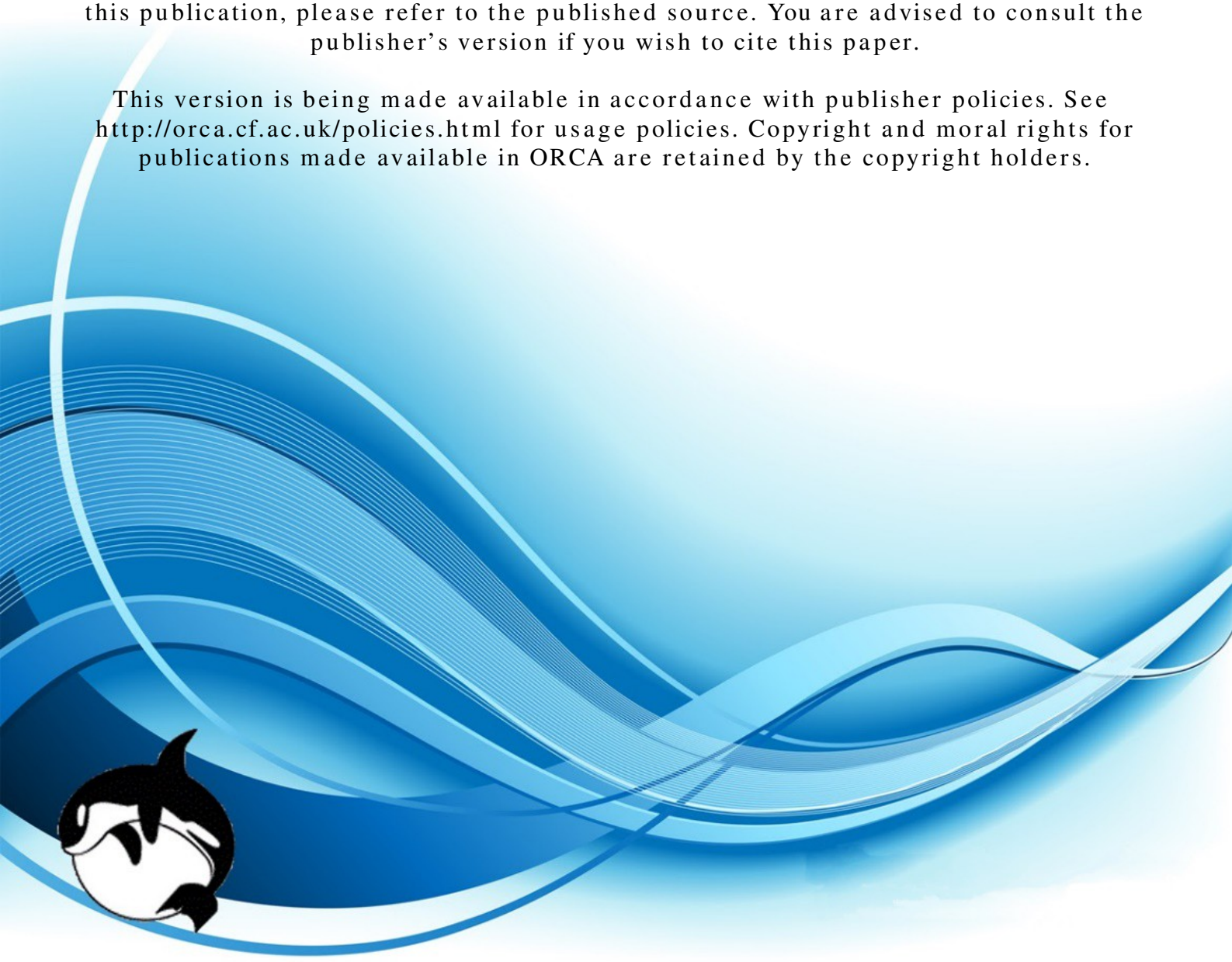

Left Out – Feelings of Social Exclusion Incite Individuals with High Conspiracy Mentality to Reject Complex Scientific Messages

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Abstract

We investigated linguistic factors that affect peoples' trust in science and their commitment to follow evidence-based recommendations, crucial for limiting the spread of COVID-19. In an experiment (N = 617), we examined whether complex (vs. simple) scientific statements on mask-wearing can decrease trust in information and its sources, and hinder adherence to behavioral measures. In line with former research on social exclusion through complex language, we also examined whether complexity effects are mediated via feelings of social exclusion. Results indicate that negative effects of text complexity were present, but only for participants with a strong conspiracy mentality. This finding informs how to increase trust in science among individuals with a high conspiracy mentality, a population commonly known for its skepticism towards scientific evidence.

Keywords: science communication, health communication, linguistic complexity, trust, social exclusion, conspiracy mentality, COVID-19

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Left Out – Feelings of Social Exclusion Incite Individuals with High Conspiracy Mentality to Reject Complex Scientific Messages

The COVID-19 pandemic has highlighted the importance of science communication for public health (Malecki et al., 2020; Wu et al., 2020). This is because successful handling of the pandemic requires citizens to conform to multiple voluntary measures that can prevent the spread of the virus. The effects of these soft policies are largely based on citizens' trust in scientific guidance and their adherence to scientific recommendations. Investigating which factors make scientific communication trustworthy and persuasive is thus a major challenge that, once addressed, can help curb the pandemic.

Science communication is defined as the use of appropriate skills, media, activities, and dialogue to produce one or more of the following personal responses to science: awareness, enjoyment, interest, opinion-forming, and understanding (Burns et al., 2003). To reach other scholars, scientists publish their findings on scientific platforms such as journals and formulate their message according to the discipline standards, usually employing professional jargon. This communication is directed towards other members of the scientific community, who by their training, have the skills required to understand and evaluate the merit of the empirical or theoretical articles. However, science communication can also be directed to the lay public. For this audience, scientific jargon can be hard to understand.

