The control group did not read anything but immediately continued to rate scientific occupations. In this way—similar to Pilot Study 1—conservatives from the control group and liberals could be compared, providing a baseline of the effect of political ideology on trust in scientists. Before completing the measures, participants in the intervention conditions first read one of the intervention texts, to all of which we added the explanation that the text particularly applies to the four types of scientists (randomly selected out of 35) presented to participants. Then, participants reported their trust in scientists (shown in a random order), rating scientific occupations on two items (not credible/credible, untrustworthy/trustworthy; randomly presented) using a 7-point bipolar scale, which was averaged into a single index. The full procedure is depicted in Figure 1.

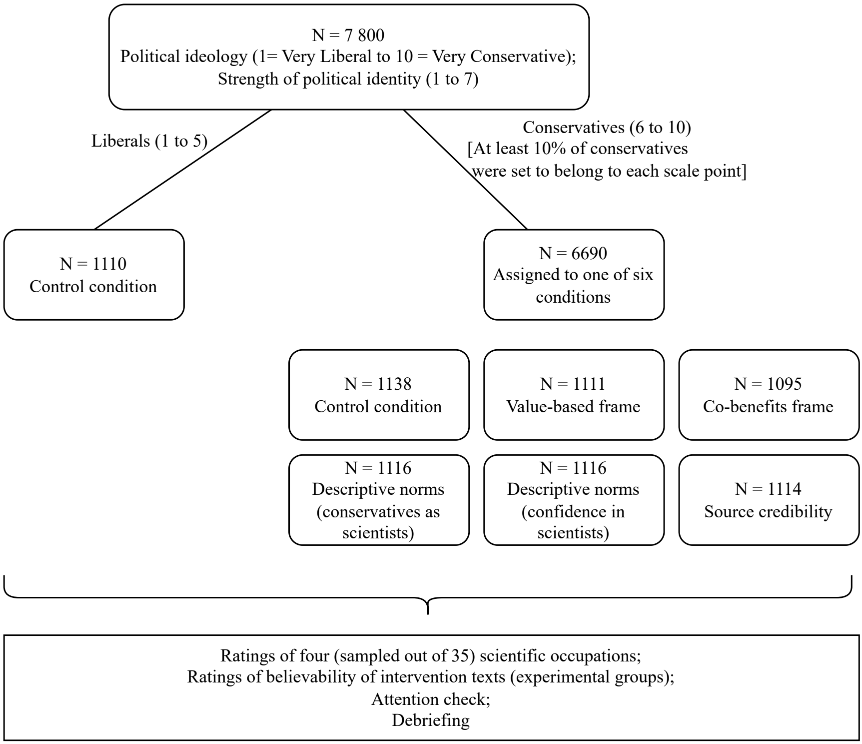

Figure 1. Design of the main study (between-subjects design). Conservatives were recruited in a balanced way, so that each of the 6-10 scale points on political ideology question was covered by at least 10%.

We also investigated whether the intervention(s) increased trust only for those who found the text to be believable (H4). After participants were done with rating scientists, they rated the text on how believable, true, and accurate they perceived it to be, using a 7-point bipolar scale (e.g., unbelievable – believable; items are presented in a randomized order). To preclude response-style effects, we positioned anchors such that positive and negative ones appeared on both sides. A mean score of intervention believability was calculated. Lastly, participants were asked to indicate what the text they read was about (scientists, animals, artists, athletes, or students). Only participants who passed this attention check question (correct response: scientists) were included in the analyses.

After finishing the survey, participants were debriefed and informed about the source of the text they read. We also gave them the option to withdraw their consent to participate and remove their data from the database (note that participants who withdrew their participation did not count toward the targeted N of 7800).

Results

All the analyses were conducted in line with the registered report, unless noted otherwise. First, we tested whether liberals trust scientists more than conservatives (H1) and whether the strength of the relationship varies across scientific occupations (H2). To do so, we used the samples of liberals and (control group) conservatives and built the same multilevel model as in Pilot Study 1. That is, we included the random intercept for both participants and occupations and the fixed and random slope of ideology (across occupations) on trust. We replicated the findings from Pilot Study 1, finding that liberals overall trust scientists more (β = -.142 [-.102, -.182], t = -6.884, p < .001). This relationship varied across different scientific occupations, which was indicated by a better fit of a model that included a random slope for the effect of ideology across occupations (compared to the model without, LRT(2) = 58.7, p < .001). Therefore, both H1 and H2 were supported. The relationship between political ideology and trust in scientists across different scientific occupations is displayed in Figure 2.

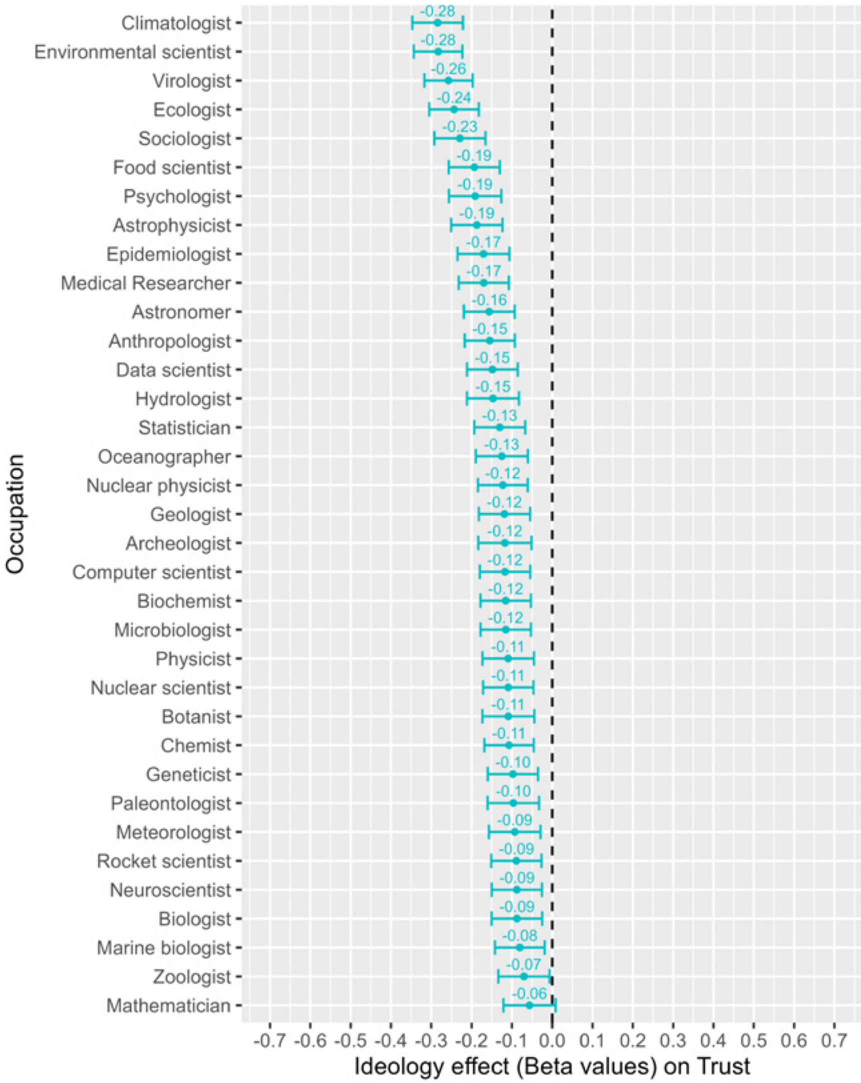

Figure 2. The relationship between political ideology and trust in scientists across different occupations (standardized β coefficients), accompanied with 95% confident intervals of the effect size. In general, liberals trusted scientists more, but the strength of the effect varied across different scientists.

Next, we tested if any of the five interventions improved trust in scientists for conservative participants (H3a-f). We ran a multilevel model that included a random intercept for both participants and occupations, and a fixed effect of the condition to which conservative participants were assigned (six levels including control). Results are given in Table 2. As the table shows, there was no significant fixed effect of any of the conditions, suggesting that no interventions increased trust in scientists. Equivalence testing (with bounds for β = -0.1 to 0.1; note that we use β rather than Cohen's *d* given the linear mixed models) showed that trust across conditions was equivalent, supporting the null hypothesis. Building a model with a random effect of condition across occupations (to see if interventions' impact was different across occupations) showed convergence issues, suggesting that including the random effect was not warranted. In short, the interventions did not change trust in any of the occupations.

Table 2

Condition	Means (SE)	β [95% CI]	*t* and *p* values
Intercept (Control)	*M* = 5.146 (.060)	β = -.006 [-.087, .074]	*t* = -.154, *p* = .878
Co-Benefits	*M* = 5.132 (.060)	β = -.009 [-.076, .057]	*t* = -.271, *p* = .786
Conservative scientists	*M* = 5.159 (.060)	β = .009 [-.057, .075]	*t* =.265, *p* = .791
Confidence in scientists	*M* = 5.195 (.060)	β = .034 [-.032, .100]	*t* = 1.005, *p* = .315
Source credibility	*M* = 5.154 (.060)	β = .006 [-.061, .072]	*t* =.166, *p* = .868
Value-based	*M* = 5.163 (.060)	β = .012 [-.054, .078]	*t* =.359, *p* = .720

Note. Means are estimated from the mixed model (trust levels rated on a 7-point scale). We report βs as effect sizes because we used linear mixed models.

As mentioned previously, we continued to test whether the strength of political identity moderated the intervention effects (H4a-f). Therefore, we built the same model as in H3 (conditions as fixed effects, random intercepts for participants and occupations), to which we added a fixed interaction term between the strength of political identity and condition. None of the five interactions between the strength of political identity and condition was significant, $\beta s < .046$, $ts < 1.356$, $ps > .05$. Equivalence testing (with bounds for β = -0.1 to 0.1) showed that moderating effects were equivalent to zero. Therefore, H4a-f were disconfirmed as the strength of political identity did not moderate the effect of conditions on trust in scientists.

Finally, we proceeded to test the effectiveness of interventions only for participants who rated the intervention texts as believable (H5a-f). We selected a subset of participants from the experimental group who rated the text greater than or equal to $M = 4$ on believability (on a 7-point scale), and conducted the same analyses as in H3. Interestingly, participants in the experimental conditions showed higher trust than participants in the control group (Table 3), suggesting support for H5. However, we realized that there was at least one more possible interpretation of the findings apart from the one we originally proposed, which is why we conducted exploratory analyses to gain further insight.

Table 3

Condition	Means (SE)	β [95% CI]	*t* and *p* values
Intercept (Control)	*M* = 5.145 (.058)	β = -.114 [-.196, -.031]	*t* = -2.707, *p* = .007
Co-Benefits	*M* = 5.322 (.059)	β = .129 [.061 .197]	*t* = 3.727, *p* < .001
Conservative scientists	*M* = 5.322 (.059)	β = .129 [0.61, .196]	*t* = 3.763, *p* < .001
Confidence in scientists	*M* = 5.352 (.059)	β = .150 [0.83, .217]	*t* = 4.401, *p* < .001
Source credibility	*M* = 5.351 (.059)	β = .150 [0.83, .217]	*t* = 4.365, *p* < .001
Value-based	*M* = 5.359 (.059)	β = .156 [0.89, .223]	*t* = 4.548, *p* < .001

Note. Means are estimated from the mixed model (trust levels rated on a 7-point scale). We report βs as effect sizes because we used linear mixed models.

Exploratory analyses

One possibility why participants in the experimental conditions had higher trust than the control group is that interventions increased trust for those who found the intervention texts believable. However, this interpretation is problematic because it would mean that interventions backfired for participants who did not find the texts believable. As shown in Table 4, conducting the same analyses but only for participants who did not find the texts believable ($M < 4$) showed that participants in the control group had indicated higher trust than participants in the experimental groups. If the original H5 was true, it would mean that interventions increased trust for those who found the texts believable, and *at the same time* (even more strongly given the effect sizes) backfired for those who did not, such that the overall effect is 0, as in H3.

Table 4

Condition	Means (SE)	β [95% CI]	*t* and *p* values
Intercept (Control)	*M* = 5.147 (.064)	β = .291 [.214, .367]	*t* = 7.459, *p* < .001
Co-Benefits	*M* = 3.926 (.112)	β = -.746 [-.871, -.622]	*t* = -11.722, *p* < .001
Conservative scientists	*M* = 3.972 (.115)	β = -.718 [-.847, -.590]	*t* = -10.934, *p* < .001
Confidence in scientists	*M* = 3.996 (.118)	β = -.703 [-.837, -.569]	*t* = -10.309, *p* < .001
Source credibility	*M* = 3.850 (.112)	β = -.793 [-.918, -.667]	*t* = -12.335, *p* < .001
Value-based	*M* = 3.787 (.116)	β = -.831 [-.961, -.701]	*t* = -12.532, *p* < .001

Note. Means are estimated from the mixed model (trust levels rated on a 7-point scale). We report βs as effect sizes because we used linear mixed models.

We offer an alternative explanation that these results are simply due to a statistical artifact. Given that believability and trust in scientists are correlated (*r* = .519), removing participants who gave low ratings of believability also meant removing participants with low trust in scientists. Since the removal of participants occurred only in the experimental conditions, participants in these groups scored highest on trust in scientists. Additionally, it would be fairly unordinary if each of the five interventions increased trust with almost identical effect sizes. Taken together, we think that the more parsimonious explanation – a statistical artifact – is the correct one, and that H5 was not properly tested.

Discussion

The present registered report investigated differences in trust in scientists between liberals and conservatives, and tested interventions to increase conservatives' trust in scientists. We found that liberals (compared to conservatives) indicated higher trust in each of the 35 scientific occupations we investigated, supporting H1. This relationship between political ideology and trust varied across different occupations such that differences in trust were particularly pronounced for certain scientists (e.g., environmental scientists and climatologists), supporting H2. Additionally, we tested five theoretically-based strategies to increase trust in scientists for conservatives. No interventions increased trust, even after accounting for the potential moderating effects of the strength of political identity, disconfirming both H3 and H4. However, conservative participants in all experimental conditions who found the interventions believable indicated higher trust than the control group, seemingly supporting H5.

The current research contributes to the broader literature in various ways. First, it informs ongoing discussions on the relationship between political ideology and trust in scientists. Whereas much of the existing evidence indicates that liberals trust scientists more than conservatives do, both in the US (Blank & Shaw, 2015; Gauchat, 2012) and globally (Cologna et al., 2024), other work suggests that these differences disappear or even reverse when different scientific occupations are considered. Specifically, proponents of the anti-reflexivity thesis (Dunlap, 2014; McCright et al., 2013) argued that conservatives trust scientific occupations such as petroleum geologists and industrial chemists because their research contributes to economic productivity, while they distrust environmental and public health scientists because their work limits it. Whereas we agree that conservatives' distrust in scientists is likely to be ideologically motivated (i.e., due to disagreements with proposed solutions or scientific conclusions; Hornsey, 2020; Hornsey & Fielding, 2017), our results demonstrate the difficulty of pointing to scientific occupations in which conservatives place more trust. Indeed, in the first pilot study, liberal participants indicated higher trust in 43 scientific occupations (vs. conservatives' 2), while in the main study, liberals indicated higher trust in all of the

35 studied occupations (note that we refer here to sample estimates). In short, compared to conservatives, liberals in the US place more trust in an overwhelming majority of scientific occupations – not necessarily only in those working on polarizing topics (e.g., climate change or COVID-19) or whose work might limit economic productivity. We do note that our study was conducted in the US, which has been argued to be a polarized society (Heltzel & Laurin, 2020) and an outlier country in terms of effects of ideology (Hornsey et al., 2018), and so future studies should test whether the same differences across many occupations exist in other countries as well.

The second part of the registered report tested intervention texts to increase trust in scientists among conservatives. Based on work on motivational accounts of science rejection (Hornsey & Fielding, 2017; Hornsey & Lewandowsky, 2022), we developed five interventions aimed at aligning scientists' work with conservatives' values and worldviews, which were hypothesized to increase conservatives' trust in scientists. However, none of the five interventions increased trust in scientists, even after accounting for the moderating effects of the strength of respondents' political identity. Interestingly, after removing participants who found the intervention texts less believable, conservative participants in all experimental conditions indicated higher trust than those in the control group. Contrary to our initial hypothesis that this would indicate that interventions increased trust when found believable, we now are more inclined to interpret this finding as reflecting a statistical artifact, and conclude that none of the interventions increased trust in scientists.

We believe our null findings address several important questions regarding interventions in the field of science attitudes and communication. As mentioned in the introduction, an increasing number of preregistered non-significant studies have been published recently. Similarly, the meta-analytic effects of interventions are not only small but also unstable: The meta-analytic effect of debunking science-related information (d = 0.19) was not significant (Chan & Albarracín, 2023), whereas the meta-analytic effect of scientific-consensus communication (g = 0.12) becomes non-significant when only preregistered experiments are considered (g = .08) (Van Stekelenburg et al., 2022). A recent 27-country test of communicating the scientific consensus on climate change showed very small effects on perceptions (ds = .05, 09, and 04; respectively for perceptions of reality, human cause, and worry about climate change) and no effects on support for public action (Većkalov et al., 2023). Another large-scale project that included 12 countries failed to find the effect of inoculation to fight climate disinformation (Spampatti et al., 2023). The second-order meta-analysis of field interventions for climate change mitigation behaviors shows a severe downward adjustment of the meta-analytic effect from d = .31 to d = .04 when accounting for publication bias using one of the methods for correction (WAAP-WLS) (Bergquist et al., 2023).

Therefore, given recent failed replications, the current results, and small meta-analytic/large-scale study effects, we urge researchers to be more cautious in the area of (science-related) intervention studies. Specifically, we recommend assuming that there is no effect (i.e., that H0 is true) when conducting a study, rather than assuming there is an effect (i.e., that H1 is true) (also given the limited use of a guiding theoretical framework in this field (Muthukrishna & Henrich, 2019). Assuming H1 might lead researchers to rationalize why they failed to find the effect (e.g., the manipulation was too subtle, or too obvious), rather than considering the possibility that there was no effect to begin with. In line with this, we suggest that researchers in the field conduct registered reports, as they have significantly better quality than standard publishing models (Scheel et al., 2021; Soderberg et al., 2021) (also note that even preregistrations might not be optimal due to changes in reporting, Van Den Akker et al., 2023). We believe implementing these recommendations would update the knowledge regarding which interventions in the field do work and which do not.

The current research also opens additional avenues for future research. Most importantly, we believe that future experimental studies should employ more elaborate, time-investing, and dialogical interventions. This could take the form of an organized workshop, repeated exposure to information, or a mixed-methods approach, in order to better understand the extent to which changing these attitudes is possible at all. Whereas it could on the one hand be seen as disheartening that interventions such as those tested here might not work, it is also encouraging that people are not that easily influenced. This raises a dilemma of whether one-way, top-down interventions should be pursued in the first place, or if increased trust in scientists might result from utilizing different approaches, which we briefly elaborate on below.

