EJHC | European Journal of Health Communication

ISSN 2673-5903
ejhc.org

Research Report *Special Issue on Mis- and Disinformation About Covid-19*

Addressing Covid-19 Vaccination Conspiracy Theories and Vaccination Intentions

DOI: 10.47368/ejhc.2022.201
2022, Vol. 3(2) 1-12

Lotte Pummerer, Kevin Winter
Leibniz-Institut für Wissensmedien, Tübingen, Germany

Kai Sassenberg
University of Tübingen, Germany; Leibniz-Institut für Wissensmedien, Tübingen, Germany

Abstract

Conspiracy theories often involve topics of uncertainty and ambivalence. One of those topics during the Covid-19 pandemic was the vaccination based on the new method using messenger RNA. In a preregistered study with *N* = 382 participants, we tested an intervention addressing the uncertainty concerning this new vaccination at a time when conspiracy theories about the vaccination method were not yet widely spread. Participants either only read short facts about the new vaccination (no explanation condition), or read these facts in addition to an explanation about the function of messenger RNA vaccines (relevant explanation condition), or they read the facts after the explanation of an alternative issue (irrelevant explanation condition). Results showed that individuals reading the relevant explanations addressing uncertainties surrounding the new vaccination method were less likely to agree with a Covid-19 vaccination conspiracy theory and were more willing to get a Covid-19 vaccination compared to the other conditions. An exploratory analysis showed that agreement with the Covid-19 vaccination conspiracy theory mediated the effect of explanation type on vaccination intentions. Potential implications and limitations are discussed.

Keywords

Misinformation, vaccination, conspiracy theory, conspiracy mentality, Covid-19.

Corresponding author:
Lotte Pummerer: l.pummerer@iwm-tuebingen.de

From the start of the Covid-19 pandemic, researchers tried to design a vaccine, which would stop the spread of the virus once enough people have been vaccinated (i.e., herd immunity is reached). Yet, despite huge efforts of promoting the vaccine, not all people were willing to get vaccinated, and often governmental goals of the desired percentage of vaccinated people, for example, in the US (Tin, 2021) or Europe (Kijewski, 2021), were not met. A critical barrier to receiving vaccinations is the belief in conspiracy theories (Hornsey et al., 2018; Jolley & Douglas, 2014).

Conspiracy theories evolve as a sense-making mechanism (Newheiser et al., 2011; Van Harreveld et al., 2014) and thus often spread in situations of personal (Heiss et al., 2021) and societal (Van Prooijen & Douglas, 2017) uncertainty. Despite their harmful consequences (Imhoff et al., 2021), ways of counteracting them are few. One of the methods that have been successful in countering misinformation and conspiracy theories is inoculation (Lewandowsky & Cook, 2020, Van der Linden, 2020). Here, participants are warned about conspiracy arguments to come and provided with anti-conspiracy arguments beforehand. However, one potential pitfall is that participants through inoculation might not only come in contact with *anti*-conspiracy arguments, but also with the conspiracy itself (Banas & Miller, 2013).

Building on the idea of providing participants with resources *before* being confronted with a conspiracy theory, we here report a study in which participants receive explanations addressing uncertainties about the new vaccination method of using messenger RNA. To our knowledge, this is the first example of an intervention based on addressing uncertainties tied to a situation and topic (i.e., the new vaccination method) where conspiracy theories are likely to arise. With the study, we seek to advance knowledge on processes underlying the development of belief in conspiracy theories as well as their confrontation. We also want to raise awareness among journalists and policymakers for the possibility of countering conspiracy theories and their consequences by identifying topics of uncertainty *before* conspiracy theories gain popularity.