This difficulty can decrease the understanding of scientific findings and reduce trust in related statements and recommendations (e.g., Brashier & Marsh, 2020; Unkelbach & Greifeneder, 2018). Effective science communication, however, strongly depends on trust (Weingart & Guenther, 2016). Previous studies have suggested that low trust in science is associated with low acceptance of a wide range of scientific information, such as statements on evolution (Nadelson & Hardy, 2015), climate change (Grasswick, 2014), and vaccination (Palamenghi et al., 2020). Achieving good communication between the scientific community

and the lay public is even more important against the background of general skepticism towards science and the extensive spread of conspiracy theories during the COVID-19 pandemic (Bierwiaczonek et al., 2020; Earnshaw et al., 2020; Pummerer & Sassenberg, 2020).

Given that effective communication between the scientific community and the lay public can contribute to slowing down infections and decreasing death rates related to the COVID-19 pandemic, this research investigates the influence of complex vs. simple scientific texts on trust in scientific messages and on adherence to behavioral measures. We also examine how reading a complex message affects individuals' feelings of social exclusion and to what extent language complexity might specifically affect participants who have a strong conspiracy mentality. To increase the inclusion of the latter group into the evidence-based discourse around science, we end this article with an appeal for the use of more readable scientific language.

Linguistic Complexity as a Stumbling Block in Science Communication

Over the past decades, research has repeatedly shown that, compared to complex language, the use of plain or simple language positively affects text comprehension (e.g., Crossley et al., 2014; Masson & Waldron, 1994; Mesmer & Hiebert, 2015; Taylor, 1979), recall (Furnham et al., 1990; Lowrey, 1998; D. Kim et al., 2016), and message persuasion (Atalay et al., 2019; Lowrey, 1998).[1] Furthermore, simple vs. complex language can affect another key variable of communication: trust. People tend to believe more in information that is easy (vs. hard) to process (Brashier & Marsh, 2020; Unkelbach & Greifeneder, 2018). In a study by Rennekamp (2012), after receiving disclosures on stock corporations, participants showed stronger reliance on information that was expressed in a simple rather than complex manner. Similarly, an online survey conducted by Ermakova and colleagues (2014) indicated that perceived readability of a website's privacy policy strongly affected participants' trust in the online service. Lower linguistic complexity not only helps raise trust in the message but can also raise trust in people

and organizations to whom it is related. Accordingly, participants in different economic games have been found to trust fictitious players with easy-to-read names more than those with complex names (Zürn & Topolinski, 2017). Similar findings have been reported in the context of health communication, for instance in consultations between doctors and patients. When doctors tailored their vocabulary to their patients' instead of maintaining technical terminology, the patients experienced the consultation as more comfortable, agreed more with their doctors, and were more willing to comply (Williams & Ogden, 2004).

Thus, language barriers can have detrimental effects on people's trust in health information from the media. In this vein, academic language with many scientific terms, abstract concepts, and sophisticated structures can be seen as complex to lay people (D. Hayes, 1992) and lead to low trust in the conveyed information. Although a certain degree of complexity is unavoidable in science given its specialized nature, it should be formulated to be as readable as possible, as it is an important pillar for people to follow scientific recommendations. This has been evident more than ever during the COVID-19 pandemic. In this context, trust in science has also been identified as an important key variable for public adherence to COVID-19 prevention measures (Dohle et al., 2020; Plohl & Musil, 2021). Recent research, however, has shown that scientific texts become more rather than less complex over time (Plavén-Sigray et al., 2017).

The aim of this research is to examine the effects of linguistic complexity in the context of scientific statements regarding mask-wearing. In line with the above-cited literature, we expect that complex (vs. simple) scientific statements on the effectiveness of mask-wearing will reduce participants' trust in the message, trust in science, and adherence to the statement (*Main Hypothesis*).

Feelings of Social Exclusion as Mediator of the Effect of Linguistic Complexity

Health communication is often referred to as “expert2expert” communication as it is expressed in a difficult-to-understand jargon including many technical and medical terms (e.g., Schindler, 2019). A good example is the medical visit in hospitals: a group of (future) physicians accompanied by the head physician typically stands around the bed of a patient and talks about their illness in medical jargon, while the patient often feels like an outsider (Tödtmann, 2012). To improve health communication, there has been a plain language movement in the medical field, similar to other areas of public life (see, e.g., Adler, 2012; Cheung, 2017; Petelin, 2010; Schindler, 2019). As a result, universities and hospitals are increasingly offering communication trainings for medical professionals (e.g., Green et al., 2014). Another achievement of the medical plain language movement was that the package inserts of pharmaceutical products have been required to be expressed “in such a way as to be clear and understandable” since 2001 (see Art. 63, 2001/83/EC, European Commission, 2001). The use of plain language aims to especially address people with low literacy skills by using shorter sentences, a simpler syntax, and more familiar words. Such a reduction of language complexity in official or medical language is intended to decrease the social exclusion of linguistically marginalized groups (see Adler, 2012; Cheung, 2017). Easier language allows reaching out to people who may struggle with complex formulations, for example people with lower cognitive abilities, learning disabilities, or lower literacy (Meppelink et al., 2015). Lower literacy, or less experience with complex scientific messages can contribute to feelings of being left out from the dialogue and result in disengagement with the message.

Being confronted with relatively complex language can even lead to feelings of social exclusion in a person. For example, children and university students who had to learn a second language after moving to a new country reported greater feelings of being socially excluded due to low language skills (MacIntyre et al., 2011) and reacted more sensitively to teacher’s feedback (Ryan & Henderson, 2018). Similarly, Hitlan and colleagues (2006) found that

employees felt socially excluded when facing English as a foreign language at their workplace. The low language proficiency, in turn, was associated with an increased risk of occupational health problems (Premji et al., 2008). A similar pattern of results has been identified in the field of (il)literacy research. A large-scale study of elderly people in South Korea by B. S. Kim and colleagues (2014) revealed that illiterate respondents were up to 3 times more likely to have depression symptoms compared to literate individuals. This effect was especially pronounced on factors related to self-esteem. In another study by Wolf and colleagues (2007) patients who were confronted with low scores on a medical literacy test reported increased negative emotions such as shame and embarrassment (compared to patients with higher literacy levels). Being exposed to subjectively complex and hard-to-understand language can thus lead to negative feelings related to social exclusion, such as lower fulfillment of essential personal needs like the need for positive self-esteem or belongingness.