Relatedly, there could be systemic reasons for distrust in science and scientists. The most obvious one is the ongoing replication crisis in the natural and social sciences: A large portion of published findings cannot be replicated (Camerer et al., 2016; Ioannidis, 2005; Open Science Collaboration, 2015), which has been shown to decrease public trust in science (Anvari & Lakens, 2018; Hendriks et al., 2020; Wingen et al., 2020). Apart from methodological and statistical issues (e.g., low power) responsible for the crisis, it is important to consider the societal and political contexts within which the scientific enterprise operates. This includes the neoliberal economic, social, and political order marked by increased competition and efficiency, privatization, and commercialization (Harvey, 2005). Neoliberalism has been argued to affect science in at least two ways (Davi et al., 2021). First, it might have increased pressures to publish ('publish or perish' culture; Berg et al., 2016), fueling questionable research practices associated with the replication crisis (Anderson et al., 2007; Nosek et al., 2012). Secondly, some evidence shows that privatization and commercialization of science – increased profit orientation and private funding of scientists' work – have been associated with more biased results (e.g., funding effect; Krimsky, 2013). Similarly, some private corporations have vested interests and have put effort into countering consensual scientific evidence (e.g., in cases of tobacco smoking, climate change) (Oreskes & Conway, 2011). Thus, it is not surprising that industry scientists evoke less trust than those working in universities (Rutjens, Niehoff, et al., 2022). In short, the internal dynamics of science – embedded within a wider societal system – is one of the crucial aspects to account for when it comes to public (dis)trust in science.

In conclusion, our study found that conservatives in the US generally exhibit less trust in most scientists compared to liberals. Our five theory-based interventions failed to increase conservatives' trust in scientists, highlighting the difficulty of improving science-related attitudes. In line with this, we encourage researchers to develop more elaborate and dialogical intervention strategies, as well as to use and refine theoretical models driving the research. Finally, we recommend that researchers endorse open science practices and thus improve trust in scientists by enhancing the quality and transparency of science itself.

Protocol registration

The Stage 1 protocol for this Registered Report was accepted in principle on 24 May 2024. The protocol, as accepted by the journal, can be found at https://osf.io/tgm8u

Table 1. Design Table

Question	Hypothesis	Sampling plan (e.g. power analysis)	Analysis Plan	Interpretation given to different outcomes
Do liberals trust scientists more than conservatives?	H1: Liberals will show higher trust in scientists than conservatives.	N = 2188 (half of the sample would be liberals, and half conservatives). Minimal effect size that can be detected with 95% power (ignoring multilevel structure): *r* = .08	Multilevel linear model with trust as DV. Ideology will be included as a fixed and random slope (across occupations). The model will also include random intercept for both participants and occupations.	In case of $p < .05$ for the fixed effect of ideology, we would conclude that H1 is supported. In case of $p > .05$, we will conduct equivalence testing using two one-sided test procedure with an effect range of d between -0.1 and 0.1. This will allow us to conclude that there is no relationship between ideology and trust in scientists (H1 is not supported).
Does the relationship between ideology and trust depend on scientific occupation?	H2: The strength of the relationship between ideology and trust will depend on scientific occupation.	N = 2188 (half of the sample would be liberals, and half conservatives). Power analysis is not applicable to the variance of the slope.	Get coefficients from the same model as above. Investigate the variance of slopes and compare models with vs without random slope using LRT.	If LRT is significant $p < .05$, we would conclude that H2 is supported. In case the variance of slopes is small (τ_{11}.std < .01), or LRT is not significant, or the model does not converge, we would conclude that the relationship between ideology and trust in scientists does not depend on type of scientists in question (H2 is not supported).

Do interventions improve conservatives' trust in scientists?	H3a: Value-based frames intervention will increase conservatives' trust in scientists H3b: Co-benefits frames intervention will increase conservatives' trust in scientists H3c: Source credibility intervention will increase conservatives' trust in scientists H3d: Descriptive norms: confidence in scientists intervention will increase conservatives' trust in scientists H3f: Descriptive norms: conservatives as scientists intervention will increase conservatives' trust in scientists	N = 6 564 (6 x 1094 conservatives) Minimal effect size that can be detected with 95% power for each condition (ignoring multilevel structure): d = .154 (note this corresponds to r = .08 in the Hypothesis 1 row)	Multilevel linear model with trust as DV, dummy variables for conditions to which conservative participants were assigned (compared to the control group). The model will also include random intercept for both participants and occupations. We will also build a model with a random slope for conditions across scientific occupations.	In case of p <.05 for any of the conditions effect, we would conclude that given intervention improved conservatives' trust in scientists (any of H3a-f is supported). In case of p>.05 for any of conditions effect, we will conduct equivalence testing using two one-sided test procedure with an effect range of d between -0.1 and 0.1. This will allow us to conclude that interventions did not alter conservatives' trust in scientists (any of H3a-f is not supported).

Does the strength of identity moderate the effect of intervention on trust in scientists?	H4a: The strength of identity moderates the effect of value-based frames intervention on conservatives' trust in scientists. H4b: The strength of identity moderates the effect of co-benefits frames intervention on conservatives' trust in scientists. H4c: The strength of identity moderates the effect of source credibility intervention on conservatives' trust in scientists. H4d: The strength of identity moderates the effect of descriptive norms (confidence in scientists) intervention on conservatives' trust in scientists. H4f: The strength of identity moderates the effect of descriptive norms (conservatives as scientists) intervention on conservatives' trust in scientists.	N = 6 564 (6 x 1094 conservatives) The interaction effect size that can be detected with 95% power for each condition: $f^2 = 0.006$ (note that $f^2 = .02$ is considered to be a small effect)	Multilevel linear model with trust as DV, dummy variables for conditions to which conservative participants were assigned- (compared to the control group), and interaction effects between conditions and the strength of identity.	In case of $p < .05$ for any of interaction effects, we would conclude that the strength of identity moderated intervention effectiveness (any of H4a-f is supported). In case of $p > .05$ for any of interaction effects, we will conduct equivalence testing using two one-sided test procedure with an effect range of d between -0.1 and 0.1. This way, we can conclude that strength of identity did not moderate effectiveness of interventions (any of H4a-f is not supported).

Do interventions improve conservatives' trust in scientists for participants who find interventions believable?	The following hypotheses will be tested only for participants who rated believability at mid-point or higher. H5a: Value-based frames intervention will increase conservatives' trust in scientists H5b: Co-benefits frames intervention will increase conservatives' trust in scientists H5c: Source credibility intervention will increase conservatives' trust in scientists H5d: Descriptive norms: confidence in scientists intervention will increase conservatives' trust in scientists H5f: Descriptive norms: conservatives as scientists intervention will increase conservatives' trust in scientists	Based on N = 7 800, after selecting only participants who rated texts as mid-point or higher on believability Power analysis is unavailable because it is unknown how many participants will be excluded based on the ratings of believability that are lower than the mid-point or higher.	Multilevel linear model with trust as DV. Ideology will be included as a fixed and random slope (across occupations). The model will also include random intercept for both participants and occupations. Finally, the model will include variables of conditions to which conservative participants were assigned (using dummy coding, compared to the control group)	In case of *p* <.05 for any of conditions effect, we would conclude that that intervention improved conservatives' trust in scientists for participants who find interventions believable (any of H4a-f is supported). In case of *p*>.05 for any of conditions effect, we will conduct equivalence testing using two one-sided test procedure with an effect range of d between -0.1 and 0.1. This way, we can conclude that interventions did not alter conservatives' trust in scientists for those who find interventions believable (any of H4a-f is not supported).
Participants exclusions: remove all responses flagged as possibly bots by the Qualtrics bot detection filter (Q_RecaptchaScore < 0.5), participants who failed the attention check question and participants who withdrew consent at the end. We will make up for excluded participants to achieve the targeted minimum N = 7,800.				

CHAPTER 7

GENERAL DISCUSSION: WHY RESEARCH ON SCIENTISTS MATTERS

Scientists could be one of the most important social groups in the contemporary world. As a motor of societal progress that saved *billions* of lives (Desjardins, 2018; Science Heroes, 2022) and improved many more, scientists have advanced knowledge and technology, and have spearheaded solutions to various challenges. These challenges, which often evolve into urgent problems, have been particularly evident in the past several years: In the wake of the COVID-19 pandemic outbreak, which was itself associated with an estimated 14.83 million excess deaths globally (Msemburi et al., 2023), scientists developed vaccines that saved tens of millions of lives (Watson et al., 2022). Another global problem – the continuation of climate change and the resulting severe floods and heatwaves – is expected to claim lives of at least five million people between 2030 and 2050 (World Health Organization, 2023).

It is not only scientists in the natural sciences that work on global challenges: Indeed, social scientists are first in line to point to the social causes of these challenges (e.g., a capitalist mode of production as one of the leading causes of climate change, Hickel, 2020) and advance public's acceptance and implementation of scientific solutions to these problems (Gauchat, 2015; Rutjens & Hornsey, 2024; Van Bavel et al., 2022). Equally important, the issue of climate change is intrinsically linked to another societal (and more social) problem, that of inequality – rich countries and rich individuals are disproportionally higher polluters (e.g., 1% of the super-rich emitted as much carbon as 66% of the poorest segment of the population), whereas poorer countries and poorer individuals are disproportionally hit (Khalfan et al., 2023). Social scientists have consistently pointed out how social inequalities and poverty are related to a wide range of problems such as higher violent crime rates, worse education and health opportunities and outcomes, lack of social cohesion (e.g., less satisfaction and trust in the political system), and so on (Kelly, 2000; Murali & Oyebode, 2004; Neckerman & Torche, 2007; Schäfer, 2012; Thorbecke & Charumilind, 2002). Lastly, social scientists' work on intergroup relations, dehumanization, and peace psychology could contribute to the resolution of deadly conflicts around the world[7].

A short outline of the scientists' work above should constitute a persuasive reason why public perceptions of scientists deserve a prominent role—and possibly a standalone subfield—in the area of social sciences. However, research was hitherto limited in understanding public perceptions of scientists, both in scope and number of studies. The present dissertation aimed to fill this gap, by advancing knowledge on the social perceptions of (different groups of) scientists. More specifically, across 15 empirical studies, the present dissertation investigated the structure of social perceptions of scientists, in terms of social evaluations (such as competence and warmth) and stereotypes, as well as antecedents and outcomes of these perceptions. Below, I summarize the dissertations' main findings and connect

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7 Solely during the work on this dissertation, four extremely deadly conflicts unfolded around the globe (Ukraine, Gaza, Sudan, Lebanon). The most notorious one is probably the Israeli bombardment of the Gaza Strip: until the 15th of August 2024, the Israeli army reportedly killed 16 456 Palestinian children (Al Jazeera, 2024), more than in all the wars around the globe in the last 4 years combined (UNRWA, 2024). Social scientists (e.g., political scientists, genocide studies experts) have offered their views on reasons and possible solutions to these wars (Finkelstein, 2018; Mearsheimer, 2014; Segal, 2023). One notable example is social psychologists' open letters in response to massacres Israel committed in Gaza, which included several hundreds of signatures (link and link)

them to the existing literature (theoretical, empirical, and practical). Next, I connect scientists' work, as well as perceptions thereof, to the wider socio-political system of neoliberal capitalism. In this part, I tie research on the perceptions of scientists to the critique of contemporary social psychological research as wrongly offering individual-level solutions to systemic problems (Chater & Loewenstein, 2023). Finally, the dissertation concludes with a section on the strengths and limitations of the reported work, and how future research can aid in understanding and improving perceptions of scientists.

Summary of main findings

In this part, I briefly summarize the research reported in the preceding five empirical chapters. In the first empirical chapter (Chapter 2), we systematically examined the perceptions of different groups of scientists. First, to generate the list of scientists that participants would evaluate, we used a bottom-up approach and asked participants to mention any scientific occupation they had in mind. This resulted in a list of over 30 groups of scientists, though three groups of scientists (chemists, biologists, and physicists) were most commonly listed, suggesting they are the most representative of the category of *scientists*. In the next study, participants rated these scientific occupations on several dimensions of social evaluations (e.g., competence, warmth, morality). Results showed that the public positively evaluated scientists – scientists are seen as extremely competent, very moral and assertive, and moderately warm. Crucially, however, the public distinguishes between different groups of scientists (e.g., neuroscientists are perceived as more competent than sociologists), forming several clusters (5 or 6) of scientific occupations based on social evaluations. The results converged across samples from the UK and the US where the studies were conducted.

In the second empirical chapter (Chapter 3), we extended this approach by conducting a larger study to investigate how these social evaluations (perceptions of competence, assertiveness, warmth, and morality) predict trust in scientists. Using the extended list from the previous chapter (containing 45 scientific occupations), we asked participants to report their social evaluations of scientific occupations, perceptions of trust, and their willingness to grant scientists decision-making power in the wake of a societal problem. Results showed that, while trust in scientists was relatively high (mean around 5 on a 7-point scale), it varied across different scientists (e.g., political scientists and economists were least trusted). The most important predictors of trust were perceptions of morality and competence (in that order). Importantly, the role of morality perceptions in trust varied across different occupations – morality was a stronger predictor of trust for scientists who work on publicly polarizing topics (e.g., climatologists, medical researchers), than other scientists (e.g., archeologists). Overall, these two chapters demonstrated that a better understanding of scientists requires acknowledgment of the diversity of scientific occupations, and that competence is perceived as the defining characteristic of scientists (perceptions of intelligence, skill, capability), while perceptions of morality are the main drivers of trust in scientists.

The goal of the following two chapters was to investigate additional perceptions of scientists, their antecedents, and outcomes. In Chapter 4, we investigated the relation between two types of perceptions of scientists – stereotypical image (e.g., scientists as white old men in labcoats, with beards and glasses) and social evaluations (e.g., perceptions of how smart or moral scientists are), as well as their antecedents (worldviews) and outcomes (trust in scientists and appeal of science career). Results showed that stereotypes and social evaluations of scientists are distinct types of perceptions (they correlate only slightly). Additionally, they stem from different worldviews, given that conservative political ideology predicts more negative evaluations of scientists, whereas religiosity and Western enculturation predict endorsement of scientist stereotypes. Finally, the two types of perceptions showed relatively separate outcomes in that only social evaluations predicted higher trust, while both less stereotyping and more positive social evaluations predicted the higher appeal of a science career. Interestingly, the relationship between stereotyping and science career appeal held only for young non-white women participants, i.e., those who did not conform to the stereotype of scientists as white old/middle-aged men.

In Chapter 5, we investigated extremely negative perceptions of scientists, which can take the form of harassment and violence against scientists. Integrating three different theoretical perspectives (motivational accounts, radicalization framework, and personality differences), these two studies investigated what predicts approving attitudes towards harassment of scientists, as well as three behavioral measures of violence against scientists (specifically developed for the study). We discovered that science cynicism (which integrates perceptions of scientists as incompetent and corrupt) is the most crucial driver of negative perceptions and behaviors. Additional contributing factors were perceptions of scientists as threatening, and dark-triad personality traits. Notably, Chapters 4 and 5 investigated perceptions of scientists in general, without accounting for the diversity of scientists as in Chapters 2 and 3. As noted in the General Introduction, this approach comes with a cost, in that the inclusion of multiple variables precluded differentiating among multiple scientific occupations in Chapters 4 and 5 for reasons of feasibility.

The first two empirical chapters demonstrated the importance of accounting for the diversity of scientific occupations; the following two chapters (as well as other work) pointed to the importance of worldviews, and prominently, political ideology (e.g., Blank & Shaw, 2015; Gauchat, 2012), in perceptions and trust in scientists. We integrated these two insights in the largest project of the dissertation to 1) investigate differences between liberals and conservatives in trust in a large number of scientific occupations, and 2) test strategies to increase trust in scientists among conservatives. We discovered that liberals overall trust scientists more than conservatives do, and that the strength of this relationship varies across occupations – liberals are particularly more likely to trust scientists who work in areas of climate change, medical research, and social sciences. In the next, main part of the study (conducted as a registered report), we tested five pre-tested theoretically-informed interventions to increase trust in scientists among conservatives. However, none of the interventions increased trust, suggesting that research might have been overly optimistic about influencing attitudes in the area of science communication. In the next part, I tie the present studies and their implications to advances in the current literature on perceptions of scientists.

Theoretical and practical advances

The research conducted in this dissertation has several theoretical and practical implications. Below, I outline the most important ones, noting that some of them have also been discussed in separate empirical chapters.

Importance of acknowledging the diversity of scientific occupations

What do we talk about when we speak about scientists? Our findings show that people largely think of three occupations (chemists, biologists, physicists) and that the perceived prototypical characteristic of scientists is competence. Crucially, we demonstrated that studying the perceptions of a single category of scientists can mask important differences: People indeed distinguish between various scientific occupations – for example, some scientific groups are seen as more competent (e.g., neuroscientists compared to sociologists) or warmer (e.g., zoologists compared to nuclear physicists) than others, while some garner less trust (e.g., economists and political scientists). Whereas some research focused on the general term of scientists (e.g., Gauchat, 2012; Wellcome Global Monitor, 2019) or one specific scientific occupation such as mathematicians (Haynes, 2016) or chemists (Finson, 2002), other research unsystematically included multiple scientific occupations (e.g., publicly most controversial, Suldovsky et al., 2019; or hand-picked from impact vs. product science, McCright et al., 2013). One notable exception is Altenmuller and colleagues' (2024) work which also showed that the public differentiates between scientific occupations, perceiving some as more liberal than others (e.g., climate and environmental scientists compared to economists and mathematicians). Additionally, they showed differences in trust levels, such that political scientists and theologians garnered the least trust (partially matching our results). This diversity of scientists also bears relevance for stereotype research more generally, in terms of levels of (sub)categorization that bring new information (e.g., Hinzman & Maddox, 2017): In our case, not each of the 35 (Chapter 2) or 45 (Chapter 3) scientific occupations is particularly informative (e.g., nuclear scientists and nuclear physicists garner very similar perceptions), and taking a few occupations from each cluster would probably suffice in future research.

This diversity is not just important in itself, it impacts relationships between the different variables as well. As we showed in Chapter 3, morality perceptions contributed to perceptions of trust in varying degrees across different scientific occupations, while pilot studies from Chapter 6 showed that the relationship between political ideology and trust also varies across occupations. Similarly, Altenmuller and colleagues (2024) showed that differences in social evaluations explain differing trust levels between conservatives and liberals. That is, conservatives trust those scientific occupations that are believed to be conservative, while for liberals vice versa applies. In short, accounting for the diversity of scientific occupations is one of the main contributions of the present dissertation to the literature.