Fertile Ground for Conspiracy Theories

Conspiracy theories are defined as the belief that powerful forces, such as Big Pharma, influential individuals, or institutions, are conspiring against the public with malign intent (Douglas et al., 2017). Believing in conspiracy theories is linked to certain personality variables (Abalakina-Paap et al., 1999; Imhoff & Bruder, 2014; Lantian et al., 2017), but situational factors also make it more likely for conspiracy theories to evolve, which include individual or collective threat (Heiss et al., 2021; Newheiser et al., 2011; Van Prooijen, 2020) and societal crises (Van Prooijen & Douglas, 2017). These situations give rise to feelings of uncertainty and ambivalence (Van Harreveld et al., 2014). Conspiracy theories can be understood as a sense-making mechanism in reaction to the uncertainty associated with a specific situation or topic, offering closure (Hofstadter, 1964; Van Prooijen & Jostmann, 2013).

The Covid-19 pandemic constituted such a societal crisis. Adding to already existing uncertainties, a new type of vaccine was introduced—a vaccine using messenger RNA (mRNA). As this was a new method, it was likely to raise uncertainties and, thus, constituted a perfect breeding ground for conspiracy theories.

Countering Conspiracy Beliefs

Once an individual believes in a conspiracy theory, it becomes very hard to correct it (Ecker et al., 2011; Lewandowsky et al., 2012), but there are attempts to decrease their influence. Some interventions work by *addressing underlying needs and motives*. For example, the tendency to believe in conspiracy theories was lower when participants felt in control (Sullivan et al., 2010; Van Prooijen & Acker, 2015, but see also Van Elk & Lodder, 2018), or after a self-affirmation intervention (Van Prooijen et al., 2013). It was also lower when motivation was high for analytical compared to intuitive thinking (Swami et al., 2014). Other interventions work by *addressing the content of the conspiracy theory*. It seems possible to decrease the belief in conspiracy theories by providing rational arguments (Banas & Miller, 2013), though other studies found that this method does not lead to the intended behaviour change (Jolley & Douglas, 2014; Stojanov, 2015) and that it fails when being confronted with conspiracy arguments right before (Jolley & Douglas, 2017).

Overall, countering conspiracy theories through arguments seems most successful when individuals encounter anti-conspiracy arguments *before* engaging with a conspiracy theory, as shown in *inoculation* interventions. In these interventions, participants are (a) warned that they will likely be confronted with a specific conspiracy theory and (b) provided with anti-conspiracy arguments debunking logical and empirical fallacies of the conspiracy theory (McGuire, 1961; Lewandowsky & Cook, 2020). This method has successfully addressed misinformation (Maertens et al., 2020; Roozenbeek & Van der Linden, 2019) and anti-vaccine conspiracy theories (Jolley & Douglas, 2017).

Current Study

The current study builds on the idea of reaching out to individuals before they might entertain conspiracy beliefs. Unlike inoculation, the current approach does not provide counterarguments but tailored explanations aiming to reduce the uncertainty associated with a specific topic or situation. This approach holds two advantages: first, it refutes potential conspiracy theory content without mentioning their arguments and, thus, bearing the risk of potentially reinforcing another conspiracy theory; second, it addresses needs of certainty regarding this specific topic, which otherwise could steer the individual towards the sense-making function of conspiracy theories.

The preregistered experiment was conducted in the Covid-19 context based on the observation that introducing the new vaccination method using mRNA evoked uncertainty amidst the already uncertain situation of a pandemic. This study aimed to address this uncertainty by providing tailored explanations, testing whether it would reduce agreement with a Covid-19 vaccination conspiracy theory and increase vaccination intentions. Crucially, the study was conducted before participants could develop a strong attitude regarding this new method, which was when mRNA vaccines first gained media attention (November/December 2020), and thus before conspiracy theories surrounding it were widely spread. We hypothesised that receiving a *relevant explanation* addressing uncertainties surrounding the vaccination reduces agreement with a Covid-19 vaccination conspiracy theory (H1) and increases vaccination intentions (H2) compared to only reading three short facts about the vaccination *(no explanation)*, or reading an *irrelevant explanation* before reading the facts.[1]

We also predicted that receiving relevant explanations would influence the agreement with a Covid-19 vaccination conspiracy theory and vaccination intentions especially in people with

a stronger propensity to believe in conspiracy theories (i.e., higher conspiracy mentality; Imhoff & Bruder, 2014), expecting an interaction between conspiracy mentality and explanation type (H3).