Given that scientific statements often have a complexity that exceeds the average reading skills of the majority of people in most countries (see Zabal et al., 2013 for Programme for the International Assessment of Adult Competencies results on adult literacy), it should be considered that this language may have an exclusionary effect for a large part of the general population. We think that the use of complex (vs. simple) scientific language can be perceived as a negative cue for many lay people, as they may become aware of their comprehension difficulties in a specific topic. As a consequence, and in line with the findings outlined above, this subtle form of linguistic exclusion is expected to evoke feelings of social exclusion, such as a lowering of mood, self-esteem, and feelings of belongingness (see Rudert & Greifeneder, 2016). In line with this, scholars have already advised to avoid scientific jargon in science communication to avoid social exclusion of readers (e.g., Burns et al., 2003; Sharon & Baram-Tsabari, 2013).

Taking this even further, we think that such feelings of social exclusion can cause a rejection of information which is difficult to understand. There is already considerable evidence from the field of social cognition research which has shown that a wide range of negative feelings is able to reduce people's trust (Forgas, 1994; Forgas & East, 2008; Zwingmann et al., 2017; see Forgas, 2003, for a historical overview). Moreover, experimental research using the cyberball paradigm has demonstrated that social inclusion increases trust (Hillebrandt et al., 2011). We thus expect that feelings of social exclusion will mediate the effect between text complexity and trust in the message, trust in science, and adherence to behavioral measures (*Mediation Hypothesis*).

Conspiracy Mentality Increases Susceptibility to Language Complexity

During the COVID-19 pandemic, conspiracy theories have spread as fast as the virus itself (Muller, 2020). According to Douglas and colleagues (2017, p. 538), conspiracy theories are "explanations for important events that involve secret plots by powerful and malevolent groups." Conspiracy theories fulfill important (epistemic) motives and needs, such as the desire to understand a subject more deeply or the need for control and security (Jost et al., 2008). According to Imhoff and Bruder (2014), the strong belief in conspiracy theories, or a person's *conspiracy mentality*, is an expression of a deeper political attitude. This variable expresses a person's tendency to blame powerful social groups and individuals for certain (negative) events. People with a strong conspiracy mentality thus assume that powerful groups and individuals are acting in an intentionally negative manner, and they also suspect state authorities or scientists of being involved in the plot. Individuals with a strong conspiracy mentality have been found to have less trust in powerful information sources, such as experts or scientists, and to report an increased credibility of powerless information sources, such as lay bloggers (Imhoff et al., 2018). This effect of reduced trust through conspiracy beliefs was even confirmed when people were experimentally confronted with conspiracy beliefs in political

domains (Einstein & Glick, 2015). In a similar vein, Lewandowsky and colleagues (2013) found that a belief in conspiracy theories predicts opposition to general scientific findings, including those regarding genetically modified foods, vaccination, and climate change. Especially with regard to preventive social behaviors, conspiratorial thinking has played a crucial role (Bierwiaczonek et al., 2020; Earnshaw et al., 2020; Pummerer & Sassenberg, 2020).

Even before the emergence of the COVID-19 pandemic, individuals who believed more in conspiracy theories were shown to have lower vaccination propensity (see Jolley & Douglas, 2014, Study 1) and to be less compliant with health behaviors (Oliver & Wood, 2014). Recent findings in the COVID-19 context have shown similar effects, namely that individuals who support conspiracy theories and endorse misinformation are less likely to follow public health instructions (for a review, see Mukhtar, 2021). In addition, results of a longitudinal national probability survey on preventive COVID-19 behaviors showed that U.S. citizens with strong COVID-19-related conspiracy beliefs were less likely to wear a mask and showed a lower willingness to be vaccinated (Romer & Jamieson, 2020).

Therefore, we think that, in the context of the COVID-19 pandemic, it is of great interest to examine the impact of complex (vs. simple) scientific messages on those with reservations toward science, such as people with a strong conspiracy mentality. Especially with regard to our focal mediator, feelings of social exclusion, belief in conspiracy theories has been identified to play an important role. According to the existential threat model (ETM), belief in conspiracy theories is promoted by experiences of existential threat, such as fear, insecurity, or threats to one's values (van Prooijen, 2019). The ETM also proposes a cyclical feedback loop, in the direction that a strong conspiracy mentality increases the vulnerability to existential threats. Many studies have confirmed the first path of the ETM showing that experiences of social exclusion lead to increased endorsement of conspiracy theories (Graeupner & Coman, 2017; Poon et al., 2020). Lantian and colleagues (2018) found that people who were asked to defend

conspiracy theories reported stronger fears of being devalued and thereby more socially excluded by others. In this study, we focus more on the feedback loop suggested by the ETM by testing whether a general conspiracy mentality increases the vulnerability towards subtle signs of social exclusion such as the use of very complex scientific jargon in health information.

The argument that conspiracy mentality influences whether text complexity leads to feelings of social exclusion can also be supported from the perspective of group membership. Readers can use different modes of language, for instance complex language instead of simple language, as a cue of group membership (Ghafournia, 2014). Scientific jargon might generally exclude readers without an academic background (Sharon & Baram-Tsabari, 2013), but its impact on feelings of social exclusion might be particularly strong for individuals who are wired to divide their surroundings into in-group and out-group members and are thus especially sensitive to cues of group membership (see Cichocka et al., 2016; van Prooijen & Lange, 2014 for in-group positivity among conspiracy theorists). On top of that, believing in conspiracy theories was previously found to be associated with lower media and health literacy (Craft et al., 2017; Duplaga, 2020) and lower educational attainment (van Prooijen, 2017). This means that people with a high conspiracy mentality are not only likely to perceive a scientific text as complex but are also more likely to interpret text complexity as a cue for group membership that expels them.

We therefore assume that complex and difficult-to-read scientific messages (compared to relatively simple messages) serve as a negative cue for people with a high conspiracy mentality, to which they react with stronger feelings of social exclusion and an immediate rejection. We will thus exploratively test whether the effect of text complexity on trust and behavioral adherence via feelings of social exclusion is more pronounced among participants with high compared to low levels of conspiracy mentality (*Exploratory Test of Moderated Mediation*).