The structure of trust in scientists

As mentioned throughout the dissertation, trust in scientists might be one of the most important concepts in research on the perception of scientists, given that it predicts compliance with scientific solutions in many fields of science (Algan et al., 2021, Motta, 2018; Cologna et al., 2022). Reflecting this importance, three out of five chapters of the dissertation included a measure of trust in scientists. We previously mentioned that studies on trust in scientists that stem from organizational psychology research advocated for three established factors of trust (ability, benevolence, and integrity) (Besley et al., 2021; Hendriks et al., 2015), possibly adding the factor of openness (Besley et al., 2021). However, as noted earlier, the problem with this approach is that there are very high intercorrelations between all factors and trust, which limits the possibilities for research due to the issue of multicollinearity. We thus employed social evaluation models (Abele et al., 2021), which exclusively focus on the basic dimensions of social perceptions, and do not explicitly address trust (though see Fiske & Dupree, 2014).

We showed that social evaluation models are also very suitable for understanding perceptions of scientists, with perceptions of morality emerging as the single most promising factor in determining trust, both in terms of magnitude (strongest predictor) and variation (across occupations). Apart from the crucial role of morality perceptions (rather than warmth as argued by Fiske & Dupree, 2014), we found that perceptions of competence (rather than assertiveness) contributes to trust. Together, this implies two requirements for trust: scientists need to be seen as skillful and capable (competence) of conducting their work (which indeed is their central characteristic) and to do so in an honest and sincere manner (morality). The central role of morality cannot be overstated, an issue to which I later return in the part on the socio-economic system of science production (in terms of how other motivations lead to corruption of trust) and in avenues for future research.

Stereotypes and social evaluations of scientists

One of the most interesting findings emerged from Chapter 4, in which we discovered that stereotypes and social evaluations of scientists are distinct types of perceptions with different predictors and potentially different outcomes. However, this opens questions about the relationship between stereotypes and social evaluations given that the latter are claimed to be based on the reduction of various stereotypes to a small number of dimensions (e.g., Fiske et al., 2002). So why are stereotypes and social evaluations of scientists so different? One plausible explanation is that perceptions of scientists are complex, with very specific stereotypes, which is why it is not sufficient to rely solely on relatively general social evaluations. Relating to the previous point of (sub)categorization, our findings suggest that the primacy of stereotypes vs. social evaluations might depend on the target group and/or the goal of perception. Indeed, research shows that different dimensions emerge depending on the relational or structural goals of the perceiver (Nicolas et al., 2022). Similarly, stereotypes or social evaluations of scientists will emerge as more important depending on the goal (e.g., understanding scientists' representation in media, science career appeal, or trust).

Worldviews as predictors of attitudes toward science and scientists

In three of our chapters (Chapters 4, 5, and 6), we demonstrated that worldviews shape attitudes toward scientists – from stereotypes and social evaluations, to trust and even harassment. In general, our work fits well with the approaches of motivational accounts of attitudes toward science, which posits that different motivations (worldviews, ideologies, fears, vested interests), rather than science knowledge, shape attitudes toward science (Hornsey, 2020; Kahan, 2010; Rutjens, Heine, et al., 2018). We advance this notion by showing that it also (and possibly even more) applies to attitudes toward scientists. As noted by other researchers in the case of political ideology, conservatives might distrust scientists because they perceive them to be liberal (Cofnas et al., 2018; Mann & Schleifer, 2020). Indeed, accounting for these ideological discrepancies between the trustor (conservative perceiver) and trustee (conservative scientists) reduces the trust gap (Altenmüller et al., 2024; McCright et al., 2013). Since the scientific method in principle can be reconciled with various worldviews—such as those held by religious individuals who do not see a conflict with science (Zarzeczna et al., 2024)—it is ultimately up to scientists to determine how science is applied, which can be more explicitly in conflict with a perceiver's worldview.

Apart from the essential role of political ideology (which might be biased given that we predominantly sampled US participants, see the limitations section below), conspiracy mentality emerged as a potentially strong driver of negative perceptions and distrust. For example, in Chapter 5, conspiracy mentality correlated *r*s =.56 and .45 (in two studies respectively) with science cynicism, one of the key drivers of harassment of scientists. Both conspiracy mentality and science cynicism encompass beliefs that actors (in this case scientists) are corrupt, malevolent, and dishonest (or *im*moral, in one word), which again stresses the centrality of perceptions of morality we mentioned previously. In any case, the current dissertation supports the idea that conspiracy beliefs are one of the major contributors to negative attitudes toward science and scientists (Rutjens & Većkalov, 2022).

Methodological and practical advances

The current dissertation also made several methodological contributions. First, we constructed a list of the scientific occupations that the public can recall most easily (Supplementary Material Chapter 2), which was very similar across the US and the UK. This list can be considered a publicly recognizable population of scientists (though note that the cut-off we used was arbitrary). Next, given that we systematically assessed public perceptions of over 30 scientific occupations which resulted in several (5 and 6) clusters, it is likely that this list could be somewhat reduced. Therefore, future studies on perceptions of scientists could select only a subset of scientific occupations (e.g., 2 or 3) from each cluster, retaining representativeness and systematicity while reducing costs (e.g., including a total of 10 to 15 scientific occupations). In addition, we showed how a large number of target groups can be employed in a study through stimuli sampling, which we did by presenting participants with only a random sample of scientific occupations.

Second, we had to develop or adapt multiple new measures throughout empirical chapters. In Chapter 3, we developed the Influence Granting Task (IGT) which measures the willingness to grant influence to scientists to manage societal problems. In this way, we employed granting influence as a key behavioral consequence of trust, given that individuals are more likely to give decision power to those who they trust (Besley & Tiffany, 2023; Mayer et al., 1995; Schoorman et al., 2007). In Chapter 4, we adapted the measure of stereotypes of scientists as a survey-based Likert scale. Previously, stereotypes of scientists were "measured" in the forms of essays (more of a qualitative approach; e.g., Mead & Métraux, 1957) and drawings (e.g., Chambers, 1983). Given that our adapted measure showed good reliability (αs over .80 in two studies) along with theoretically relevant predictors and outcomes, I believe it can be readily used in future research. In Chapter 5, we developed three behavioral measures of violence against scientists: first, we adapted the Voodoo Doll Task (DeWall et al., 2013) so that the voodoo doll resembles a stereotypical scientist. Next, we adapted two standard behavioral measures of donation (with real money) and (real) petition signing, which we developed specifically in relation to scientists. These new measures attempted to go beyond standard attitudinal measures, and as such can be used or adapted for future research.

Theoretical and methodological advances previously described are also associated with more practical contributions of the dissertation. For example, in work on harassment of scientists (Chapter 5), we discovered which individuals (those who see scientists as corrupt and threatening, and with pronounced dark personality traits) would be more likely to approve of harassment of scientists, and possibly actually harass them. While this advances the literature on worldviews, radicalization, and personality, it also has the potential to curb violence against scientists by identifying the types of individuals or organizations likely to incite dangerous attitudes and violent behavior against scientists. Similarly, work on science career appeal from Chapter 4 showed that a potential way to increase this appeal is to counter stereotypes of scientists among the group that does not conform to those stereotypes (e.g., young non-white women), as well as to improve social evaluations of scientists.

Perhaps the most important practical question of this dissertation is how to increase trust in scientists, given its repeatedly emphasized significance. As work in Chapters 3 and 4 demonstrated, perceptions of morality might be the most important factor that shapes trust. However, as Chapter 6 showed, it proved quite challenging to increase trust. I believe that, paradoxically, our failure to increase trust in scientists (among conservatives) offers the most important practical contribution to the field. As mentioned in Chapter 6, the failure of all five theoretically-informed interventions to increase conservatives' trust in scientists should raise concern about similar interventions in the field of science communication and attitude change more generally. Indeed, many recent large-scale studies and meta-analyses showed very low (with no practical significance) or even non-significant effects (Bergquist et al., 2023; Chan & Albarracín, 2023; Spampatti et al., 2023; Van Stekelenburg et al., 2022; Većkalov et al., 2023). Therefore, in line with the wider replication crisis in psychology (Open Science Collaboration, 2015), interventions in this area are likely to have replicability issues, and should not be trusted by default. Given that knowing about the replication crisis decreases public trust in science (Anvari & Lakens, 2018; Hendriks et al., 2020; Wingen et al., 2020), it is an important question why the replication crisis occurred in the first place. As others noted, systemic problems require systemic solutions (e.g., Chater & Loewenstein, 2023), and a systemic analysis beforehand.

Socio-economic system of science production

In this part, I discuss how the broader socio-economic system, i.e. neoliberal capitalism, influences science production, focusing mainly on its detrimental aspects. More specifically, I offer a systematic outline of how neoliberal transformations impact science production and, consequently, erode trust in science and scientists. By doing so, I connect previously isolated ideas and examples to offer a comprehensive view of this dynamic. Before outlining the model, it is important to note an underlining assumption that science cannot be separated from the societal context in which it takes place. As noted by different (though mainly Marxist) streams in social science, economic order (base) influences and shapes all other societal aspects (superstructure) such as political behavior, law, culture, media, and education (Harman, 1986; Marx, 1859; Williams, 1973). Thus, it would be reasonable to assume that neoliberalism influences and shapes science production (Davi et al., 2021; Lave et al., 2010; Mula-Falcón & Caballero, 2022). My central idea is that essential characteristics of neoliberalism that transform science production facilitate questionable research practices (e.g., selective reporting and publishing, p-hacking, questionable practices in data analysis), producing non-reliable science, and subsequently leading to lower trust. In universities (more basic research), this stems from the neoliberal transformation of research culture to a more productive and competitive one. In industry (more applied research), this happens due to neoliberalism's increasing privatization and competing corporate interests.

Figure 1 summarizes a model of the detrimental effect neoliberalism has on science production and scientists' trustworthiness. One of the central pillars of the neoliberal socio-economic order is an extreme turn to profit maximization (see 'Friedman doctrine'), characterized by (among other things) higher demands for efficiency and/or productivity, increased commercialization, and an increased role of the free market (more privatization) combined with less government spending (e.g., budget cuts in academia) (Ganti, 2014; Hackett, 2014; Harvey, 2005). These features of neoliberal capitalism are well reflected in scientists' work too:

Scientists start participating in a system with very limited resources such as grants and positions (Musselin, 2018), with two general outcomes.

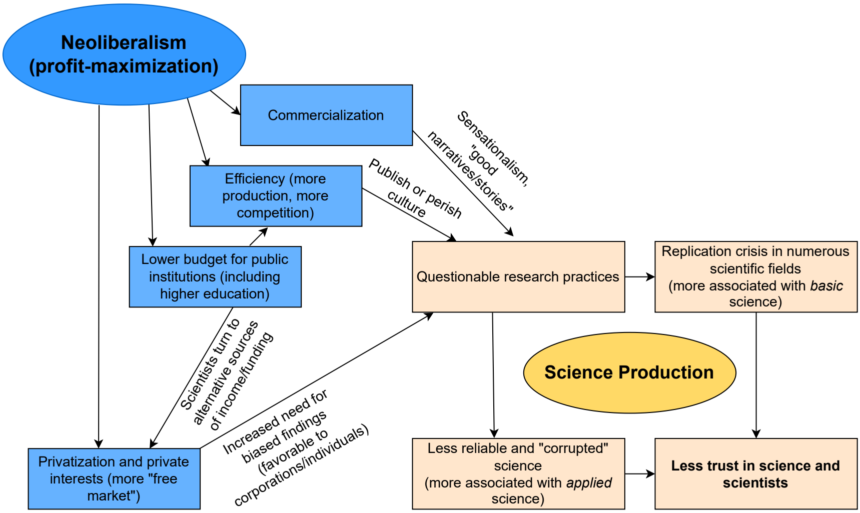


Figure 1. Detrimental effects of neoliberal transformation of science. Neoliberalism, whose central pillar is profit maximization, is characterized by commercialization, demands for efficiency and competition, privatization, and less government spending (including budget cuts in academia). Through different mechanisms, these factors can inadvertently motivate scientists to engage in questionable research practices. This contributes to "corrupt science" in applied settings, and the replication crisis in basic research. Such science and scientists are consequently less trusted by the public.

Firstly, the emphasis on productivity and commercialization has transformed research culture into a very competitive one (Berg et al., 2016). This has been marked by a 'publish or perish' culture, in which scientists are required to publish excessively (Lee & Lee, 2013; Vurayai & Ndofirepi, 2022), as well as with an emphasis on the novelty and/or importance of the findings, which can result in sensationalism (Ball, 2015; Feldman & Sandoval, 2018; Wagner, 2018). Under conditions of pressure and scarcity, scientists turn to different practices to facilitate publishing, such as increased working hours (Archer, 2008; Mula-Falcón & Caballero, 2022). However, for the same goal of "publication productivity", scientists turn to questionable research practices and even scientific misconduct – an array of negative behaviors responsible for the replication crisis (Anderson et al., 2007; Mula-Falcón & Caballero, 2022; Nosek et al., 2012; Tijdink et al., 2016). In turn, such behaviors negatively impact trustworthiness (Grimes et al., 2018; Mede, Schäfer, Ziegler, et al., 2021), whereas scientists' transparency, openness, and prosocial orientation improve trust (Benson-Greenwald et al., 2023; Rosman et al., 2022; Schneider et al., 2022). Relatedly, 'novelty' and 'impact' expectations and requirements have been argued to cause questionable research practices (Ware & Munafò, 2015) and generate findings with lower reproducibility (Bishop et al., 2015; Ten Hagen, 2016). The most drastic example would certainly be the publication of evidence of the paranormal (i.e., precognition, the capability to see in the future; Bem, 2011) in likely the most prestigious journal in social and personality psychology (*Journal of Personality and Social Psychology*). In short, the neoliberal transformation of academic research has led to a culture of 'publish or perish' with a strong incentive for individuals to over-emphasize impact and novelty, and try to oversell their research. These systemic forces have led scientists to engage in questionable research practices, which is one way neoliberalism jeopardizes the credibility of scientific research, and consequently, trust in scientists.

Secondly, private for-profit corporations and scientists become more entangled, given that scientists turn to alternative sources of income and funding, whereas corporations increase reliance on science and scientists (e.g., Langin, 2019). Such corporate science and scientists are indeed associated with more biased (i.e., more favorable to the funder) findings. For example, trials on experimental drugs funded by a non-profit organization were recommended as a treatment of choice in 16% of cases, compared to 51% trials funded by for-profit organizations (Als-Nielsen et al., 2003; also see, Kjaergard, 2002 and Lundh et al., 2017). Similarly, in oncology, pharmaceutical company-sponsored studies were more likely to reach favorable conclusions (95%) than those sponsored by non-profit organizations (62%) (Friedberg, 1999). Whereas these numbers can vary, they demonstrate that funding or competing interests more often yield favorable results compared to when there are no such interests (named funding effect or bias; Krimsky, 2013). Similarly, private companies and corporations aim to misrepresent the *actual* health or environmental risks they produce, resulting in a "*…history [of] a substantial tradition of manipulation of evidence, data, and analysis, ultimately designed to maintain favorable conditions for industry*" (p. 332; Egilman & Bohme, 2005). This detrimental relationship between corporations and science has been evidenced by a special issue on "Corporate Corruption on Science" in which authors demonstrate numerous examples of dishonest reporting in industry-related science, and ways of conducting such science (Egilman & Bohme, 2005). Apart from the well-known attempts of right-wing think tanks and corporations to undermine scientific consensus regarding the reality of the risks of tobacco smoking and climate change (Oreskes & Conway, 2011), many corporations used the same strategies regarding individual products (e.g., cancer risk of asbestos in automobile manufacturing, Egilman & Monárrez, 2017; also see, Nader, 1998 and Tran et al., 2019). Overall, this demonstrates how the privatization of scientific research and competing interests systematically lead to questionable research practices, ultimately producing less reliable results associated with applied/industry research. This is another way in which the neoliberal transformation of science likely reduces trust in science and scientists. Indeed, when scientists are affiliated with industry or financial motives, they garner less trust (Eom & Choy, 2024; Rutjens, Niehoff, et al., 2022).

Strengths, limitations, and future research

The current dissertation has several strengths and offers contributions to the fields of science communication and social perceptions. First, three empirical chapters (Chapters 2,3, and 6) have, in a systematic way, demonstrated the importance of accounting for the diversity of scientific occupations, thus advancing research on perceptions of scientists. Second, in this process, we developed or adapted multiple new methods: bottom-up approach of generating the list of scientists (Chapter 2), stimuli sampling (Chapters 2, 3, and 6), and notably, development of new measures and materials – IGT measure (Chapter 3), measures of stereotypes of scientists (Chapter 4) and attitudes toward scientists harassment (Chapter 5), and three behavioral measures of violence against scientists (Voodoo Doll Task, donation, petition; Chapter 5). Both our novel approach and measures could be readily applied in future research to further advance the understanding of perceptions of scientists (see below). Finally, the whole dissertation was conducted in line with the highest standards of Open Science practices given that all materials, data, and analysis scripts are publicly shared on the Open Science Framework, and pre-registration was conducted as often as possible (all studies in Chapters 3, 4, and 5 were pre-registered). Most notably, the largest project of the dissertation (Chapter 6) was conducted as a registered report, ensuring that the interventions we aimed to test were also approved by other researchers (reviewers and editors), thus avoiding post-factum criticism of our interventions (e.g., that interventions were flawed, but that general approach is still worthwhile). As mentioned in the introduction, this outcome (publication of null findings in a highly impactful journal) will hopefully motivate other early-career researchers to commit to registered report formats more often.

The presented studies are not without limitations. First, all studies were conducted in Western countries (predominantly in the US) in the English language, limiting the generalizability of findings. More generally, this is indicative of the US hegemony in psychological research (Henrich et al., 2010; Reddy & Amer, 2023), given that none of the collaborators on the dissertation studies are American nor based in the US. As the US is an outlier even among Western countries (e.g., highest crime rates, highest income inequalities, highest working hours; Lipset, 1996), it is imperative to study perceptions of scientists outside of the US and Western countries more generally. Secondly, the majority of the studies (Chapters 2-5) were correlational, precluding causal conclusions (we also note this throughout the chapters). The only experimental study in the dissertation (Chapter 6) did not affect any attitudes, which limits our understanding of how these attitudes and behaviors *change*. This may be the most urgent line of research (given the importance of trust), and it would be particularly valuable to experimentally test the effects of morality and competence on trust in scientists across different fields (extending Chapter 3). Finally, all studies were quantitative and survey-based, even when they included behavioral measures (as in Chapter 5). Future studies should thus be more methodologically diverse and include a qualitative approach and/or fieldwork, which would potentially represent a richer source of data.