Methods

Participants and Procedure

We aimed at a sample size of at least $N = 485$ (power of .80, $\alpha = .05$, expected effect size: $f^2 = .02$) after data exclusions. The sample was recruited through a German online survey panel between 26 November and 2 December 2020, and was representative of the population regarding age, gender, and county of residence. Of the 504 participants who submitted complete data, we excluded 122 for failing an attention check, as preregistered. With the resulting sample of $N = 382$ (181 male, 200 female, 1 Other; $M_{Age} = 44.29$, range: 19-69 years) we had 69% power to detect the target effect of $f^2 = .02$, but 80% power to detect an effect of $f^2 = .026$. We had also preregistered to exclude participants based on an outlier analysis ($n = 2$) for analyses concerning both predictors, as well as participants with medical conditions ($n = 46$) and/or people who already had a Covid-19 infection ($n = 7$) for those analyses predicting vaccination intentions, expecting that the latter two groups would not want or be able to get vaccinated. However, they still reported considerably high intentions to get vaccinated ($M = 44.7$, $SD = 36.3$), invalidating our concerns. Thus, to not further reduce the originally representative sample, we did not follow up on these three exclusions, and doing so did not meaningfully change the results (see Supplement, Table S1). Results also did not meaningfully change when controlling for age and gender (see Supplement, Table S2). As exclusions were much larger than expected, we additionally report analyses for all complete observations in the Supplement (Table S3).

Participants were randomly assigned to the *no explanation* ($n = 119$) *relevant explanation* ($n = 131$), or the *irrelevant explanation* ($n = 132$) condition. All participants were confronted with three short facts potentially raising uncertainty about the new vaccination method: (1) that it is based on the mRNA technique (which seems to have similarities with DNA and could raise the fear of genetic modifications), (2) that it is used for the first time in this form (which might convey insecurities in procedure and unknown side effects); and that (3) the approval of the vaccine is much faster than usual (which might raise anxieties that safety protocols are not met). In the *no explanation* condition, participants only read the three statements. In the *relevant explanation* condition, all facts were accompanied by three to five sentences giving background information addressing potential uncertainties. The text (1) explained how mRNA vaccinations work explicitly stating that it would not interfere with the genetic substance of the cell; (2) it mentioned this technique being researched for decades and that it is one of the safest techniques, but so far mainly was not used due to low effectiveness rather than unwanted side effects; and (3) that approval procedures are accelerated due to public importance, but that all safety protocols are met. In the *irrelevant explanation* condition, participants read an explanatory text about yeast dough before reading the three facts about the vaccination. The number of paragraphs and length of this text matched the text about the vaccination method. Participants had to spend at least 10 seconds per paragraph (at least 30s total) before they could proceed.

After receiving the respective information, all participants responded to our measures of Agreement with a Covid-19 Vaccination Conspiracy Theory, Vaccination Intention, and Conspiracy Mentality. As exploratory measures, we also included 4 items measuring Institutional Trust and Support of Governmental Regulations (Pummerer et al., 2022). The study was preregistered under https://aspredicted.org/V6W_PTG, and all deviations from the preregistration are noted in the manuscript. All materials are included in the Supplement.[2] Data and scripts are available under http://dx.doi.org/10.23668/psycharchives.5377 (data) and http://dx.doi.org/10.23668/psycharchives.5378 (syntax).

Measures

Agreement with a Covid-19 Vaccination Conspiracy Theory (VCT) was measured with six items (e.g., "Pharma companies working on the new vaccines against SARS-CoV-2 are hiding dangers about this new vaccine" from 1 = *Totally disagree* to 7 = *Totally agree*; Cronbach's alpha = .93; adapted from Shapiro et al., 2016).

Vaccination Intention was assessed by asking "How likely is it that you will get vaccinated against the new corona-virus once a vaccination is available?" (from 0% = *I certainly will not get vaccinated against the Corona-Virus* to 100% = *I will definitely get vaccinated against the Corona-Virus*).