Overview of the Present Research

In the current study, we used an experimental design with pretested materials to test the effect of scientific statements' linguistic complexity on readers' trust in the message, trust in science in general, and adherence to behavioral recommendations linked to these statements. Mask-wearing is a crucial measure to prevent the transmission of COVID-19 through respiratory droplets. When this research was first developed in September 2020, mask-wearing was a controversial topic among English-speaking countries including the U.K. and the U.S. The pursuit of practical implications thus encouraged us to conduct this research in the context of mask-wearing. We pre-registered how we determined our sample size, all data exclusions, all manipulations, and all measures in the experiments at the Open Science Framework (https://osf.io/hb9aq/).

Pretest: Construing a Complex vs. Simple Text Manipulation

To construct high-quality materials to manipulate text complexity, we composed two short texts on mask-wearing. The texts contained almost identical content that was expressed in either simple or complex language. The pretest was preregistered: http://osf.io/hb9aq.

Method

Participants. We relied on an a priori power analysis using G*Power (Faul et al., 2007). Computed for the parameters $d = .80$, $\alpha < .05$, and $1 - \beta = .95$, the power analysis indicated that a sample of 84 participants was required. Given that online data collection often involves data loss due to low data quality, we aimed for 120 participants. All participants were native English speakers recruited via Cardiff University's online testing system. Participants received one course credit for their participation. From the pool of completed questionnaires, we had to exclude 13 participants based on preregistered criteria.[2] The final sample consisted of 107

participants (89 women, 13 men, and five people not indicating their gender; M_{age} = 19.38, *SD* = 2.09).

Procedure and materials. Participants were informed that the study would involve reading a short text and answering questions about it. After giving informed consent, they were randomly assigned to read either a simple or complex text about the effectiveness of face mask-wearing in the context of the COVID-19 pandemic (see Figure 1 for the texts and summaries of their basic properties, including length, syntactic complexity, and narrativity).

The texts were composed to be of similar length and content, but to vary in complexity. According to the objective estimates provided by a Coh-Metrix 3.0 text complexity analysis (Graesser et al., 2004), the texts differed in terms of syntactic complexity scores. In the pretest, we measured whether their subjective complexity varied as well, that is, whether participants evaluated the complexity of the prepared texts as intended.

After reading the text, participants judged the text's complexity ("Do you think the paragraph is easy or hard to read?" and "Do you think the paragraph is simple or difficult to understand?") on a 9-point Likert scale ranging from "easy/simple" to "hard/difficult." We also recorded response times for reading the text, attention check measures for exclusion purposes, and participants' age and gender.

	Simple condition	**Complex condition**
Text	The world is experiencing the second wave of the coronavirus. Research shows that wearing facemasks slows the spread of the virus. Surgical masks help very well to reduce the risk of infection. But also, homemade masks reduce the chances of passing the virus. Research on COVID-19 suggests that, when many people wear masks, there are fewer infections in the communities. Masks also prevent the spread of the virus by people who are infected but do not have symptoms. As a result, fewer	The second wave of SARS-CoV-2 has arrived globally. Research shows that wearing facemasks impedes the transmission of SARS-CoV-2. Importantly, both surgical masks and even homemade face coverings curtail the aerosolization of the virus into the air and onto surfaces. Model simulations with data relevant to COVID-19 dynamics suggest that wide adoption of masks should be effective in reducing the risk of infection (e.g., preventing the transmission of SARS-CoV-2 by asymptomatic individuals) and in decreasing hospitalizations and the death

	people die or have to go to the hospital. Moreover, healthcare workers who wear facemasks have a lower risk of becoming infected. Researchers thus advise wearing a mask so that fewer people get sick. The bottom line is that wearing masks can reduce the social consequences of the pandemic.	rate. Moreover, masking has been associated with a significantly lower rate of SARS-CoV-2 positivity among healthcare workers. Researchers thus advise masking as part of a multipronged infection-reduction strategy in both healthcare settings and the general population, resulting in the minimization of the social burden caused by the pandemic.
Length	131 words	126 words
Syntactic simplicity (z-score)	0.821	-1.109
Narrativity (z-score)	-0.684	-1.5

Figure 1. Treatment Materials: Simple versus Complex Text.

Results

Multivariate analysis of variance that compared participants' answers in the two conditions revealed that the simple text was evaluated as easier to read (M = 3.02, SD = 1.94) than the complex version (M = 5.09, SD = 1.50), $F(1, 104) = 38.11$, $p < .001$, $\eta p^2 = .27$, and was less difficult to understand (M = 2.45, SD = 1.80) than the complex version (M = 4.51, SD = 1.74), $F(1, 104) = 35.72$, $p < .001$, $\eta p^2 = .26$. However, participants' reading time for both the simple text (M = 40.57, SD = 20.31) and the complex text (M = 44.92, SD = 19.04) were similar, $F(1, 104) = 1.29$, $p = .26$, $\eta p^2 = .01$. Overall, the results indicated that the simpler text was not only objectively but also subjectively simpler than the complex text, and thus, we used the prepared texts in the subsequent main study.

Main Study: The Effects of Text Complexity on Trust and Adherence Following Scientific Messages

The aim of the main study was to experimentally establish the hypothesized effects of text complexity on trust in the message and science as well as on adherence to the message via social exclusion. The study was also preregistered (osf.io/vfq72).[3]

Method

Participants. We relied on a WebPower analysis for a SEM-based mediation model (Zhang & Yuan, 2015) with RMSEA H1 ≤ .08, $df = 6$, $\alpha < .05$, and $1 - \beta = .95$ (for up to two mediators) that recommended a minimum sample size of 544 participants. Given that online data collection often involves data loss due to low data quality, we aimed for 634 participants, who were then recruited through Amazon Mechanical Turk at a rate of $9.00 per hour. All participants were adult U.S. citizens, and their native language was English. From the pool of completed questionnaires, we excluded 29 participants based on preregistered criteria.[4] The final sample consisted of 605 participants (281 women, 323 men, and one person who did not indicate their gender; $M_{age} = 41.27$, $SD = 13.62$).

Procedure and materials. Participants were informed that the study would include reading a short text and answering questions about it. After giving informed consent, participants were randomly assigned to read either a simple or complex text about the effectiveness of face mask-wearing in the context of the COVID-19 pandemic (see Figure 1).