The above-mentioned avenues for future research mostly relate to the work conducted in this dissertation. However, as previously mentioned, some research investigated the nature of science production in profit-oriented societies, focusing on its relation to the replication crisis (Tijdink et al., 2016; van Wesel, 2016) and bias in private-funded research (Krimsky, 2013, 2019). Future research should thus investigate how internal conflicts of science within the current socio-economic system impact trust in scientists. I believe that studies investigating how the replication crisis impacts trust (e.g., Mede, Schäfer, Ziegler, et al., 2021; Wingen et al., 2020), or the impact of industry/private funds on trust (Eom & Choy, 2024; Rutjens, Niehoff, et al., 2022) are steps in the right direction, even though this research has been limited in scope. Unfortunately, science and scientists have been involved in numerous controversies and scandals within private companies (e.g., Purdue Pharma downplaying the addictive nature of OxyContin and using aggressive promotional marketing strategies with doctors, GlaxoSmithKline concealing safety risks of Avandia medicine, Pfizer conducting unethical research in Nigeria), but systematic research on how this has impacted public trust is lacking. Future research should take a more systematic and systemic approach and investigate how a profit-seeking system such as neoliberal capitalism, undermines both science and trust in it.

Conclusion

Scientists have improved and saved billions of lives. Given their prominent role in society, as well as the urgency of contemporary societal problems, it is surprising that research on perceptions of scientists has been limited. The present dissertation set out to fill this gap by investigating public views of scientists, and their antecedents and outcomes. Indeed, scientific solutions can only be effectively applied when we understand both the nature of scientific work and its relation to the broader socio-economic system, as well as public perceptions of science and scientists. This is an essential task, given the range of problems scientists can help solve, from climate change and pandemics to social inequalities and even wars.

Supplementary Material Chapter 2

Steps in Study 1a

1. Manually correct spelling mistakes in Excel ("Physisist" -> "Physicist")
2. Import database
3. Capitalize first letter ("chemist" -> "Chemist")
4. Remove spaces before and after ("Chemist " -> "Chemist")
5. Remove 's' at the end of occupations ("Chemists" -> "Chemist")
6. Count the entries (934 unique entries/occupations)
7. Selecting only occupations that have counts over two (187 entries)
8. Renaming occupations:
    a. Psychologist (Psychology)
    b. Pharmacologist (Pharmaceutical Researcher)
    c. Chemist (Chemical Scientist, Chemistry, Chemistry Researcher)
    d. Physicist (Physics)
    e. Geneticist (Genetic Scientist)
    f. Environmental Scientist (Environmentalist, Environmental)
    g. Climatologist (Climate Scientist)
    h. Microbiologist (Micro biologist)
    i. Biologists (Biology, Biological)
    j. Astronomer (Astronomist, Astronomy)
    k. Researcher (Research, Scientific Researcher)
    l. Volcanologist (Vulcanologist)
    m. Biochemist (Bio Chemist)
    n. Food Scientist (Food)
    o. Archeologist (Archaeologist)
    p. Medical Researcher (Medical, Medical Scientist, Medical Research, Medicine)
    q. Computer Scientist (Computer Science)
    r. Nuclear Scientist (Nuclear)

9. Cut-off (arbitrary in previous studies): 5% i.e., 15 counts. In total, 57 occupations
10. Delete non-scientific occupations (second column represents counts):

Doctor	98
Pharmacist	93
Engineer	54
Science Teacher	51
Forensic Scientist	50
Astronaut	44
Chemical Engineer	39
Vet	39
Pathologist	38
Dentist	35
Lab Technician	31
Nurse	29
Psychiatrist	24
Surgeon	23
Teacher	19
Radiologist	18
Inventor	17
Laboratory Technician	17
Phlebotomist	17
Physician	16
Neurologist	15
Research Scientist	15

11. Number of occupations: **35**
12. When no pre-processing is done (from step 4 on), a similar list is obtained

Supplementary Table 1.

Supplementary Table 1. Counts, prototypicality, and social evaluations (BRM) ratings for different scientific occupations in all studies

	Studies 1a & 1b (UK)					Studies 2a & 2b (US)				
	Counts	PROTO	COMP	SOC	MOR	Counts	PROTO	COMP	SOC	MOR
Chemist	229	85.13	6.04	4.39	5.15	214	91.93	6.27	4.08	5.23
Biologist	193	85.42	6.07	4.83	5.41	206	91.34	6.11	4.63	5.28
Physicist	175	86.30	6.27	4.22	5.22	159	89.37	6.24	4.10	5.22
Geologist	93	77.17	5.74	4.75	5.24	145	82.00	5.96	4.45	5.36
Astronomer	89	78.66	6.06	4.71	5.27	126	82.22	6.06	4.36	5.31
Marine Biologist	79	81.93	5.94	5.17	5.47	72	86.42	6.08	5.33	5.50
Astrophysicist	74	86.57	6.36	4.36	5.27	55	90.41	6.32	4.09	5.23
Psychologist	72	63.42	5.45	4.86	5.18	72	64.07	5.44	4.84	4.94
Microbiologist	68	86.84	6.24	4.65	5.48	54	88.06	6.21	4.21	5.15
Zoologist	65	75.91	5.82	5.60	5.66	72	82.55	5.76	5.50	5.43
Botanist	62	77.96	5.65	5.23	5.33	93	80.11	5.82	5.08	5.43
Biochemist	58	84.17	6.13	4.36	5.10	41	92.20	6.31	4.03	5.13
Meteorologist	58	73.57	5.71	4.81	5.15	67	76.17	5.43	5.22	5.12
Virologist	53	85.58	6.10	4.45	5.26	36	89.70	6.06	4.28	5.39
Archaeologist	49	66.65	5.64	4.84	5.24	101	82.21	5.97	4.44	5.10
Mathematician	42	71.91	6.05	4.09	5.05	53	78.72	6.29	3.99	5.18
Medical Researcher	41	78.26	5.93	4.60	5.33	40	86.45	6.09	4.37	5.30
Geneticist	40	84.31	6.25	4.63	5.25	38	89.14	6.15	4.28	5.14
Paleontologist	37	75.84	5.84	4.63	5.19	43	82.55	5.91	4.63	5.29
Ecologist	35	73.84	5.36	4.65	4.98	31	83.92	5.71	5.03	5.47
Environmental Scientist	33	75.87	5.57	4.92	5.26	48	84.13	5.71	4.80	5.24
Nuclear Physicist	32	87.09	6.40	4.03	5.00	23	93.03	6.48	3.80	4.95
Epidemiologist	29	78.15	6.13	4.57	5.39	28	82.85	5.99	4.40	5.25
Computer Scientist	28	70.42	5.83	4.09	4.78	36	69.25	5.94	3.86	4.8
Nuclear Scientist	24	85.97	6.34	3.97	4.89	20	90.53	6.40	3.83	5.02
Rocket Scientist	24	84.58	6.46	4.14	5.02	24	91.35	6.36	4.17	5.16
Anthropologist	22	71.32	5.47	4.89	5.14	60	77.97	5.76	4.60	5.11
Oceanographer	20	73.97	5.81	5.15	5.51	40	86.29	6.08	5.01	5.40
Climatologist	18	76.68	5.62	4.76	5.31	22	78.08	5.60	4.64	5.22
Data Scientist	17	68.07	5.53	4.04	4.76	18	73.57	5.81	4.07	4.93
Food Scientist	16	68.54	5.28	4.68	4.96	16	71.78	5.53	4.74	5.06
Neuroscientist	16	87.98	6.47	4.48	5.55	34	92.37	6.32	4.24	5.43
Sociologist	16	58.93	4.98	4.89	4.86	31	65.22	5.23	4.76	4.85
Pharmacologist	18	80.31	5.93	4.59	5.39	/	/	/	/	/
Statistician	/	/	/	/	/	21	71.40	5.82	3.96	5.03
Hydrologist	/	/	/	/	/	19	82.20	5.72	4.50	5.16
Researcher	51	/	5.33	4.67	5.02	43	/	5.72	4.35	5.06
Scientist	/	/	6.03	4.26	5.09	/	/	6.12	4.06	5.13

Note. Occupations are sorted by counts from Study 1a. "Pharmacologist", "statistician", and "hydrologist" are presented after occupations that were used in both countries, and have values only for one country. "Researcher" and "Scientist" are generic terms and did not contain prototypicality questions. PROTO = Prototypicality, COMP = competence, SOC = sociability, MOR = morality. Tables from Studies 1a and 2a where occupations are sorted by counts of each study are given on OSF.

Steps in Study 2a

1. Manually correct spelling mistakes in Excel ("Physisist" -> "Physicist")
2. Import database
3. Capitalize first letter ("chemist" -> "Chemist")
4. Remove spaces before and after ("Chemist " -> "Chemist")
5. Remove 's' at the end of occupations ("Chemists" -> "Chemist")
6. Count the entries (930 unique entries/occupations)
7. Selecting only occupations that have counts over two (190 entries)
8. Renaming occupations:
    a. Psychologist (Psychology)
    b. Pharmacologist (Pharmaceutical)
    c. Chemists (Chemical Scientist, Chemistry, Chemical)
    d. Physicist (Physics)
    e. Geneticist (Genetic)
    f. Environmental Scientist (Environmentalist, Environmental, Environmental Science)
    g. Climatologist (Climate Scientist)
    h. Biologists (Biological, Biology)
    i. Astronomer (Astronomist, Astronomy)
    j. Researcher (Research)
    k. Microbiologist (Micro biologist, Microbiology)

l. Volcanologist (Vulcanologist)
m. Food Scientist (Food)
n. Archeologist (Archaeologist)
o. Medical Researcher (Medical, Medical Scientist)
p. Political Scientist (Political, Political Science)
q. Astrophysicist (Astrophysics, Astro Physicist)
r. Mathematician (Mathematics)
s. Geologist (Geology)
t. Computer Scientist (Computer Science)
u. Nuclear Scientist (Nuclear)

9. Cut-off (arbitrary in previous studies): 5% i.e., 15 counts. In total, 48 occupations
10. Delete non-scientific occupations (second column represents counts):

Engineer	53
Doctor	51
Pharmacist	50
Astronaut	30
Physician	29
Psychiatrist	19
Veterinarian	19
Chemical Engineer	18
Pathologist	18
Mechanical Engineer	17
Nurse	16
Medical Doctor	15

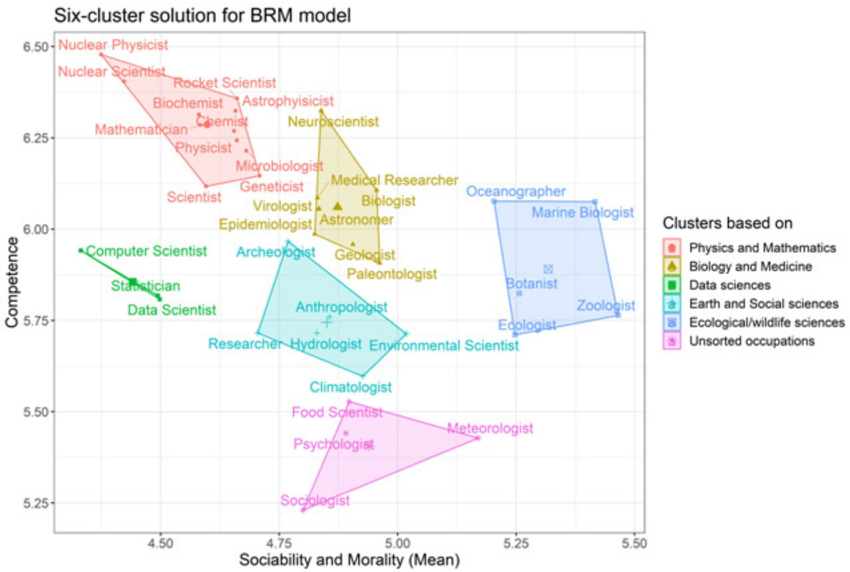
11. Number of occupations: **36**
12. When no pre-processing is done (from step 4 on), a similar list is obtained

Study 2b - BRM model results

Before testing for clustering, we again first estimated means from a mixed model which included random intercept for participants ($ICC_{competence}$ = .52, $ICC_{sociability}$ = .52, $ICC_{morality}$ = .58). Ratings for each occupation on BRM dimensions are given in Supplementary Table 1. Means suggest that scientific occupations are highly competent (*M* = 5.97), moderately sociable (*M* = 4.45), and relatively moral (*M* = 5.19). Differences between all dimensions were significant, *t*s > 11.68 p_{bonf} < .001. Correlations between dimensions across occupations are given in Supplementary Table 2.

We used the same approach in determining the number of clusters as in Study 1b. NbClust showed that most indices (10) suggested the 6-cluster solution, which resonates with the findings from the previous study. Both hierarchical clustering algorithm and k-means returned the same cluster memberships. The 3D plot is given here, while the 2D graph which collapsed sociability and morality into one dimension is given in Supplementary Figure 1.

The six-cluster solution from Study 2b replicated the findings from Study 1b, which is why we named clusters in the same way. Again, "scientist" is among the physical and mathematical occupations. Overlap between these and biomedical occupations is even more pronounced in this study, given that "geneticist", "microbiologist", and "astronomer" do not belong to their respective content-based clusters. In this study, ecological/wildlife sciences also included "ecologist" (it belonged to unsorted occupations in Study 1b), while "statistician" (new occupation in Study 2b) was classified as data sciences. Interestingly, based on the social evaluations, "psychologist" was classified as an unsorted occupation, which is a cluster with lower perceptions of competence.



Supplementary Figure 1. Six clusters of scientific occupations based on the ratings of competence, sociability, and morality in Study 2b. For the 2D representation, we collapsed sociability and morality because many models consider them subdimensions of a higher-order factor (named warmth; Fiske et al., 2002 or communion; Abele et al., 2016). Lines represent cluster borders, with each cluster having their own color and symbol. Cluster centroids are represented with a large symbol in the cluster center.

Social evaluations dimensions (BRM) and Prototypicality

We next investigated which social dimensions contribute to perceptions of prototypicality. Rating an occupation as more prototypical of scientists was associated with perceptions of higher competence, lower sociability, and higher morality (Supplementary Table 2). Linear regression with three social evaluations as predictors showed that the model was significant, $F(3,31) = 40.480$, $p < .001$, $adj\ R^2 = .78$. Replicating findings from Study 1b, higher levels of competence contributed to prototypicality ratings ($t = 5.824$,

p <.001), while sociability and morality did not, (t = .921, p = .36, and t = 1.991, p = .055, respectively).

Supplementary Table 2. Correlations between social perceptions and prototypicality ratings

	Competence	Sociability	Morality
Competence			
Sociability	-.606***		
Morality	.209	.483**	
Prototypicality	.817***	-.250	.508**

Note. Correlations with prototypicality did not include generic occupations of "scientist" and "researcher". **p < 0.01. ***p<.001

Study 2b - DPM model results

Clusters of occupations

Before testing for clustering, we first estimated means from a mixed model which included random intercept for participants ($ICC_{competence}$ = .63 , $ICC_{assertiveness}$ = .65, ICC_{warmth} = .51, $ICC_{morality}$ = .64). Ratings for each occupation on DPM dimensions are given in Supplementary Table 3. Means suggest that, on general, scientific occupations are perceived as highly competent (M = 5.99.), relatively assertive (M = 5.43) and moral (M = 5.39), and moderately warm (M = 4.85). Differences between all dimensions except assertiveness and morality (t = 1.088, p =1.000) were significant, ts > 6.791 p_{bonf} < .001. Correlation table between all dimensions, and prototypicality is given in Supplementary Table 4.

Supplementary Table 3.
Ratings of warmth, morality, competence, and assertiveness for each occupation

	Warmth	Morality	Assertiveness	Competence
Scientist	4.56	5.38	5.47	6.12
Researcher	4.73	5.34	5.47	6.00
Chemist	4.52	5.39	5.37	6.07
Biologist	4.94	5.45	5.43	6.11
Physicist	4.51	5.35	5.50	6.25
Geologist	4.76	5.37	5.23	5.95
Astronomer	4.73	5.46	5.49	6.15
Marine Biologist	5.79	5.76	5.50	6.07
Astrophyisicist	4.37	5.26	5.51	6.16
Psychologist	5.45	5.38	5.39	5.55
Microbiologist	4.67	5.49	5.36	6.10
Zoologist	5.90	5.65	5.23	5.75
Botanist	5.29	5.52	5.01	5.82
Biochemist	4.49	5.31	5.61	6.29
Meteorologist	5.39	5.24	5.30	5.66

Virologist	4.80	5.51	5.60	6.12
Archeologist	4.78	5.36	5.60	5.98
Mathematician	4.33	5.36	5.44	6.31
Environmental Scientist	5.28	5.46	5.42	5.78
Geneticist	4.73	5.36	5.54	6.14
Paleontologist	4.86	5.38	5.48	5.93
Ecologist	5.41	5.62	5.50	5.89
Medical Researcher	4.78	5.40	5.60	6.09
Nuclear Physicist	4.22	5.13	5.74	6.33
Epidemiologist	5.00	5.48	5.60	6.03
Computer Scientist	4.29	5.10	5.08	5.84
Data Scientist	4.38	5.25	5.22	5.98
Food Scientist	4.98	5.34	5.14	5.68
Rocket Scientist	4.51	5.29	5.69	6.29
Anthropologist	5.00	5.35	5.39	5.82
Oceanographer	5.46	5.69	5.58	6.06
Nuclear Scientist	4.24	5.26	5.75	6.33
Climatologist	5.18	5.47	5.35	5.68
Statistician	4.27	5.26	5.28	5.94
Neuroscientist	4.75	5.45	5.69	6.19
Sociologist	5.32	5.25	5.14	5.46
Hydrologist	4.87	5.35	5.24	5.83

Supplementary Table 4.
Correlations between social perceptions and prototypicality ratings

	Competence	Assertiveness	Warmth	Morality
Competence				
Assertiveness	$.717^{***}$			
Warmth	$-.630^{***}$	-.259		
Morality	-.047	.087	$.707^{***}$	
Prototypicality	$.790^{***}$	$.700^{***}$	-.247	.234

Note. Correlations with prototypicality did not include generic occupations of "scientist" and "researcher". $^{\dagger}p<.10$· $^{**}p < 0.01$· $^{***}p<.001$

Supplementary Material Chapter 3

Pilot Studies

With three pilot studies (N = 100 in each study), we aimed to develop a measure that reflects a behavioral consequence of trust. Our goal was to obtain a measure that would have convergent validity with trust (high correlations) and a distribution that would not be asymmetric (we aimed to avoid both floor and ceiling effects). In all three pilot studies, participants followed the same procedure, with the only difference in the wording of the influence granting task (IGT). Participants were presented with six scientific occupations (one from each of the six clusters of scientific occupations, Gligorić et al., 2022) and asked to answer the same task for each scientific occupation. In order to eliminate any confounds, we made the task the same across all occupations. We aimed to construct a general task that could be then applied to all 45 occupations in the main study. The tasks, which were constant-sum questions (choices had to total 100) are described below (see Pilot Studies 1-3). Before completing the task, participants responded to two practice questions in order to familiarize themself with the instructions and answering format. After responding to a task for all six occupations (randomized order), participants filled out three measures of trust in the following order.