Measures. After reading either the complex or simple version of the message, participants indicated their trust in the message, adherence to mask-wearing (which was the topic of the text), feelings of social exclusion, trust in science, conspiracy mentality, concern regarding COVID-19, sociodemographic information (age, gender, and education), U.S. state of residence, and political ideology. At the end of the study, participants completed attention check questions. Scale reliabilities, descriptive statistics, and correlations are shown in Table 1. For all materials and data, see the accompanying OSF webpage.

Table 1

Scale Points, Reliability Coefficients, Means, Standard Deviations and Bivariate Correlation Coefficients for the Variables Used in Main Study.

	Scale	α	*M*	*SD*	2.	3.	4.	5.

1. Trust (Message)	1-7	.85[+]	5.74	1.36	.58***	.39***	-.52***	-.31***
2. Adherence	1-7	.97	5.37	2.01		.22***	-.42***	-.11**
3. Trust (Science)	1-7	.93	5.10	1.14			-.20***	-.57***
4. Social Exclusion	1-9	.94	3.06	1.77				.13**
5. Conspiracy Mentality	1-11	.89	6.24	2.51				

Note.[+] Spearman's rho is reported instead of Cronbach's alpha for two item measures.
** $p < .01$, *** $p < .001$.

Trust in the message. Participants answered two questions ("To what extent do you think the text is trustworthy?" and "To what extent would you use this piece of information to persuade other people around you to wear a face mask?") on a 7-point Likert scale ranging from "not at all" to "very much." The answers were averaged into one score, with a higher score indicating a higher trust in the presented message.[5]

Adherence to behavioral measures. Participants responded to three statements — "In comparison to before reading, how likely is it that this text will affect your willingness to (1) wear a mask when you meet others; (2) wear a mask when you go shopping; (3) expect others to wear a face mask?" — on a 7-point Likert scale ranging from "not at all" to "very much." The answers were averaged into one score, with a higher score indicating a higher intention to adhere to the described behavior.

Feelings of social exclusion. We used need fulfillment to measure feelings of social exclusion. Participants indicated fulfillment of their needs with the *Need Threat Scale* by Rudert and Greifeneder (2016), which is considered a common measurement of people's feelings after experiences of social exclusion. It included four items pertaining to four aspects of need fulfillment (belongingness, self-esteem, control, and meaningful existence) answered on 9-point semantic differentials. Following the sentence "Please indicate how you feel after

having read the text", participants indicated their feelings on the answer scales rejected – accepted, devalued – valued, powerless – powerful, and invisible – respected. In order for the scale to reflect social exclusion, all answers were recoded and averaged into one score. Higher scores indicate higher feelings of social exclusion.

Trust in science. Participants completed three subscales of the *Negative Perceptions of Science Scale* by Morgan and colleagues (2018): *science as corrupt* (5 items, e.g., "Most scientists are politically biased," α = .93), *science as onerous* (5 items, e.g., "Science is too complicated to understand," α = .88), and *science as limited* (5 items, e.g., "The scientific method is limited," α = .87). Answers were given on a 7-point Likert scale ranging from "totally disagree" to "totally agree." Given a similar pattern of results for all three subscales, we report one general measure of trust in science formed as an average of all items. The original scale was designed with higher scores indicating higher negative perceptions of science, in the current experiment, reverse coding was used for the sake of more convenient analysis, with higher scores indicating higher trust in science.

Conspiracy mentality. Participants completed the *Conspiracy Mentality Questionnaire* by Bruder and colleagues (2013) which comprises five items (e.g., "Events which superficially seem to lack a connection are often the result of secret activities"). Answers were given on an 11-point Likert scale ranging from "certainly not" to "certain". All answers were later averaged into one score, with higher scores indicating a stronger conspiracy mentality.

Results

Main effects. To examine whether the experimental text manipulation affected variables of interest in the study, we conducted a one-way MANOVA with text complexity as independent factor (simple vs. complex), results of which are presented in Table 2.[6] Additionally we included participants' conspiracy mentality, to see whether this variable was affected by the experimental treatment as it was recorded after the manipulation. Not

confirming our Main Hypothesis, across almost all dependent variables used in the study we did not observe any difference between simple and complex conditions. Regarding the test of our moderator variable, conspiracy mentality, a significant effect of the treatment was identified. Unexpectedly, the results indicate that higher conspiracy mentality values were observed in the simple (compared to complex) condition. Given that the observed effect was very small in magnitude, and the obtained pattern of results does not bias the moderated mediation analyses in the predicted direction, we decided to keep conspiracy mentality in the forthcoming moderation analyses.

Table 2

MANOVA Test Results along with the Descriptive Statistics for the Dependent Variables

	Test results	***M (SD)*** Simple Text	***M (SD)*** Complex Text
1. Trust (Message)	$F(1, 603) = 0.37$, $p = .543$, $\eta_p^2 = .00$	5.77 (1.38)	5.70 (1.35)
2. Adherence	$F(1, 603) = 0.03$, $p = .861$, $\eta_p^2 = .00$	5.38 (2.00)	5.36 (2.02)
3. Trust (Science)	$F(1, 603) = 0.31$, $p = .576$, $\eta_p^2 = .00$	5.07 (1.21)	5.12 (1.07)
4. Social Exclusion	$F(1, 603) = 1.22$, $p = .269$, $\eta_p^2 = .00$	2.98 (1.68)	3.14 (1.85)
5. Conspiracy Mentality	$F(1, 603) = 5.51$, $p = .019$, $\eta_p^2 = .01$	6.48 (2.48)	6.00 (2.53)

Mediation analyses. We hypothesized that the effects of text complexity on the dependent variables would follow an indirect path through feelings of social exclusion, which means that reading a complex (vs. simple) text would be related to higher feelings of exclusion and, therefore, affect trust in the message, adherence, and trust in science. However, as indicated in Table 2 above, the effect of text complexity on the hypothesized mediator was not significant. Accordingly, none of the mediation tests conducted with A. Hayes's (2017) PROCESS macro (version 3.5; model 4) and the 1,000 bootstrap procedure was significant:

trust in the message (point estimate = -0.06, BootCIs [-.18; .05]), adherence (point estimate = -0.08, BootCIs [-.21; .06]), and trust in science (point estimate = -0.02, BootCIs [-.06; .01]).

Exploratory moderated mediation analyses. We went beyond the pre-registration to test whether the path between text complexity and social exclusion was moderated by conspiracy mentality (mean centered). We thus conducted an exploratory mediated moderation analysis using A. Hayes' (2017) PROCESS macro (version 3.5; model 7) and the 5,000 bootstrap procedure. For a graphical demonstration of the model and additional details, see Figure 2 and Table 3, respectively.

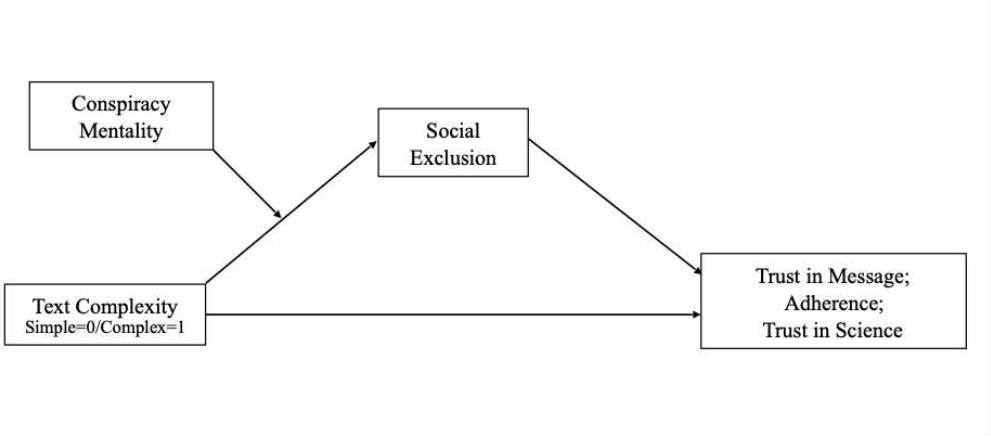

Figure 2 Moderated Mediation Model Illustration

Note. See Table 3 for model specifications.

First of all, we report regression coefficients pertaining to the mediator variable, social exclusion. As visible in Table 3, there was a significant interaction of text complexity and conspiracy mentality, $\Delta R^2 = .04$, $F(1, 601) = 8.60$, $p < .001$. Analyses of conditional effects of the text complexity on social exclusion indicated that text complexity mattered only for participants with high conspiracy mentality (point estimate = 0.70, BootCIs [.31; 1.09]) in such that a more complex text led to higher feelings of social exclusion. For participants with

average (point estimate = 0.20, BootCIs [-.08; .48]) and low conspiracy mentality (point estimate = -0.30, BootCIs [-.70; .09]) text complexity had no effect on social exclusion ratings.

Table 3

Results of the First Stage Effects of Text Complexity and Conspiracy Mentality on Feelings of Social Exclusion

	B	*SE*	*t*	95% *CI*
Constant	2.98***	.10	29.55	2.78; 3.18
Text Complexity (TC)	0.20	.14	1.40	-0.08; 0.48
Conspiracy Mentality (CM)	0.00	.04	-0.12	-0.08; 0.07
Interaction (TC×CM)	0.20	.06	3.53	0.09; 0.31

Note. Text complexity (TC) was coded 0 = simple and 1 = complex.

Trust in the message. The overall model explained 27% of the variation in participants' trust in the message (R^2 = .27, $F(2, 602) = 110.80$, $p < .001$), with social exclusion being a significant predictor of trust in message (B = -.40, SE = .03, t = -14.87, p <.001). The significant moderated mediation index (for detailed values, see Table 4) indicated that text complexity increased social exclusion and, in turn, decreased trust in the message only for participants with a high conspiracy mentality. Importantly as well, pairwise contrasts between conditional indirect effects for individuals with high and those with average (point estimate = -0.20, BootCIs [-.33; -.08]) and low conspiracy mentality (point estimate = -0.40, BootCIs [-.66; -.16]) were significant.

Table 4

Moderated Mediation Indexes and Conditional Indirect Effects of the Treatment

Outcome Variable	*Estimate*	*BootSE*	*BootLLCI*	*BootULCI*
Trust in Message (MM index)	-.08	.03	-.13	-.03

Low Conspiracy	.12	.08	-.02	.27
Average Conspiracy	-.08	.06	-.20	.03
High Conspiracy	-.28	.10	-.48	-.09
Adherence (MM index)	-.10	.03	-.16	-.04
Low Conspiracy	.15	.09	-.03	.33
Average Conspiracy	-.10	.07	-.23	.04
High Conspiracy	-.34	.11	-.56	-.12
Trust in Science (MM index)	-.03	.01	-.05	-.01
Low Conspiracy	.04	.02	-.007	.09
Average Conspiracy	-.03	.02	-.07	.01
High Conspiracy	-.09	.04	-.17	-.03

Note. Text complexity was coded 0 = simple and 1 = complex. MM = Moderated mediation. BootSE = Bootstrap standard error. BootLLCI = Bootstrap lower level of 95% confidence interval. BootULCI = Bootstrap upper level of 95% confidence interval. ***p < .001.

Adherence to behavioral measures. The overall model explained 18% of the variation in participants' reported adherence to the measure (R^2 = .18, $F(2, 602) = 66.17$, $p < .001$), with social exclusion being a significant predictor of adherence (B = -.48, SE = .04, t = -11.50, p <.001). The significant moderated mediation index (for detailed values, see Table 4) indicated that text complexity increased social exclusion, and, in turn, decreased adherence only for participants with a high conspiracy mentality. Also, pairwise contrasts between conditional indirect effects for participants with high and those with average (point estimate = -0.24, BootCIs [-.40; -.09]) and low conspiracy mentality (point estimate = -0.48, BootCIs [-.79; -.18]) were significant.

Trust in science. The overall model explained 4% of the variation in participants' trust in the science (R^2 = .04, $F(2, 601) = 13.45$, $p < .001$), with social exclusion being a significant predictor of trust in science (B = -0.13, SE = .03, t = -5.15, p <.001). The significant moderated

mediation index (for detailed values, see Table 4) indicated that text complexity increased social exclusion, and, in turn, decreased trust in science only for participants with high conspiracy mentality. Again, pairwise contrasts tests between the conditional indirect effects for people high conspiracy mentality compared to those with average (point estimate = -0.07, BootCIs [-.12; -.02]) and low values (point estimate = -0.13, BootCIs [-.24; -.05]) were significant.