General trust was assessed by asking participants to respond to the question "How much do you trust [occupation]?" using a seven-point scale (1 = *do not trust at all*, 7 = *trust completely)* (Algan et al., 2021). Next, they answered the four-item scale of trust which asked how much they trust or distrust [occupation] to: "create knowledge that is unbiased and accurate", "create knowledge that is useful", "advise government officials on policy?", and "inform the public on important issues?". Answers were given on a five-point scale from 1 = *completely distrust* to 5 = *completely trust* (McCright et al., 2013). Finally, participants were asked to answer three items with the following question: "How much or little influence/control do you think [scientific occupation] should have: 'over public policy', 'on the choices that other people make' and 'on the issues that matter to you'". They responded using a five-point scale (1 = *none at all* to 5 = *a great deal*). After completing the three measures for one occupation, they completed the same measure for the next one, until responding to all six occupations. The order of occupations was randomized. In each study (N = 100), participants were recruited through Prolific (country filter: the US) and received £1.40 for their participation. The completion lasted around 10 minutes. The survey and data for all three pilot studies are provided on the project's OSF page. An overview of sample demographics is given in Table S1.

S1 Table. Sample demographics of the pilot studies

	Gender	Age	Education
Pilot 1	50 men 50 women	M = 38.57 SD = 13.39	Completed high/secondary school: 22 Undergraduate degree (BSc, BA): 46 I'm currently studying: 5 Graduate degree: 27
Pilot 2	51 men 46 women 3 other	M = 36.15 SD = 12.72	Less than high/secondary school: 1 Completed high/secondary school: 28 Undergraduate degree (BSc, BA): 41 I'm currently studying: 12 Graduate degree: 18
Pilot 3	49 men 51 women	M = 42.89 SD = 13.04	Completed high/secondary school: 36 Undergraduate degree (BSc, BA): 44 I'm currently studying: 7 Graduate degree: 13

Results of the pilot studies— i.e., correlations of the trust task with the three other measures of trust, as well as answering distribution—are given in S2 Table below. Based on the intercorrelations and means, we concluded that the phrasing in Pilot Study 2 was best (note that, for the main study, we added "must" in the last sentence).

Pilot Study 1

The phrasing of the task and the offered parties (all randomized except "scientific occupation" and "Other scientists" which were always the third and fourth option) in Pilot Study 1 was as follows:

> Imagine there is a pressing societal problem in your country. You have the complete power to make a decision about how to solve the problem. This problem is very complex and, therefore, to solve it, the help and advice of various types of scientists would be useful. If you were to make a final decision, how strongly would you value the input of the following parties? Note that points sum up to 100.

Community leaders	0
Politicians	0
Citizens	0
[Scientific occupation]	0
Other scientists	0
Family members	0
Friends	0
Myself	0

Answers were given using a slider for each option, with a possible allocation of anywhere between 0 and 100 points per option. The points had to total 100.

Pilot Study 2

The phrasing of the task and the offered parties (all randomized) in Pilot Study 2 was as follows:

> Imagine there is a pressing problem in your country that is affecting every citizen. You have the complete power to make a decision about how to solve the problem. This problem is very complex and, therefore, to solve it, the help and advice of various types of scientists would be useful. If you were to make a final decision, how strongly would you value the input of the following parties? Note that points sum up to 100.

Community leaders	0
Politicians	0
Citizens	0
[Scientific occupation]	0
Family members	0
Friends	0
Myself	0

Answers were given using a slider for each option, with a possible allocation of anywhere between 0 and 100 points per option. The points had to total 100.

Pilot Study 3

The phrasing of the task and the offered parties (all randomized except scientific occupation and Other scientists which were always third and fourth options) in Pilot Study 1 was as follows:

> Imagine there is a pressing problem in your country that is affecting every citizen. You have the complete power to make a decision about how to solve the problem. This problem is very complex as it involves a combination of forces of nature, technical elements, impact on plants and animals, and societal aspects that need to be considered. Therefore, to solve the problem, the help and advice of various types of scientists would be useful. If you were to make a final decision, how strongly would you value the input of the following parties? Note that points must sum up to 100.

Community leaders	0
Politicians	0
Citizens	0
[Scientific occupation]	0
Family members	0
Friends	0
Myself	0

The answers were given using a slider for each option, with a possible allocation of anywhere between 0 and 100 points per option. The points had to total 100.

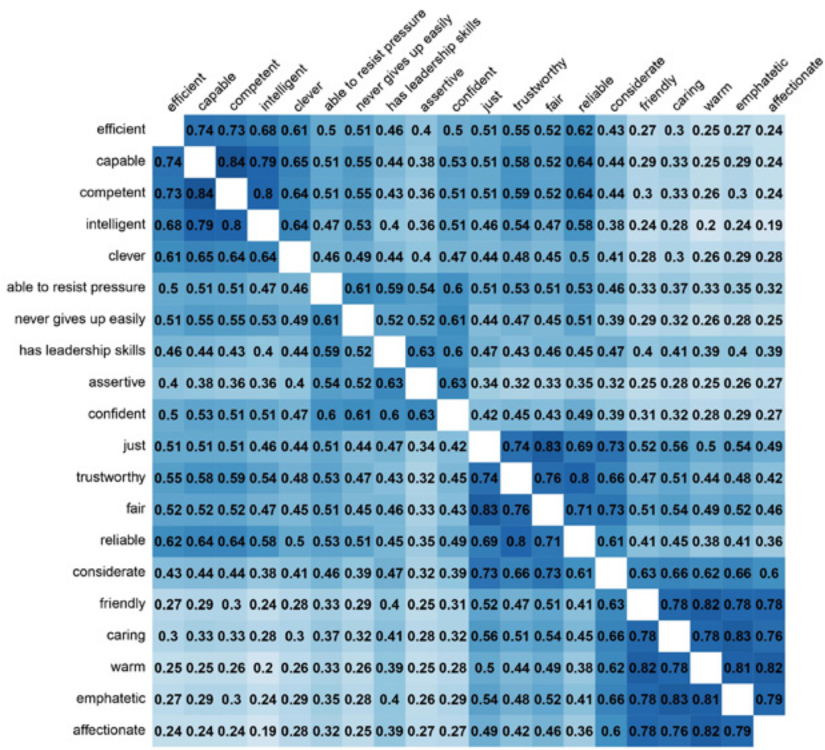
S2 Table. Descriptives for IGT and intercorrelations of four trust measures, for six different scientific occupations (Anthropologist, Biologist, Computer Scientist, Oceanographer, Physicist, Sociologist) in three pilot studies. Each trust measure is labeled with a number (1-4); distribution statistics (means, standard deviations, and medians) are given only for the IGT measure. Intercorrelations are given between all trust measures. There are three correlation coefficients (in order: Pearson's r, Spearman's rho, Kendall's Tau B) because of the non-normal distribution. All the statistics presented in the table are given for each of the six occupations and each of the pilot studies.

	Pilot 1			**Pilot 2**			**Pilot 3**		
				Anthropologist					
	1.	2.	3.	1.	2.	3.	1.	2.	3.
1. Task	*M* = 15.33 *SD* = 13.44 *Med* = 12			*M* = 32.56 *SD* = 26.53 *Med* = 30			*M* = 34.40 *SD* = 23.10 *Med* = 30		
2. Overall trust	.193 .168 .132			.332 .295 .228			.283 .295 .230		
3. Trust or distrust	.168 .197 .153	.739 .596 .509		.367 .328 .247	.802 .763 .683		.329 .343 .262	.680 .726 .625	
4. Influence/ control	.244 .240 .182	.299 .224 .183	.454 .430 .344	.321 .364 .276	.585 .511 .435	.693 .588 .488	.348 .467 .356	.485 .493 .405	.554 .515 .410
				Biologist					
	1.	2.	3.	1.	2.	3.	1.	2.	3.
1. Task	*M* = 16.59 *SD* = 14.27 *Med* = 15			*M* = 40.03 *SD* = 27.53 *Med* = 36.5			*M* = 45.90 *SD* = 22.61 *Med* = 42.5		
2. Overall trust	.285 .275 .224			.431 .435 .349			.173 .205 .161		
3. Trust or distrust	.253 .203 .161	.630 .593 .520		.481 .450 .343	.750 .672 .588		.212 .177 .130	.744 .766 .688	
4. Influence/ control	.231 .240 .175	.287 .277 .236	.498 .412 .330	.416 .379 .275	.507 .475 .400	.583 .497 .402	.185 .233 .161	.595 .586 .496	.610 .583 .474
				Computer scientist					
	1.	2.	3.	1.	2.	3.	1.	2.	3.

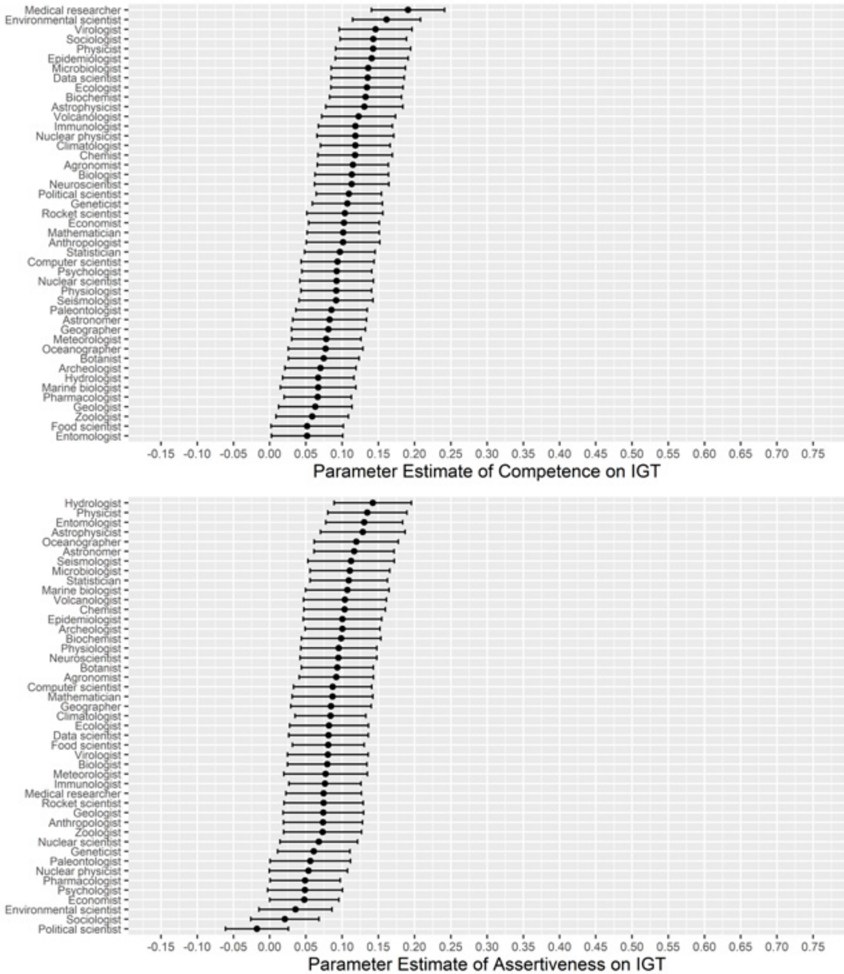
1. Task	*M* = 14.31 *SD* = 13.20 *Med* = 11.5			*M* = 32.67 *SD* = 25.90 *Med* = 28			*M* = 32.36 *SD* = 25.41 *Med* = 29		
2. Overall trust	.217 .198 .161			.286 .293 .225			.221 .200 .147		
3. Trust or distrust	.211 .195 .148	.744 .557 .482		.325 .263 .208	.762 .764 .657		.189 .179 .128	.801 .779 .687	
4. Influence/ control	.358 .361 .278	.531 .485 .409	.549 .484 .388	.219 .192 .140	.488 .449 .372	.627 .595 .479	.271 .278 .197	.628 .620 .531	.603 .587 .470
Oceanographer									
	1.	2.	3.	1.	2.	3.	1.	2.	3.
1. Task	*M* = 13.06 *SD* = 14.16 *Med* = 10			*M* = 28.88 *SD* = 25.86 *Med* = 28			*M* = 36.57 *SD* = 25.44 *Med* = 32		
2. Overall trust	.168 .130 .111			.283 .209 .160			.254 .323 .257		
3. Trust or distrust	.086 .021 .018	.639 .570 .497		.301 .208 .153	.730 .748 .640		.232 .273 .203	.512 .569 .502	
4. Influence/ control	.326 .403 .311	.481 .465 .386	.454 .384 .311	.406 .362 .264	.506 .503 .404	.698 .668 .538	.280 .316 .228	.530 .512 .426	.537 .474 .386
Physicist									
	1.	2.	3.	1.	2.	3.	1.	2.	3.
1. Task	*M* = 15.28 *SD* = 14.43 *Med* = 12			*M* = 35.37 *SD* = 28.08 *Med* = 30			*M* = 37.89 *SD* = 24.97 *Med* = 31		
2. Overall trust	.084 .011 .013			.336 .332 .265			.307 .285 .225		
3. Trust or distrust	.176 .158 .119	.626 .605 .530		.428 .332 .248	.720 .709 .622		.186 .222 .164	.713 .799 .710	
4. Influence/ control	.279 .256 .197	.337 .300 .260	.588 .546 .444	.426 .372 .273	.492 .512 .425	.590 .548 .435	.263 .293 .217	.527 .528 .443	.621 .590 .480
Sociologist									

	1.	2.	3.	1.	2.	3.	1.	2.	3.
1. Task	*M* = 24.02 *SD* = 17.01 *Med* = 20			*M* = 35.19 *SD* = 23.82 *Med* = 32			*M* = 34.06 *SD* = 22.28 *Med* = 32		
2. Overall trust	.352 .328 .255			.330 .345 .260			.292 .268 .209		
3. Trust or distrust	.402 .381 .292	.777 .708 .606		.323 .326 .244	.857 .805 .713		.238 .184 .134	.865 .821 .725	
4. Influence/ control	.273 .252 .186	.531 .488 .402	.659 .599 .496	.323 .365 .265	.647 .597 .507	.672 .643 .530	.312 .344 .262	.703 .688 .589	.744 .735 .617

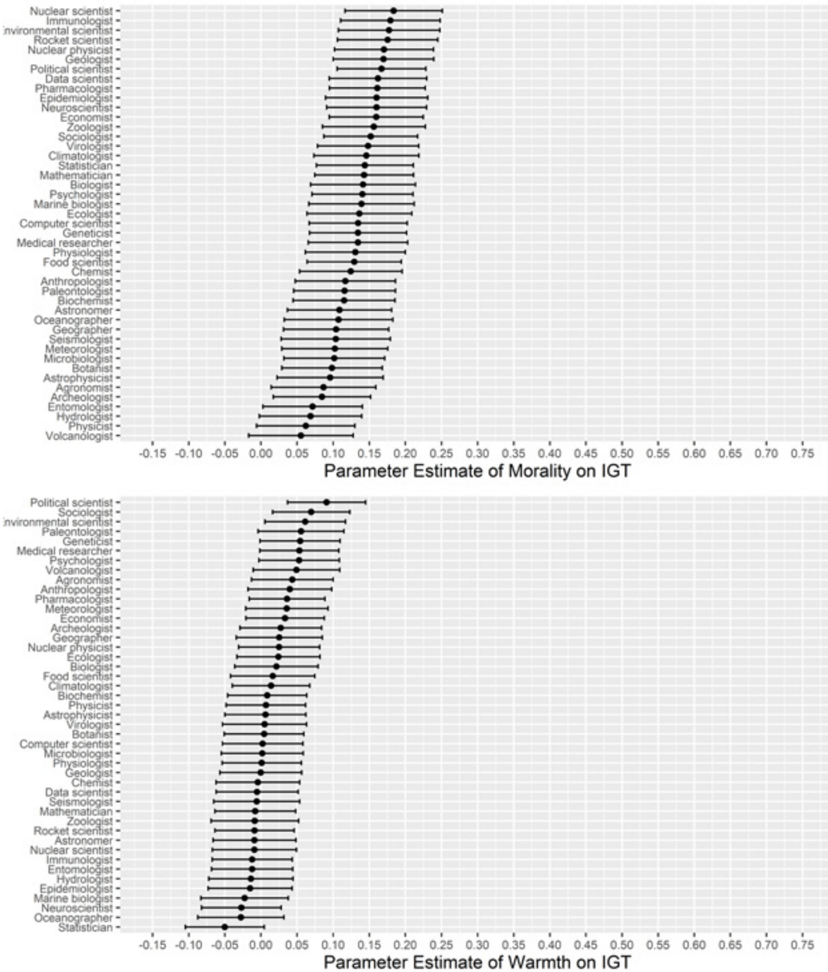
Note. *M* = Mean, *SD* = Standard deviation, *Med* = Median. We do not mark significance levels because we were not interested in inference, but in estimating (correlation) size



S1 Fig. Correlations between items measuring competence, assertiveness, morality, and warmth (each dimension was measured with five items). Stronger correlations are represented with stronger shades of blue.



S2A Fig. The estimates (beta coefficients, with 95% confidence intervals) of competence and assertiveness predicting influence granting for all 45 occupations. All estimates were uniform across occupations.



S2B Fig. The estimates (beta coefficients, with 95% confidence intervals) of morality and warmth predicting influence granting for all 45 occupations. All estimates were uniform across occupations.

Table S3. Multilevel model (with a random intercept for participants and occupations) in which social evaluation measures predict trust and IGT (influence granting task) when "trustworthy" is excluded from the calculation of morality dimension

	Trust		IGT	
	Fixed effects			
	β (Standard error)	*t* value	β (Standard error)	*t* value
Competence	.22 (.01)	23.44***	.11 (.01)	11.60***
Assertiveness	.06 (.01)	6.47***	.08(.01)	9.23***
Morality	.39 (.01)	38.94***	.13 (.01)	12.52***
Warmth	.09 (.01)	11.50***	.02 (.01)	2.082*
	Random effects			
$\tau_{00\ participant}$	.25		.63	
$\tau_{00\ occupation}$	.07		.03	
ICC	.53		.72	
Marginal R^2 / Conditional R^2	.42/ .73		.08/ .74	

Note. *** p <.001, * p <.05, τ_{00} = intercept variance, ICC = Intraclass correlation

Variances below are calculated from a model that contains random effects for all social evaluations.

Variances for the effects of competence, assertiveness, morality and warmth on trust across occupations were respectively .001, .001, .007, .003.

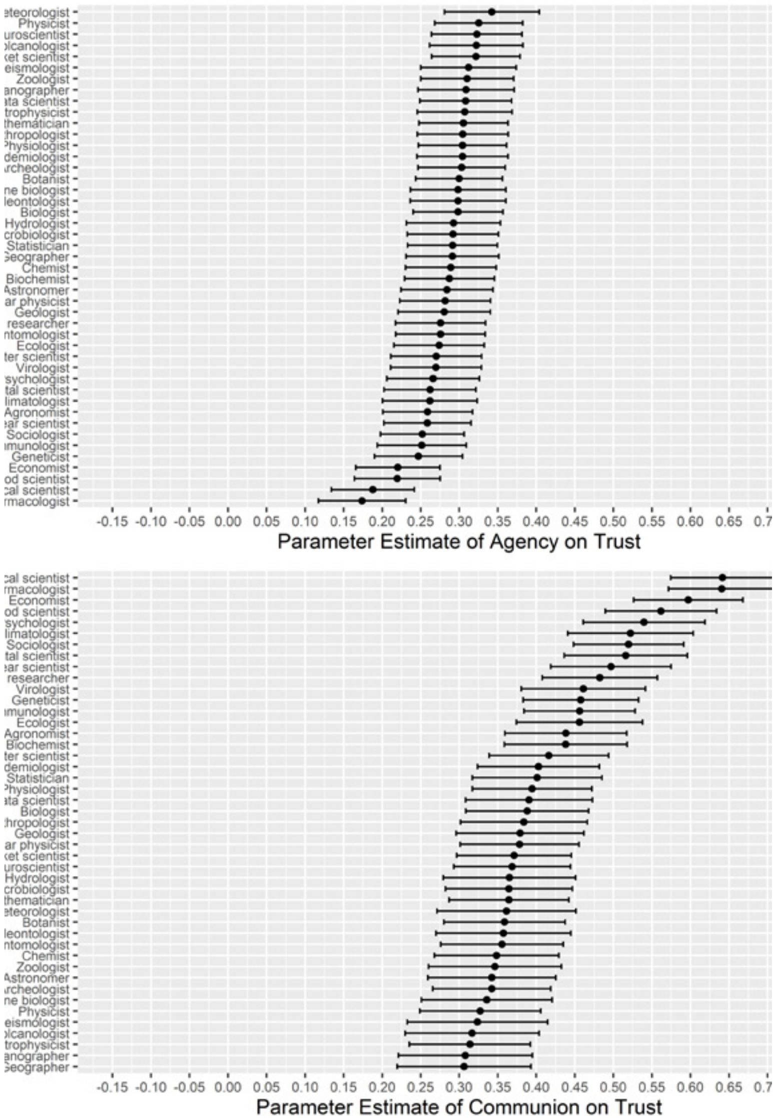
Variances for the effects of competence, assertiveness, morality and warmth on IGT across occupations were respectively .001, .002, .002, .002.

Random indirect effects by occupation were also calculated from two regression models. In contrast to the averaged effects mediation model, we allowed random slopes of social evaluations on trust. We also included the random effect of trust on IGT. In this way, indirect effects were calculated from models in which all paths could vary across occupations.

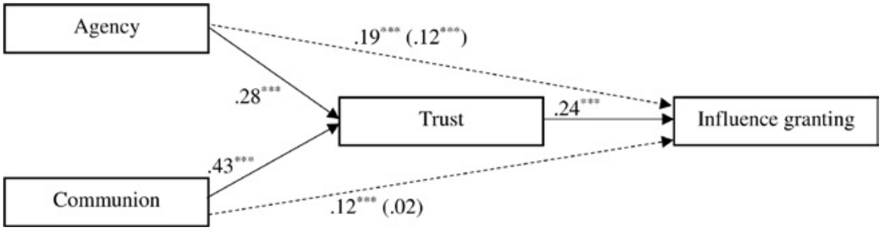
Table S4. Random indirect effects of competence, assertiveness, morality and warmth for each occupation (standardized)

Occupation	Competence	Assertiveness	Morality	Warmth
Agronomist	0.04	0.02	0.07	0.03
Anthropologist	0.04	0.01	0.10	0.01
Archeologist	0.03	0.01	0.05	0.02
Astronomer	0.05	0.02	0.09	0.01
Astrophysicist	0.05	0.02	0.08	0.02
Biochemist	0.05	0.01	0.12	0.02
Biologist	0.04	0.01	0.07	0.03
Botanist	0.04	0.01	0.07	0.01
Chemist	0.04	0.01	0.11	0.00
Climatologist	0.05	0.00	0.15	0.01
Computer scientist	0.04	0.01	0.10	0.02
Data scientist	0.05	0.02	0.13	0.02
Ecologist	0.05	0.01	0.12	0.02
Economist	0.04	0.00	0.15	0.03
Entomologist	0.04	0.01	0.07	0.01
Environmental scientist	0.04	0.00	0.13	0.01
Epidemiologist	0.06	0.02	0.13	0.02
Food scientist	0.03	0.01	0.09	0.02
Geneticist	0.04	0.01	0.09	0.02
Geographer	0.04	0.02	0.04	0.02
Geologist	0.04	0.01	0.09	0.02
Hydrologist	0.05	0.02	0.09	0.02
Immunologist	0.05	0.01	0.11	0.02

Marine biologist	0.04	0.01	0.08	0.01
Mathematician	0.05	0.01	0.11	0.01
Medical researcher	0.05	0.01	0.12	0.03
Meteorologist	0.03	0.00	0.10	0.00
Microbiologist	0.06	0.02	0.10	0.02
Neuroscientist	0.05	0.01	0.10	0.01
Nuclear physicist	0.04	0.01	0.11	0.01
Nuclear scientist	0.04	0.01	0.12	0.02
Oceanographer	0.04	0.02	0.07	0.01
Paleontologist	0.03	0.01	0.05	0.02
Pharmacologist	0.03	0.00	0.08	0.04
Physicist	0.05	0.02	0.10	0.02
Physiologist	0.04	0.01	0.09	0.02
Political scientist	0.03	0.01	0.12	0.04
Psychologist	0.04	0.00	0.13	0.02
Rocket scientist	0.05	0.01	0.10	0.02
Seismologist	0.04	0.02	0.07	0.01
Sociologist	0.03	0.01	0.10	0.02
Statistician	0.05	0.01	0.13	0.01
Virologist	0.05	0.01	0.13	0.02
Volcanologist	0.04	0.02	0.08	0.01
Zoologist	0.03	0.01	0.06	0.01

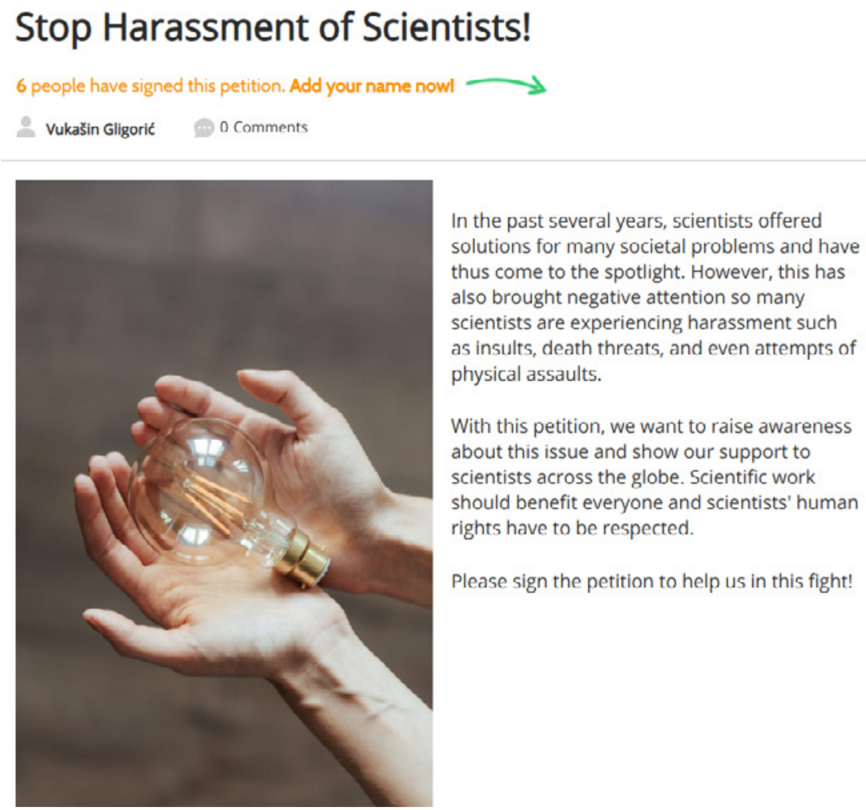


S3 Fig. The estimates of big two social evaluations (agency and communion) predicting trust for all 45 occupations. The estimates represent beta coefficients, with 95% confidence intervals.



S4 Fig. The effect of the big two (agency and communion) predicting influence granting via trust. The model is averaged across occupations and participants with random intercepts for both factors. Trust partially mediated the effects of agency and communion (respectively 35% and 82% proportion of mediated effect). Significant paths are marked with three asterisks (***p < .001). Direct effects are given within brackets.

Supplementary Material Chapter 5



Stop Harassment of Scientists!

6 people have signed this petition. **Add your name now!**

Vukašin Gligorić 0 Comments

In the past several years, scientists offered solutions for many societal problems and have thus come to the spotlight. However, this has also brought negative attention so many scientists are experiencing harassment such as insults, death threats, and even attempts of physical assaults.

With this petition, we want to raise awareness about this issue and show our support to scientists across the globe. Scientific work should benefit everyone and scientists' human rights have to be respected.

Please sign the petition to help us in this fight!

Figure S1. Petition against scientists' harassment presented to participants in Study 2.

Supplementary Material Chapter 6

Pilot Study 1

The relationship between political ideology and trust in scientists was investigated using data previously collected for another project (https://osf.io/d5zcj/?view_only=1126a1f95b214b76a252db67ceb61038). This study (Gligorić, Van Kleef, et al., 2024) recruited participants (*N* = 2780) through Prolific, with only US participants who had a minimum approval rate of 95/100 selected (1333 men, 1382 women, 65 indicated "other"; M_{age} = 39.03, SD_{age} = 14.93). Data collection took place in May 2022. Participants indicated their political ideology ("Please indicate your political orientation") using a seven-point scale (1 = *Liberal* to 7 = *Conservative*). They were next presented with six scientific occupations, which were randomly presented out of 45 used in the study. Participants rated how much they trust these scientists ("How much do you trust [occupation]?" using a seven-point scale, 1 = *do not trust at all* to 7 = *trust completely*) (Algan et al., 2021).

To determine the relationship between political ideology and trust in scientists, we ran a multilevel model (trust ratings were nested in participants and occupations). The model included a random intercept for both participants and occupations, and political ideology as a fixed effect. It also included a random slope for the effect of political ideology across occupations, so the relationship between ideology and trust for different occupations could be estimated. The analyses were pre-registered at https://osf.io/47zrd/?view_only=162adc1534a84e98af667cfcc87f7bab.

Multilevel modeling (ICC = .55) showed that trust varied both across participants (τ_{00} = .44) and occupations (τ_{00} = .07), and a fixed effect of political ideology indicated that liberals trusted scientists more (β = -.173 [-.123, -.223], t = -6.802, p < .001). Importantly, the effect of political ideology varied across different occupations, as indicated by random slopes variance (τ_{11} = .02). Including the random slopes in the model resulted in a better fit than the model without random slopes (LRT(2) = 288.4, $p < .001$). Indeed, as Figure S1 shows, liberals placed more trust in some of the occupations (e.g., environmental scientists, immunologists), while for other occupations there were no differences in trust between liberals and conservatives (e.g., pharmacologists). Importantly, occupations dealing with climate change seem to be the most polarized, followed by occupations dealing with medical science/vaccination and social issues. Higher trust among liberals in other occupations seemed to be less variable, except for conservatives' preference for computer scientists and economists, whose nature of work indeed might be more aligned with conservative worldviews (e.g., a focus on economic productivity). In sum, liberals seem to trust scientists more, whereas this ideological polarization in trust is especially pronounced for groups of scientists that work on hot-button topics such as climate change, medical research (COVID-19) and social issues like inequality.

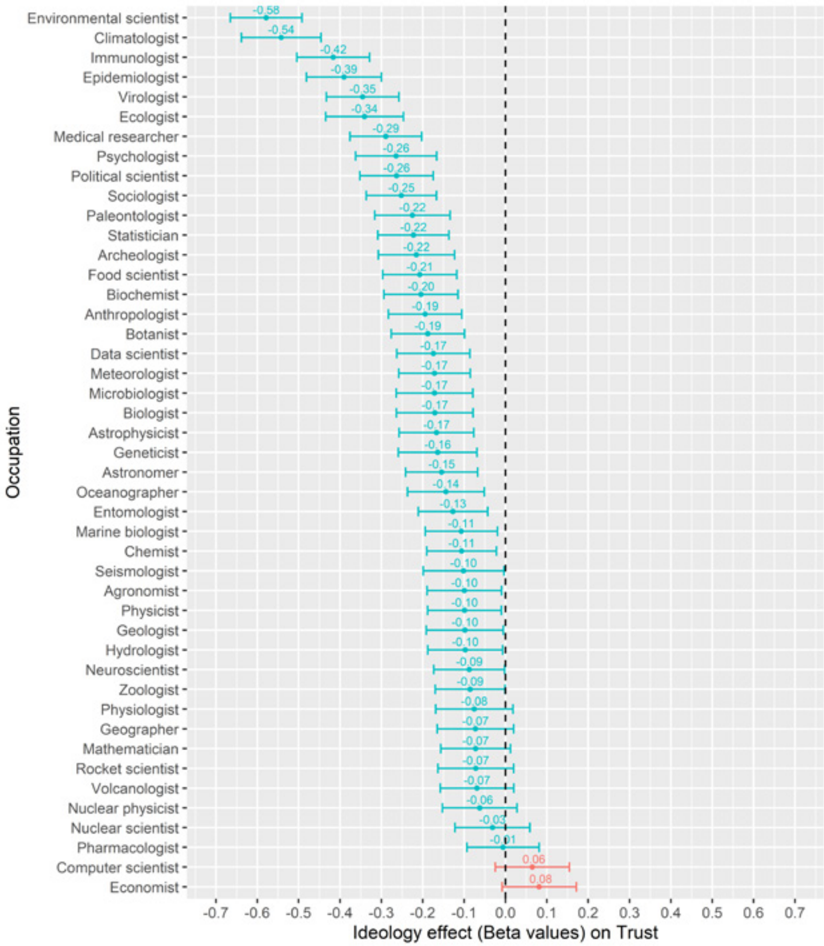


Figure S1. The relationship between political ideology and trust in scientists across different occupations (beta values), accompanied with 95% confident intervals of the effect size. In general, liberals trusted scientists more, but the effect depended on scientific occupation in question, largely due to several occupations for which liberals indicated much higher trust, and two of them for which conservatives indicated higher trust.

Pilot Study 2

Based on the five strategies identified to increase trust among conservatives, we developed interventions drawing from factual information (none of the text interventions involved deception). The goal of Pilot Study 2 was to test the validity of these theory-based interventions, by investigating whether they are perceived as believable, accurate, true, comprehensible, and fitting a conservative outlook. For four of the strategies, two intervention versions were designed and tested. For the source credibility strategy, we tested the respective impact of referring to one of 10 different public conservatives on trust in science (five politicians and five intellectuals).

We recruited 201 participants from Prolific US (119 females, 82 males; M_{age} = 40.99, SD_{age} = 13.53), preselecting only ideological moderates and conservatives (because in the main study, only conservatives were exposed to interventions) using the Prolific filter. Data collection took place in February 2023. Each participant was presented with one version of all five texts and asked to rate the information they read on how unbelievable or believable, inaccurate or accurate, false or true, and incomprehensible or comprehensible they thought it was, using 5-point bipolar scales. Participants were also asked to indicate to what extent they believed the information they read would appeal to a person with a politically conservative outlook (5-point bipolar scale, *it does not fit at all* to *it fits completely*). Factor analysis showed that, for each intervention, these items loaded on a single factor. Therefore, one rating of the perceived validity of the information was calculated for each intervention. We set out to develop interventions that would produce perceived validity scores above the scale mean of three ($M > 3$).

The five strategies, the respective interventions (two versions) based on the strategies, and their perceived validity levels are given in Table S1. Appeal ratings are followed by a one-sample *t*-test which compared whether mean ratings are higher than 3. As evident from the table, all interventions had relatively high appeal ratings (higher than 3), except the first version of the descriptive norms (confidence in scientists) strategy. In deciding on which version to select when both of them had an appeal higher than 3, we opted for the one that had a higher effect size. There were three exceptions to this. The first exception is the selection of the value-based frame without the photo of the flag and eagle because, as reviewers noted, it is unclear whether a potential effect would be caused by the text or the photo. Secondly, in the source credibility strategy, we selected Henry Kissinger (instead of Ronald Reagan), because we wanted to include more diverse political occupations (rather than two presidents). Finally, given the reviewers' concerns that the term "ideological polarization" in the descriptive norm condition is loaded, we decided to replace it with a more neutral alternative (see original and edited versions in Table S1). Versions selected for the main study are in bold.

Table S1. Overview of five strategies, intervention versions and their appeal. Versions of interventions selected for the main study are in bold.