Discussion

In this research, we tested three hypotheses regarding various aspects of text complexity in reference to scientific communication. The conducted experiment did not obtain support for the hypothesized main effects of complex vs. simple texts on trust in the message or science, nor adherence to the message. Relatedly, participants overall did not feel more socially excluded when reading the complex instead of the simple text, implying that we have also not observed the hypothesized mediation path. Importantly, however, the results indicated that the hypothesized mediation effects were present, but only for participants with a high conspiracy mentality. For those participants, reading a complex (vs. simple) text indeed led to feelings of social exclusion which, in turn, affected evaluations of message trustworthiness, trust in science, as well as adherence to the message. In more detail, participants with a strong conspiracy mentality felt more rejected and devalued as well as less powerful and respected when reading the complex instead of the simple message. Such effects were not observed for participants with average nor with low conspiracy mentality. Although this is an effect concerning a rather small group, it is nevertheless important, as it is advantageous if all subgroups of society are reached through targeted health communication, especially during a pandemic. Given the exponential spread of COVID-19, even a small group of people can cause (or prevent) great harm.

In line with other work, the present research highlights that media recipients are not a tabula rasa on which scientific messages impinge (Rubin, 2002). In the field of science and health communication, the concept of the "general population" should be reconsidered. Rather, the general population is divided into different sub-groups, some of which need to be addressed differently. To our knowledge, this research is the first to show that exposing individuals with a high conspiracy mentality to simple (vs. complex) scientific messages can enhance not only their trust in that message and in science in general but also their behavioral intentions to follow recommendations. In addition, this research also uncovered why simple language is more effective in reaching these individuals: it makes them feel more included than a complex message. Against this background, it is also important to note that increased text comprehensibility in our study did not negatively affect other parts of the sample. This means that the benefits for one target group can be increased by linguistic simplicity without reducing them for other groups.

The Conspiracy Mindset as One of Many Determinants of Information Processing

Considering personality variables as important factors for information processing is by no means a new idea. Potter's (2004) cognitive theory of media literacy has already claimed that the construction of meaning based on media reports is dependent on certain individual-level variables, such as knowledge or skills. Accordingly, personal-level variables, such as the need for cognition (See et al., 2009, Sicilia et al., 2005; Williams-Piehota et al., 2003), need for closure (Kossowska et al., 2012; Vermeir et al., 2002), personal involvement (Braverman, 2008; Petty et al., 1981; see Johnson & Eagly, 1989, for a meta-analysis), or political ideology (Entman, 1989; LaMarre et al., 2009) have been repeatedly confirmed to affect information processing. With regard to the processing of health information, personal needs, such as the need for consistency or personal control, play an important role. Keller and Block (1999), for example, found that participants with strong affect-based dissonance denied health messages

about safer sex more often than participants with lower scores on this variable. In a similar vein, our results indicate that simple instead of complex messages suit individuals with a strong conspiracy mentality better. At this point, we know that simple texts lead to decreased feelings of social exclusion in people with a strong conspiracy mentality, and thus to higher levels of trust and adherence. However, we do not know the underlying cause of this finding yet. To understand whether the moderated mediation effect is related to lower literacy levels within this group (see, e.g., van Prooijen, 2017 for lower education) or to intergroup processes (Cichocka et al., 2016; van Prooijen & Lange, 2014), additional variables need to be assessed on how the texts are subjectively perceived by participants.

Reducing Message Complexity to Increase Inclusiveness of Scientific Communication

Building upon previous findings that have shown the effectiveness of tailoring messages to individuals with specific personalities and dispositions, our findings show that using simple instead of complex language is a helpful way to reach and influence individuals with a high conspiracy mentality. Reducing language complexity to be heard by individuals with high conspiracy mentality is in line with Nisbet and Scheufele's (2009) recommendation to take the needs of particular audiences into account so that messages are comprehensible and valid for a given target.

The improved chances of influencing individuals with a high conspiracy mentality are not the only reasons to minimize complexity of scientific messages. Science is a common good, therefore scientific findings should be accessible to the lay public. This concern is being increasingly addressed with the Open Science movement in reference to accessibility of scientific texts and data. However, this concern could be also addressed through the language we use to communicate our findings (Baram-Tsabari & Lewenstein, 2013; Illes et al., 2010). Science communication should conform to Grice's Maxims of effective communication. In particular, this pertains to the maxim of manner, which refers to being as clear as possible and

avoiding any ambiguity or confusion. While jargon and detailed presentation of research findings are more appropriate in scientific blogs, narratives and storytelling can be more appropriate for a general audience. Indeed, judgments of the quality of scientific communication in newspapers were positively related to the use of metaphors and narratives (August et al., 2020).

However, science is inherently complex and often cannot be thoroughly explained in a very simple language. As such, when writing papers for academic journals, scientists tend to use a technical language that serves as a crucial shortcut in communicating details efficiently to the science community who has basic knowledge of the background. The efficiency and precision of science communication is guaranteed in this way, but at a cost of readability for the lay public. This was not such a big issue before the current era of open-access publishing, because the lay public was unlikely to access scientific articles as a source of information. Instead, scientific findings had been interpreted and reported by journalists and news reporters. In order to raise the readability for the lay public, however, the media agencies had to simplify research findings by reducing some nuance, sometimes at the cost of exaggerating and misrepresenting the findings (E. Lee et al., 2016). By communicating their findings to the lay public themselves, scientists have the opportunity to summarize their findings as accurately as possible, which can forestall misrepresentations and misinterpretations introduced by intermediaries. Along with the development of open-access publishing, the opportunities and challenges are coming at the same time. The lay public has direct and free access to academic papers now, which brings higher chances for scientific findings to be read by more people. However, the complexity of scientific language can be a threshold preventing people from understanding scientific papers and accepting their findings. Striving for an optimal level of simplicity to ensure the readability of scientific findings, inclusion of additional plain language

abstracts, and strategizing media plans can be new tasks for scientists or journals in the recent future.

Limitations and Future Directions

The results of this study indicated that the majority of participants tended to trust both the complex and the simple message on mask-wearing. While this result is not in accord with our main hypothesis, the design of the study might have affected the obtained null finding. First of all, after months into the COVID-19 pandemic, the effectiveness of mask-wearing had been widely acknowledged. When we conducted the experiment in January 2021, participants were already familiar with mask-wearing and its efficiency. This general knowledge might have reduced the overall effect of complexity on participants' trust in and adherence to the message. Anticipating this issue, we ran the main study on participants in the U.S. instead of the U.K. given the more controversial attitudes toward mask-wearing in the U.S. However, we still cannot deny the potential shortcomings caused by using such a familiar topic. In this vein, communication about more novel, complex, and controversial measures against COVID-19, such as vaccination, should be investigated in future studies. Especially for new technologies (e.g., mRNA vaccines), participants' baseline trust might be lower, allowing complexity effects to emerge not only in individuals with a conspiracy mindset, but also to a greater extent in the general population. However, the null main effect on the familiarized topic can also be interpreted from a different angle. It may indicate that repetitive scientific information conveyed via media can raise people's general trust in scientific messages and behavioral adherence. Second of all, we presented participants with a relatively short text. Given the shortness of the manipulated texts, the complex version might still have been too simple to elicit feelings of social exclusion and distrust in participants with low and medium conspiracy mentality. Future studies could include longer texts to address that potential limitation.

Furthermore, future studies could address one aspect of language processing that was not directly addressed in the current research, namely fluency. Numerous studies have shown how fluency, that is the ease with which a text can be processed, enhances its liking (Reber et al., 2004), perceived truthfulness (Dechêne et al., 2009), and its trustworthiness (Newman et al., 2014; for an overview, see Schwarz et al., 2020). When research was presented with high audio quality or easy-to-read fonts, thus in a way that could be processed easily instead of hard, it was perceived to be of higher quality and the associated researchers were perceived to be more competent and intelligent (Newman & Schwarz, 2018; Oppenheimer, 2006). When exercise routines and cooking recipes were presented in an easy-to-read (vs. hard-to-read) font, participants also expected them to be easier to follow and were more motivated to carry them out (Song & Schwarz, 2008). Fluency research is thus not only relevant with regards to trust in scientific messages and science, but also with regards to adherence to messages. While our research has shown how individuals with high conspiracy mentality trust and adhere to complex (vs. simple) texts less because complexity elicits feelings of social exclusion, the impact of text complexity on mere processing fluency and consequences of experienced (dis)fluency have not been taken into account. It is possible that experiences of (dis)fluency can serve as a heuristic to determine text complexity. Future research will have to further disentangle how text complexity affects processing fluency and feelings of social exclusion and how experienced (dis)fluency might be the first step towards feeling excluded by a message.

Another possible limitation of this study is that both the moderators and mediators were collected in the cross-section of a study. We thus strive to measure relevant moderators such as conspiracy mentality and scientific literacy prior to the main study in future studies. Furthermore, it is worth considering the possibility of experimentally manipulating the mediator, as this may help to explain the mediation process in more detail (Pirlott & MacKinnon, 2016). In addition, we want to address that the moderated mediation analysis

which uncovered the role of conspiracy mentality has been of exploratory nature. Future studies are thus needed to replicate the obtained result patterns, ideally following a preregistration preceding them.

Conclusion

Improving science communication is generally important because it engages the audience with scientific findings (Burns et al., 2003), which, in turn, affects the extent to which science is an important factor in shaping people's decisions, known as scientific literacy. There is no better occasion than a global pandemic to reconsider how difficult it should be for the lay public to understand and follow crucial messages. Expressing findings and recommendations in a less complex way seems to be a promising way to reach individuals with a high conspiracy mindset— those we have been struggling to reach.

Ethical Compliance

Data collection was conducted in accordance with the ethical standards of the German Association of Psychology (DGPS) and with the 1964 Helsinki Declaration. The study was approved by the local ethics committee. All participants agreed with the privacy statement and the informed consent of the study.

Declaration of Conflict of Interest

The authors declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Notes

[1] Given that the term plain language is a protected term and follows specific rules of text composition and writing, in this article, we use terms complex and simple language. These terms are easy to follow and also adequately express the goal of this research.

[2] We excluded all participants who did not complete both complexity measures, failed the comprehension check, or indicated that they did not participate seriously.

[3] The preregistration included the Main Hypothesis as well as the Mediation Hypothesis.

[4] We excluded all participants who did not give consent, did not finish the experiment, read the treatment text or participated extremely slowly or quickly (- 3SDs or + 3SDs), failed the comprehension check, or indicated that they did not participate seriously.

[5] We are aware that in recent years, the concept of message credibility also has gained importance in communication science (e.g., T.T. Lee, 2018). However, we assume that the concepts of trust and credibility are interdependent. Common scales for measuring message credibility include trust items as well (see Meyer, 1988; Roberts, 2010). Therefore, in our study, we will focus primarily on message trust as a key variable.

[6] Please note that this analysis was chosen for multiple testing correction, but deviates from the preregistered analyses of single ANOVAs. Importantly, the pattern of results remains unaltered when conducting multiple ANOVAs.

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Alexandra Lux is a PhD candidate at the Psychology Department of the University of Leuven (KU Leuven) in Belgium. She received her MA in social psychology (Cum Laude) from the Vrije Universiteit Amsterdam (VU Amsterdam) in the Netherlands. In her PhD project supervised by prof. Vera Hoorens and prof. Susanne Bruckmüller, she investigates how the way we compare social groups can impact how readers judge and interpret claims, perceive claimants, and reconsider their beliefs about social groups. Together with Julia Schnepf, Zixi Jin and Magdalena Formanowicz, she researches how we can make science communication more inclusive so that people (including people with high conspiracy mentality) trust and follow messages more. Broadly speaking, she is interested in how and why the specific way we express ourselves matters.

Zixi Jin is a PhD student in School of Psychology in Cardiff University. She completed both her Bachelor's and Master's degree in Applied Psychology in China. Her main research interest is on embodied cognition and metaphoric effects on cognitive processes.

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