Strategy	Intervention Version 1	Appeal ratings	Intervention Version 2	Appeal ratings
Value-based frame	**Many scientists work to preserve the world we live in and protect it against various natural and societal threats. They actively engage to conserve the order of the communities we love, giving us a sense of security and stability.**	$M = 3.724$; $SD = .855$; $t(101) = 8.551$, $p < 001$, $d = .847$ [.619, 1.071]	Many scientists work to preserve the world we live in and protect it against various natural and societal threats. They actively engage to conserve the order of the communities we love, giving us a sense of security and stability. *(In the form of pamphlet with an American flag and eagle)*	$M = 3.685$; $SD = .702$; $t(98) = 9.704$, $p < 001$, $d = .975$ [.734, 1.213]
Co-benefits frame	Many scientists work to develop new jobs and promote technological innovation, actively contributing to the economy. Scientists are believed to directly contribute to a substantial share of the Gross Domestic Product each year.	$M = 3.620$; $SD = .842$; $t(109) = 7.719$, $p < 001$, $d = .736$ [.524, .945]	**Many scientists work to develop new jobs and promote technological innovation, actively contributing to the economy. In certain countries, it is estimated that scientists directly contribute as much as 11% to the Gross Domestic Product each year.**	$M = 3.582$; $SD = .685$; $t(90) = 8.113$, $p < 001$, $d = .850$ [.609, 1.089]

Descriptive norms (confidence in scientists)	Recent research shows that scientists are among the most trusted professions in the US. Various surveys with representative samples in the US found that a majority of conservative respondents reported high levels of confidence in scientists.	M = 3.138; SD = .885; t(101) = 1.616, p = .055, d = .156 [-.035, .347]	**Recent research shows that scientists are among the most trusted professions in the US. Various surveys with representative samples in the US found that a majority of conservative respondents (over 70%) reported high levels of confidence in scientists.**	M = 3.191; SD = .935; t(101) = 1.985, p = .025, d = .205 [.000, .408]
Source credibility	Over the course of the last 75 years, various respected conservatives have publicly signaled their trust in scientists. For example, conservative politicians such as [*randomly inserting one politician*] relied heavily on scientists' input on various issues, whereas many scientists and intellectuals such as [*randomly inserting one intellectual*] were conservatives themselves.	*Politicians (selected ones are in bold)*: **Henry Kissinger** (M = 3.640; SD = .726; t(39) = 5.573, p < .001, d = .881 [.511, 1.243]) Ronald Reagan (M = 3.750; SD = .764; t(39) = 6.206, p < .001, d = .981 [.599, 1.355]) **George W. Bush** (M = 3.705; SD = .725; t(39) = 6.153, p < .001, d = .973 [.591, 1.346]) John McCain (M = 3.515; SD = .801; t(39) = 4.066, p < .001, d = .643 [.298, .980]) Arnold Schwarzenegger (M = 3.698; SD = .856; t(40) = 5.220, p < .001, d = .815 [.457, 1.165]) *Intellectuals/scientists (selected ones are in bold)*: **William F. Buckley** (M = 3.718; SD = .774; t(43) = 6.152, p < .001, d = .927 [.569, 1.278]) Thomas Sowell (M = 3.635; SD = .810; t(39) = 4.958, p < .001, d = .784 [.425, 1.135]) **Ayn Rand** (M = 3.746; SD = .628; t(36) = 7.222, p < .001, d = 1.187 [.760, 1.605]) Milton Friedman (M = 3.668; SD = .833; t(40) = 5.140, p < .001, d = .803 [.446, 1.152]) Kerry Emanuel (M = 3.538; SD = .813; t(38) = 4.135, p < .001, d = .662 [.311, 1.006])		

Descriptive norms (conser-vatives as scientists)	**[original version]** Although there seems to be ideological polarization about the role of science in society, many scientists in fact consider themselves conservatives. Currently, there are approximately 400 000 conservative scientists working in the US alone. **[edited version] Although there are ideological differences among scientists, many scientists in fact consider themselves conservatives. Currently, there are approximitely 400 000 conservative scientists working in the US alone.**	*M* = 3.374; *SD* = .782; *t*(108) = 4.999, *p* < 001, *d* = .479 [.280, .676]	Although there seems to be ideological polarization about the role of science in society, many scientists consider themselves conservatives. In fact, many of almost 10 million conservatives who have post-graduate degree work as scientists.	*M* = 3.337; *SD* = .898; *t*(91) = 3.600, *p* < 001, *d* = .375 [.163, .586]

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English summary

Scientists have saved and improved billions of lives. Today, they are at the forefront of combating large-scale societal challenges, from climate change and pandemics to social inequalities and conflicts. These challenges, along with proposed scientific solutions, have placed scientists in the spotlight. Nevertheless, research on perceptions of scientists remains limited – particularly on how the public views scientists, where these views stem from, and what their outcomes are. This hinders both our understanding of how such a prominent social group is viewed and how scientific solutions, especially needed in times of crisis, could be effectively implemented. Across 15 empirical studies (total N = 14,162), this dissertation examined the structure, antecedents, and outcomes of perceptions of scientists.

The first empirical chapter (Chapter 2) systematically examined the perceptions of various groups of scientists (from agronomists to zoologists) in the UK and the US. First, we discovered that although participants identified a wide range of scientific groups, chemists, biologists, and physicists were the most commonly mentioned, comprising the most representative of the category of *scientists*. Next, we discovered that the public has positive perceptions of scientists, seeing them as extremely competent, very moral and assertive, and moderately warm. Crucially, however, the public distinguishes between different groups of scientists (e.g., neuroscientists are perceived as more competent than sociologists). Extending these findings in the next chapter (Chapter 3), we investigated the role of social evaluations (perceptions of competence, assertiveness, warmth, and morality) in predicting trust in scientists. We found that trust in scientists was relatively high (means around 5 on a 7-point scale), although it varied across different scientists (e.g., political scientists and economists were least trusted). Perception of morality was the strongest predictor of trust, followed by perception of competence. Importantly, the role of morality perceptions

in trust varied across different occupations – morality was a stronger predictor of trust for scientists who work on polarizing topics such as climatologists and medical researchers, than those who do not such as archeologists. Overall, these two chapters demonstrated how acknowledging the diversity of scientific occupations leads to a better understanding of the public views of scientists.

Chapter 4 integrated two distinct lines of research on the perceptions of scientists – one on the stereotypical image of scientists (scientists viewed as white old men in lab coats, with beards and glasses, surrounded by lab equipment) and the other on social evaluations described previously (e.g., views of how competent or moral scientists are). This chapter demonstrated that stereotypes and social evaluations of scientists are indeed distinct types of perceptions as they correlate only slightly, with association to different worldviews (political ideology predicts social evaluations, whereas religiosity and Western enculturation predict stereotypes). Additionally, unlike stereotypes, only positive social evaluations predicted higher trust in scientists, whereas both related to the appeal of a science career.

Unfortunately, perceptions of scientists can be extremely negative: Many scientists working on COVID-19 (but also other issues that polarize the public) have experienced harassment such as doxing, death threats, and even attempts of lynching. These experiences were a key driver for Chapter 5, which investigated potential contributors to these negative perceptions. Integrating three different theoretical perspectives (motivational accounts of science attitudes, radicalization framework, and personality differences), this chapter found that science cynicism (views of scientists as incompetent and corrupt) crucially predicts approving attitudes towards the harassment of scientists. Perceptions of scientists as threatening, as well as dark personality traits (psychopathy and narcissism), were additional contributing factors.

The final empirical chapter (Chapter 6) constitutes the largest project of the dissertation. This chapter investigated the relationship between political ideology and trust in scientists by integrating findings on the importance of scientists' diversity and the role of political ideology in the perceptions of scientists. The first part of the research demonstrated that in the US, liberals tend to trust scientists more than conservatives across a broad range of scientific fields. In the pilot study, liberals indicated higher trust in 43 out of 45 scientific occupations, while in the main study, they reported higher trust in all of the 35 included occupations. The second part of the study, conducted as a registered report, tested five theoretically-informed interventions aimed at increasing conservatives' trust in scientists. However, none of the interventions increased trust, suggesting that intervention studies in the field of science communication may not be as successful as previously assumed. These non-significant results inform the discussion on the possibility of changing stable attitudes like trust in scientists, and the replication crisis in the field. Finally, the general discussion examines how the broader socio-economic system of neoliberal capitalism, through facilitating questionable research practices, might be responsible for producing 'corrupt science' in applied research (due to profit-driven motives, corporatization, industry science) and the replication crisis in basic research (due to 'publish or perish' culture, competition, sensationalism), consequently reducing trust in scientists.

In conclusion, the present dissertation explored public perceptions of various scientists, the role of worldviews in these perceptions, and their potential consequences—from unconditional trust to harassment and violence. Acknowledging the crucial role scientists hold in society, this research will hopefully contribute to fostering more positive perceptions of scientists and help facilitate the implementation of scientific solutions to society's most pressing challenges.

Nederlands samenvatting

Wetenschappers hebben miljarden levens gered en verbeterd. Tegenwoordig staan zij aan de frontlinie in de strijd tegen grootschalige maatschappelijke uitdagingen, van klimaatverandering en pandemieën tot sociale ongelijkheden en conflicten. Deze uitdagingen, samen met voorgestelde wetenschappelijke oplossingen, hebben wetenschappers in de schijnwerpers geplaatst. Desondanks blijft het onderzoek naar de percepties van wetenschappers beperkt – vooral over hoe het publiek wetenschappers ziet, waar deze percepties vandaan komen en wat de gevolgen zijn. Dit belemmert zowel ons begrip van hoe zo'n prominente sociale groep wordt gezien, als de effectieve implementatie van wetenschappelijke oplossingen, die vooral in tijden van crisis nodig zijn. In 15 empirische studies (totaal N = 14.162) heeft deze dissertatie de structuur, antecedenten en gevolgen van percepties van wetenschappers onderzocht.

Het eerste empirische hoofdstuk (Hoofdstuk 2) heeft systematisch de percepties van verschillende groepen wetenschappers (van agronomen tot zoölogen) in het VK en de VS onderzocht. Ten eerste ontdekten we dat, hoewel deelnemers een breed scala aan wetenschappelijke groepen identificeerden, chemici, biologen en natuurkundigen de meest genoemde waren, wat hen de meest representatieve groep wetenschappers maakte. Vervolgens ontdekten we dat het publiek een positieve perceptie van wetenschappers heeft; wetenschap worden beschouwd als extreem competent, zeer moreel en assertief, en gematigd warm. Cruciaal is echter dat het publiek onderscheid maakt tussen verschillende groepen wetenschappers (neurowetenschappers worden bijvoorbeeld als competenter gezien dan sociologen). In het volgende hoofdstuk (Hoofdstuk 3) hebben we de rol van sociale evaluaties (percepties van competentie, assertiviteit, warmte en moraliteit) onderzocht in de voorspelling van vertrouwen in wetenschappers. We vonden dat het vertrouwen in wetenschappers relatief hoog was (gemiddelden rond 5 op een 7-puntschaal), hoewel dit varieert tussen verschillende wetenschappers (politicologen en economen werden bijvoorbeeld het minste vertrouwd). De perceptie van moraliteit was de sterkste voorspeller van vertrouwen, gevolgd door de perceptie van competentie. Belangrijk is dat de rol van moraliteit in vertrouwen varieerde tussen verschillende beroepen – moraliteit was een sterkere voorspeller van vertrouwen voor wetenschappers die werken aan polariserende onderwerpen zoals klimatologen en medisch onderzoekers, dan voor degenen die dat niet doen, zoals archeologen. Al met al toonden deze twee hoofdstukken aan hoe het erkennen van de diversiteit van wetenschappelijke beroepen leidt tot een beter begrip van de publieke percepties van wetenschappers.

Hoofdstuk 4 integreerde twee verschillende onderzoeksrichtingen over de percepties van wetenschappers – één over het stereotiepe beeld van wetenschappers (wetenschappers als oudere witte mannen in laboratoriumjassen, met baarden en brillen, omringd door laboratoriumapparatuur) en de andere over sociale evaluaties die eerder zijn beschreven (bijv. opvattingen over hoe competent of moreel wetenschappers zijn). Dit hoofdstuk toonde aan dat stereotypen en sociale evaluaties van wetenschappers inderdaad verschillende soorten percepties zijn, aangezien ze slechts matig correleren, met associatie met verschillende wereldbeelden (politieke ideologie voorspelt sociale evaluaties, terwijl religiositeit en westerse enculturatie stereotypen voorspellen). Bovendien, in tegenstelling tot stereotypen, voorspelden alleen positieve sociale evaluaties een hoger vertrouwen in wetenschappers, terwijl beide gerelateerd waren aan de aantrekkingskracht van een carrière in de wetenschap.

Helaas kunnen percepties van wetenschappers extreem negatief zijn: veel wetenschappers die aan COVID-19 werken (maar ook andere kwesties die het publiek polariseren) hebben te maken gehad met intimidatie zoals doxing, doodsbedreigingen en zelfs pogingen tot lynchen. Deze ervaringen waren een belangrijke drijfveer voor Hoofdstuk 5, dat potentiële bijdragers aan deze negatieve percepties onderzocht. Door drie verschillende theoretische perspectieven te integreren (motivationale verklaringen van attitudes ten opzichte van wetenschap, radicaliseringskader en persoonlijkheidsverschillen), vond dit hoofdstuk dat wetenschappelijke cynisme (opvattingen over wetenschappers als incompetent en corrupt) een cruciale voorspeller is van goedkeurende houdingen ten opzichte van de intimidatie van wetenschappers. Percepties van wetenschappers als bedreigend en donkere persoonlijkheidseigenschappen (psychopathie en narcisme) droegen ook bij aan deze houdingen.

Het laatste empirische hoofdstuk (Hoofdstuk 6) vormt het grootste project van de dissertatie. Dit hoofdstuk onderzocht de relatie tussen politieke ideologie en vertrouwen in wetenschappers door bevindingen over het belang van diversiteit onder wetenschappers en de rol van politieke ideologie in de percepties van wetenschappers te integreren. Het eerste deel van het onderzoek toonde aan dat in de VS, liberalen de neiging hebben meer vertrouwen te hebben in wetenschappers dan conservatieven in een breed scala van wetenschappelijke gebieden. In de pilotstudie gaven liberalen een hoger vertrouwen aan in 43 van de 45 wetenschappelijke beroepen, terwijl ze in de hoofdstudie hoger vertrouwen meldden in al de 35 opgenomen beroepen. Het tweede deel van de studie, uitgevoerd als een geregistreerd rapport, testte vijf theoretisch geïnformeerde interventies die gericht waren op het vergroten van het vertrouwen van conservatieven in wetenschappers. Geen van de interventies vergrootte echter het vertrouwen, wat suggereert dat interventiestudies op het gebied van wetenschappelijke communicatie mogelijk niet zo succesvol zijn als eerder werd aangenomen. Deze niet-significante resultaten informeren de discussie over de mogelijkheid om stabiele houdingen zoals vertrouwen in wetenschappers te veranderen, en de replicatiecrisis in het veld. Tot slot onderzoekt de algemene discussie hoe het bredere socio-economische systeem van neoliberale kapitalisme, door het vergemakkelijken van twijfelachtige onderzoekspraktijken, verantwoordelijk kan zijn voor het produceren van 'corruptie wetenschap' in toegepast onderzoek (vanwege winstgedreven motieven, corporatisering, industrie-gerelateerde wetenschap) en de replicatiecrisis in fundamenteel onderzoek (door 'publiceer of verga' cultuur, concurrentie, sensatiezucht), wat uiteindelijk het vertrouwen in wetenschappers vermindert.

Samenvattend heeft deze dissertatie de publieke percepties over verschillende wetenschappers, de rol van wereldbeelden in deze percepties en hun potentiële gevolgen – van onvoorwaardelijk vertrouwen tot intimidatie en geweld – verkend. Door de cruciale rol die wetenschappers in de samenleving spelen te erkennen, zal dit onderzoek hopelijk bijdragen aan het bevorderen van positievere percepties van wetenschappers en helpen bij de implementatie van wetenschappelijke oplossingen voor de meest urgente uitdagingen die we momenteel hebben in de samenleving

Authors' Contributions and Funding

Authors' Contributions by Empirical Chapters

Chapter 2: Social Evaluations of Scientific Occupations

Vukašin Gligorić carried out the initial idea, conception, and design; data collection, analysis, and interpretation; drafted the article and revised it critically for important intellectual content.
Gerben van Kleef and Bastiaan Rutjens carried out the design, data interpretation, and supervision; revised the article critically for important intellectual content.

Chapter 3: How Social Evaluations Shape Trust in 45 Types of Scientists

Vukašin Gligorić carried out the initial idea, conception, and design; data collection, analysis, and interpretation; drafted the article and revised it critically for important intellectual content.
Gerben van Kleef and Bastiaan Rutjens carried out the design, data interpretation, and supervision; revised the article critically for important intellectual content.

Chapter 4: Stereotypes and Social Evaluations of Scientists are Related to Different Antecedents and Outcomes

Vukašin Gligorić carried out the initial idea, conception, and design; data collection, analysis, and interpretation; drafted the article and revised it critically for important intellectual content.
Roy Clerc and Gabi Arkensteijn contributed to the design and drafting of the article, and conducted data collection in Study 1
Gerben van Kleef and Bastiaan Rutjens carried out the design, data interpretation, and supervision; revised the article critically for important intellectual content.

Chapter 5: Who Harasses Scientists? The Role of Worldviews, Radicalization Risk Factors, and Personality in Violent Behavior Toward Scientists

Vukašin Gligorić carried out the initial idea, conception, and design; data collection, analysis, and interpretation; drafted the article and revised it critically for important intellectual content.
Carlotta Reinhardt carried out the data analysis and interpretation, drafted the article, and revised it critically for important intellectual content.
Ella Nieuwenhuijzen and Josha Orobio de Castro conducted data collection in Study 1, contributed to the study design, drafted and revised the article.
Allard Feddes, Gerben van Kleef and Bastiaan Rutjens carried out the design, data interpretation, and supervision; revised the article critically for important intellectual content.

Chapter 6: Political Ideology and Trust in Scientists

Vukašin Gligorić carried out the conception and design; data collection, analysis, and interpretation; drafted the article and revised it critically for important intellectual content; carried out the initial idea on the relation between political ideology and trust in scientists.
Gerben van Kleef and Bastiaan Rutjens carried out the design, data interpretation, and supervision; revised the article critically for important intellectual content. Gerben van Kleef also carried out the initial idea on interventions.

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Finally, there is one person to whom I owe everything listed and everything unsaid. From the highways of Morocco and the waves of Indonesia, to military checkpoints (and rockets!) in Palestine and (not entirely legal) crossings into the occupied part of Cyprus, our escapades will forever be woven into my being. I do not know if *anyone* else can possess such selflessness and provide such freedom. I am bound to say that there is no part of my academic work or this dissertation we have not discussed. I am bound to say there is no talented person like You. I am bound to say that no one knows more about my work, my political principles, my life than You. I am bound to say that I owe everything to You. *Hasta te creo dueña del universo*. Iva, I hope that in eternity, I can repay that debt.

Amsterdam, 2024
Vukašin

ZAHVALNICA

Kako bi Neruda *umalo* rekao - *noćas bih mogao napisati najduže redove*. Zaista, ne postoji dovoljan broj reči i stranica koje bi mogle, ni u najmanjoj meri, da približe dug koji imam i zahvalnost koju osećam prema ljudima koji su deo mog života. Zaista, ova teza nije rezultat četvorogodišnjeg rada. Ona je rezultat nesebične ljubavi, podrške i vere ogromnog broja ljudi koji su, u najmanju ruku ostavili predubok trag u ovoj disertaciji; u veću ruku, oni su je pisali kroz mene. Zaista, ovaj rad pripada *vama*.

Nisam dugo razmišljao kako da otpočnem ovaj deo. U skladu sa svojim filozofskim uverenjima istorijskog materijalizma, najbolje je početi *ispočetka* (materijalnih okolnosti). Glavnu ulogu u mom postojanju, pogodićete, odigrali su moji roditelji. Ne mislim ovo samo u fizičkom smislu, već i akademskom. Potpuno nova definicija ljubavi, odricanja i žrtvovanja dobila je svoj oblik kroz njih. Svom ocu (ili bolje rečeno, *ćalcu*), Milovanu, dugujem intelektualnu radoznalost, ljubav prema znanju, interes za politiku, i neodoljivu želju za kontriranjem. Nismo imali ni dvocifren broj godina, brat i ja bismo u dugim vožnjama sa ćalcom saznali da je albatros ptica sa najvećim rasponom krila, da je sekvoja najviše drvo na svetu i da postoji država na slovo „Dž" (Džibuti). Nije slučajnost što me ćalac baš danas pitao gde je neka njegova davno izgubljena Larusova enciklopedija (doduše nije iznenađujuće s obzirom da ovo pitanje postavlja jednom mesečno). Ćalac će uvek biti naša enciklopedija. Svojoj majci (takođe poznatoj kao *kevi*), Slađani, dugujem pragmatičnost, organizovanost, samopouzdanje i veru u sebe. Kevo, koliko su ti puta „uši bile ovolike", koliko puta si htela da prodaš stan za moje obrazovanje i koliko si puta stala iza mene ma koliko god da sam bio u krivu. Keva će uvek biti naš Tajson (ne šalim se, to joj je bio nadimak u *nezgodnim* krugovima Vrnjačke Banje) i samostalni preduzetnik (više samostalni nego preduzetnik, ali bez brige, sledeće godine postajemo *milioneri*). Dušanu (aka Doox-u iz Sombora) sam beskrajno zahvalan što je svoju ulogu velikog brata odigrao gotovo udžbenički – da li u Americi na arbajtu kada je trebalo švercovati se u smeštaju ili naći posao, da li u ranim studentskim danima gubljenja u Beogradu ili u ranom detinjstvu u Vrnjačkoj Banji kada se neizbežno zapadalo u nezgodne situacije, *Gliga* je uvek tvrdoglavo bio uz mene. Takvi su samo ljudi ogromnog srca.

Drugom delu moje porodice dugujem jednako mnogo – prerano preminuloj babi Radi sam ostao dužan „pet banki" i najbolje palačinke na svetu, dedi Lazi dar za snalaženje (iliti *muljanje*). Dedi Milinku, koji nažalost neće pročitati ove redove, dugujem saznanje kako izgledaju ruke radničke, kako je Jugoslovenska firma gradila po Iraku, Ujedinjenim Arapskim Emiratima, i umalo u Libiji, kao i da Maksimu Gorkom to nije bilo pravo ime. Babi Peli dugujem bezuslovnu ljubav i briljantne izlive narodne mudrosti i instikta pravde. Evo malog dokaza njene snage: Pošto je bez problema cepala drva u 70-im godinama, rekao sam joj da je baba zmaj, na šta mi je baba lepo stavila do znanja da ona nije zmaj, već *zmajica*. Baba, nadam se da ćeš ozdraviti i da nam sledi još mnogo Božića, Usrksa i Svetog Nikole. Konačno, moja šira porodica – Živanovići, Stojančići/Ranisavljevići, Rankovići i Marjanovići – je odgovorna za moj osećaj sigurnosti i pružanju pomoći kad je trebalo; da li u poseti doktoru, najboljoj hrani ili pomoći na putu, znam da su tu uvek za mene. Zahvalnost dugujem i mnogim ljudima iz mog detinjstva iz Vrnjačke Banje koji su mi omogućili bezbrižno detinjstvo (takozvanom komšiluku Dubrave), a onda i Conetu, Fleksiću, Đapsu, koji kolike god da su *glave*, moje su. Cone, nadam se da ćeš jednom pobediti u MMA, Fleksiću, znaš šta sledi kada završiš faks, Đape, sledeći slučaj je *naš*. Marija, hvala što si znala da me čekaju dobre stvari. Koki-Stevo, hvala za Dejva. Hvala prijateljima mojih roditelja (a pre svega Čapi mangupu i Šumaru) koji su me oslovljavali sa *filozofe* dok još nisam ni u osnovnu školu pošao, i sa kojima i danas vodim bitne diskusije. Hvala Šapčanima, a pre svega Kaluu (čia semenčici) i Kikiju-Kipru što su bili tu kad god je trebalo.

Sa ovakvom porodicom i okruženjem, bilo je lako. Ipak, za moj intelektualni put i razvoj kao istraživača je nesumnjivo i potpuno odgovoran Filozofski Fakultet u Beogradu i posebno Odeljenje za Psihologiju. Dr Bilji Stanković dugujem najuzbudljiviju ideološku transformaciju i spas iz čeljusti (levog) liberalizma. Ulazak u nauku u potpunosti dugujem Prof. Vanji Ković (našoj akademskoj majci) i celom *labu* o kom bih mogao naširoko da pišem. Vanja, hvala što si me naučila šta je podrška, srdačnost i srčanost i pravilo da „Baja Bajić časti". Hvala što si me poslala na ovaj put na kom ni nakon više od 6 godina van Srbije nisam sreo osobu takve posvećenosti, altruizma i plemenitosti. Hvala što si nam odavno dala ključeve kancelarije i ključeve znanja, za sve slaniše i slatkiše, Voju (i njegove oštre političke

stavove), Anđelu (i njene blaže političke stavove) i sve druge. Hvala ti za Anu, kojoj dugujem nove redove. Ana (a uskoro i Dr Vilotijević), hvala ti za zajedničke prve korake u nauci, prve konferencije i vreme provedeno u labu. Hvala ti za naš prvi naučni rad (iskoristiću ovo mesto da se pohvalim da smo, bez ikakve supervizije, objavili naš prvi naučni rad sa moje 24, odnosno njene 22 godine). Hvala ti za duge i srčane diskusije koje umalo nisu eskalirale u nasilje kada smo se *svađali* oko Čomskog i Fukoa.

Ulazak u prva istraživanja u socijalnoj psihologiji dugujem ključnom momentu kada smo Bojana-Boka (uskoro Dr Većkalov) i ja pokucali na vrata Prof. Iris Žeželj sa rečima da „želimo da radimo neko istraživanje u oblasti verovanja u teorije zavere" (negde kasne 2017, mnogo pre nego što su istraživanja u ovoj oblasti bila kul). Ostalo je zaista istorija. Mada je ta ideja (inače veoma dobra) završila samo u zborniku konferencije, to će zauvek biti naše *prvo* pisanije u karijeri, i nastanak jako neobičnog dua koji je prošao mnogo više nego što se ovde može ispisati. Od ranih radova do pridruživanja istom labu u Amsterdamu za doktorat, od Boke sam naučio da istraživač može i mora biti temeljan, sistematičan i ozbiljan. Boko, zbog tebe sam konačno razumeo dinamiku braće Gallagher: kako neko ko je u stanju da stvori nešto zaista veliko i bitno istovremeno bude redovno na ivici svađa. Obožavam tu dinamiku i radujem se budućim projektima. Boki dugujem i činjenicu da je *skautovala* Mariju-Maku (uskoro Dr Petrović) kao izuzetno talentovanu i duhovitu osobu koja je ubrzo postala jedna od najbližih osoba sa kojom obožavam da razgovaram o političkim procesima, političkoj situaciji i političkim dešavanjima (i ako nije jasno, sa Makom izuzetno volim da pričam o politici). Ovde naravno treba i pomenuti i ostalu Irisinu decu, a pre svega kaminerose (i uskoro doktore) Pecu (hvala što mi pokazuješ da ima ciničnijih i tvrdoglavijih od mene) i Jovana (kakva blagost, čoveče). Iris, zauvek ću pamtiti tvoja predavanja i vežbe, kao i savet (koji sam, *kunem ti se*, usvojio) – da ne smem da šaljem ljudima hitan mejl u pet do dvanaest. Hvala što si mi pogledala CV i motivaciono kada sam se prijavljivao na master (inače, Iris je to uradila na ulazu u avion, uz opravdan prekor da mi to neće tolerisati u Amsterdamu); da nisi, ove disertacije vrlo verovatno ne bi bilo. Hvala celoj Irisinoj grupi (Milici, Lei, Marii) što ste sanirali moje gluposti u Južnoj Americi (ožiljak je, ipak, i dalje tu). Odeljenje za psihologiju na FF mi je podarilo i druge doživotne prijatelje – Staši, hvala što si osoba koja mi je najviše učinila u životu i što si jednostavno najbolja na svetu, Miljane, hvala što mogu da ti se poverim za bilo šta u životu. Hvala i Nataliji (mojoj novoj najboljoj Vračar-frendici), Mici (moj životni guru i inspiracija blagosti), Mini (večnom psihodinamskom tandemu) i ostatku neformalne grupe нео-пропаганда. Filozofskom dugujem i upoznavanje sa Andreom (hvala za kritičku školu kapitalizma), Cimerom (izuzetni sociolože, hvala za one duge, noćne i *oprezne* diskusije) i intelektualnim gromadama poput Marksa, Gramšija, Altisera, Fanona, Sezera, Fukoa.

Amsterdamu nesumnjivo dugujem najbolji deo života – od prijatelja sa istraživačkog mastera – Paskala (nadam se da ćemo džemovati uskoro), Džejmi (nadam se da ćeš uskoro naći vremena za kafu u svom *Dutch* rasporedu) i Emiru (čoveku koji je, ne šalim se, preživeo avionsku nesreću), do iskrene Zhen (samo sa pravim prijateljem možeš da dogovoriš viđenje u Vijetnamu nakon 5 godina hiljadukilometarske razdvojenosti). Ne postoje reči niti redovi koji bi približno mogli da opišu ono što Shenanigansi, najelitnija grupa prijatelja (i još elitnija whatsapp grupa) predstavlja u mom životu (verujte, odgovorno tvrdim da je *pola* Amsterdama čulo za ovu grupu). Davne 2018. čuo sam dvoje mladih i prepametnih ljudi – Martina i Jelenu – da govore *naš* jezik za stolovima CREA-e, trenutak nakon čega je moj život zauvek bio promenjen. Martine, šta god da se desi, nadam se ćemo uvek moći da slušamo Miršajmera zajedno i pričamo o Spinozi i Platonu. Jelena, kao što sam ti rekao – onog trenutka si postala moja sestra; zauvek ti hvala što si mi otkrila bogatstvo života i porušila zakone fizike (dokazom o *stvaranju energije* ni iz čega) i za nezaboravno leto '21 u Baru. Koni, habibi gusko, hvala što si tako divna osoba. Neopisivo mi je drago što smo postali nerazdvojni komradi iako sam ti, prilikom upoznavanja, satima držao monolog o Sovjetskom savezu (inače, Konrad je Litvanac); hvala što si me učio da sadim biljke i hvala što si nam priredio najmagičnije putovanje. Petra, nastavi da nas učiš kako da budemo hrabri, posvećeni i beskompromisni, i u potpunosti dekolonijalni. Mads, ti najtoplija i najluđa Francuskinjo, hvala što se trudiš oko nas, hvala za Pariz (i Sen Žermen), i hvala što si *classic Mads* – uvek ćemo se jedini razumeti pogledom kao dva ludaka kada sve oko nas *deluje* normalno. Strahinja, hvala što si moj mlađi/stariji investment bro, što mi pokazuješ da ima i većih bumera od mene, i što si ogromna dobrica koju svi roditelji vole (nastavljamo da brojimo kalorije). Toni cimi, ne mogu dovoljno da ti zahvalim što se uvek trudiš da probudiš intuitivni deo mene

i što si me inspirisao da odem na glumu (obećavam da ću nastaviti). Šta je ovo, Mad Max? Luiza, hvala što si moja nezapadna sestra (they told me not to get political). Bruno (man), hvala za muziku (i produkciju), pokušaj učenja holandskog, i što si uvek slušao o mom ***magnum opusu***; ostaću ti dužan jedno predavanje o ex-yu roku (šta ću, nisam više bumer). Hvala Duju, Pjekiju, Luki Saviću, Ari i Polu na nezaboravnom vremenu u Amsterdamu. Shenanigans, vi ste me naučili šta je toplina zajednice – naše legendarne žurke, haotičnost, putovanja, kašnjenja, najoriginalniji pokloni i provodi će ostati najbolji deo mog života. Od Soundgardena, Kriteriona i L'Afficha do De Schoola i stanova na Leidse i Prinsengrachtu; od Hrvatske, Crne Gore i novogodišnjeg Beograda do Pariza i Litvanije; vaša inteligencija, spontanost, kreativnost, otvorenost, hipertalenti, i potpuna komplementarnost su svedok jednog vremena: nadam se da ćemo jednom otvoriti taj kulturni centar. Rečima Kneza – what it's gonna beee... tonight? Činjenica da se svi drugari članova Shenanigansa (takozvano drugo koleno Shenanigansa) aktivno druže, da se nas 30-ak skupi u Beogradu za novu godinu, i da je u centru svega ovoga Bracki (od svinjarnika do krindžerske trojke i *koktela ljubavi*, voljen od svih), dovoljno govori o čvrstini našeg prijateljstva. Hvala ostalim prijateljima u Amsterdamu, Kseniji (drugarica i ekspert za kafu), Šarlot (skrivena Balkanka), Nun (najbolji introvert za Varufakisovu tribinu), bendu Sunbow Jurnay (Go Your Own Way ide u pozadini), cimerkama Tiffany i Nadi i ogromnom broju drugih koje ne stižem da pomenem. Posebno ističem svežeg jednog-od-najboljih prijatelja, princa od Bijeljine i grofa od Groningena, Luku Todorovića-Bosanca. Ne znam da li da ti se zahvalim na svim ručkovima, diskusijama (o ***doslovno*** svemu što čovek može da zamisli; mada je bolje po nas da ne zamišlja), tetovaži u Riju, rilovima, zajedničkom kritikovanju sistema, ili smejanja zbog kojeg često manično lupam o sto (kad god pogledam u mobilni i počnem da se smejem, Iva me pita 'je l' Luka?'). Ustvari, zahvaljujem ti se na svemu i nadam se da ćemo nekako pregurati moju selidbu.

Univerzitet u Amsterdamu mi je otvorio istraživačke puteve za koje nisam ni znao da postoje, od svakojakih statističkih modela do najkompleksnijih metodologija. Zbog toga je čin Dr Allarda Feddesa koji me je ohrabrio da sprovedem svoju ideju za istraživanje za master tezu (u Holandiji se ona inače radi tako što se student pridruži projektu svog mentora) utoliko veći. Hvala Allarde i na svim savetima i podršci; zbog tvog izvanrednog pedagoškog dara, o našem radu o političkom baljezganju se i dalje priča. Sličnu zahvalnost dugujem i Prof. Bertjanu Doosje-u. Hvala obojici što ste mi omogućili da predajem političku psihologiju – toliko toga sam naučio. Ogromnu zahvalnost dugujem svojim mentorima na doktorskoj tezi – Prof. Gerbenu van Kleefu i Dr Bastijanu Rutjensu. Gerbene, hvala što mi uvek postavljaš konceptualna pitanja i navodiš da razmišljam o čitaocu; obećavam da ću se *uskoro* vratiti na projekat o moralnim normama koji smo počeli pre 5 godina. Bastijane, hvala što si mi ukazao poverenje da radim na projektu; hvala na slobodi, filmskim citatima i na kolaborativnoj i opuštenoj atmosferi u našem labu; hvala što si dozvolio Srbima da ti čine pola istraživačkog tima. Obojici hvala što ste razumeli moju tvrdoglavost i način rada, koji priznajem, nije uvek najbolji za moje saradnike. Mnogo smo postigli. Obojici dugujem staru dobru Kubansku cigaru. Celom odeljenju za socijalnu psihologiju sam zahvalan na svim diskusijama, raspravama i ohrabrenju, kao i atmosferi ravnopravnosti. Mojoj najdražoj *companeri* Anastasiji, zahvalan sam što je unela duh Latinske Amerike i *kolektivizovala* mlađe članove odeljenja – zaista si pokazala da jedna osoba može da napravi pravu revoluciju. Hvala Saari (pozdravi mi Gava, tiha drugarice – izborićemo se da te izvučemo iz FCP-a), Enzu (mom novom companeru), Anni B (na insistiranju na vezi između kapitalizma i ekološke katastrofe), Anni S (na mnogim razgovorima o aktivizmu i Barseloni), Alaa-i (što smo vežbali moj egipatski arapski), Maien (nadam se da ću se jednom pridružiti onom bitnom sastanku), Kunalanu (klasa je uvek najbitnija), Yong-Qi (za najbolji stil oblačenja na odeljenju), kolegama iz kancelarije i to posebno Nili (uživaj u vikendu, collega!), Hanni (za višečasovne diskusije kada je zapravo trebalo da radimo), Nataliji (za nedovoljno tračeva), Rohanu (za najkičastije dekoracije koja jedna kancelarija može da ima), i svim drugim mlađim i starijim članovima osoblja koje ne stižem da pobrojim. Posebnu zahvalnost dugujem Anemik, koja drži stvari pod kontrolom i rado mi pomaže sa holandskim. Karlota, drago mi je što smo postali saradnici! Hvala i članovima moje komisije sa Univerziteta u Amsterdamu, koju čine Prof. David Amodio, Dr Katharina Block, Dr Bert Bakker i Dr Suzanne Oosterwijk; svestan sam da ovo nije uvek lak zadatak.

Zahvalan sam Njujorškom unvirzitetu (NYU) gde sam proveo dva meseca, a pre svega Profesoru Džonu Džostu, jednom od mojih najranijih intelektualnih uzora – nikada neću zaboraviti svoje ush-

ićenje kada sam prvi put video da je neko uspeo da prevede koncept lažne svesti u socijalnu psihologiju. Nisam ni sanjao da ćemo kasnije postati saradnici: Džone, dubina i širina tvog znanja je impresivna; nadam se da je ovo samo početak naše saradnje i da ćemo nastaviti sa našim (ne)slaganjima. Vrednost čoveka je odista u ljudima kojima je okružen, a tvoje je okruženje, Džone, zaista jedno od najplemenitijih i najposvećenijih koje sam susreo.

Konačno, postoji jedna osoba kojoj dugujem sve pobrojano i prećutano. Od autoputeva Maroka i talasa Indonezije, do vojnih kontrolnih punktova (i raketa!) u Palestini i (polu)legalnog prelaska u okupirani deo Kipra, naše eskapade će zauvek ostati utkane u moje biće. Ne znam da li *iko* može da poseduje takvu nesebičnost i takvo pružanje slobode. Dužan sam da kažem drugima da ne postoji deo mog naučnog rada niti ove disertacije koji nismo prodiskutovali. Dužan sam da kažem drugima da ne postoji talentovana osoba kao što si Ti. Dužan sam da kažem da niko ne zna više o mom stvaralaštvu, mojim političkim načelima, mom životu više od Tebe. Dužan da kažem da Tebi dugujem sve. *Hasta te creo dueña del universo*. Iva, nadam se da ću ti, u večnosti, isplatiti taj dug.

Amsterdam, 2024

Vukašin

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