Conspiracy Mentality (CM) was measured with 12 items (e.g., "Those at the top do whatever they want" from 1 = *Disagree* to 7 = *Agree*; Cronbach's alpha = .94; Imhoff & Bruder, 2014). Correlations between measures are reported in Table 1.

Results

Regression Models

To test the hypotheses, we conducted separate linear multiple regression analyses regressing VCT (H1) and vaccination intention (H2) on explanation type, CM (mean-centred), and their interaction (H3). Explanation type was coded using orthogonal contrasts (focal contrast: +2 *relevant*, -1 *irrelevant*, -1 *no*; residual contrast: 0, +1, -1) in order to allow for an independent interpretation of the regression coefficients (Aiken et al., 1991). Both contrasts, as well as their interactions with CM, were included as predictors. We checked whether CM differed between explanation types, which was not the case, $F(2, 379) = 0.01$, $p = .991$.

As hypothesised, people in the *relevant explanation* condition were less likely to agree to items suggesting a Covid-19 vaccine conspiracy theory (H1) and showed higher vaccination intentions (H2) compared to the *irrelevant* and *no explanation* condition (see Table 2), as shown by a significant main effect of the focal contrast (see Table 3). Higher CM predicted stronger agreement with a Covid-19 vaccination conspiracy theory and lower vaccination intentions. However, contradicting H3, there was no interaction between CM and the focal contrast, indicating that the relevant explanation had an effect independent from participants' general propensity for conspiratorial thinking. The regression model predicted VCT with $F(5, 376) = 83.63$, $p < .001$; explained variance $R^2 = .53$; and vaccination intentions with $F(5, 376) = 46.01$, $p < .001$; explained variance $R^2 = .38$. Results were similar when

controlling for age and gender as well as when conducting the analysis with the full sample (see Supplement, Table S2 & S3).

Table 1. Correlations Between Measures

Measures	Agreement with a Covid-19 Vaccination Conspiracy Theory (VCT)	Conspiracy Mentality (CM)
Vaccination intention	-.73	-.60
Conspiracy mentality (CM)	.72	–

Note. All correlations are significant at $p < .001$.

Table 2. Means and Standard Deviations

Condition	VCT (1-7)		Vaccination Intention (0-100)		CM (1-7)	
	M	*SD*	*M*	*SD*	*M*	*SD*
Relevant explanation	3.4	1.6	64.0	35.7	3.7	1.6
Irrelevant explanation	3.6	1.5	56.4	37.8	3.7	1.4
No explanation	3.9	1.5	52.2	34.1	3.7	1.5
overall	3.6	1.5	57.7	36.2	3.7	1.5

Note. VCT = Agreement with a Covid-19 vaccination conspiracy theory, CM = Conspiracy mentality.

Table 3. Multiple Regressions for Agreement with a Covid-19 Vaccination Conspiracy Theory (VCT) and Vaccination Intention (*N* = 382)

Predictors	VCT (1-7)						Vaccination Intention (0-100)					
	b (*SE*)	β	*t*	*p*	95% CI LL	95% CI UL	*b* (*SE*)	β	*t*	*p*	95% CI LL	95% CI UL
Constant	3.63 (0.06)	–	66.28	<.001	3.52	3.74	57.57 (1.47)	–	39.16	<.001	54.68	60.46
CM (mean-centred)	0.75 (0.04)	.71	20.01	<.001	0.67	0.82	-14.76 (1.00)	-.60	-14.76	<.001	-16.73	-12.79
Focal contrast	-0.11 (0.04)	-.10	-2.94	.004	-0.19	-0.04	3.15 (1.03)	.12	3.05	.002	1.11	5.17
Residual contrast	-0.11 (0.07)	-.06	-1.63	.105	-0.24	0.02	2.17 (1.81)	.05	1.19	.233	-1.40	5.73
Interaction term (CM x focal contrast)	0.01 (0.03)	.02	0.53	.599	-0.04	0.06	0.24 (0.68)	.02	0.36	.721	-1.10	1.59
Interaction term (CM x residual contrast)	0.00 (0.05)	.00	-0.01	.995	-0.09	0.09	-0.30 (1.27)	-.01	-0.24	.810	-2.79	2.18

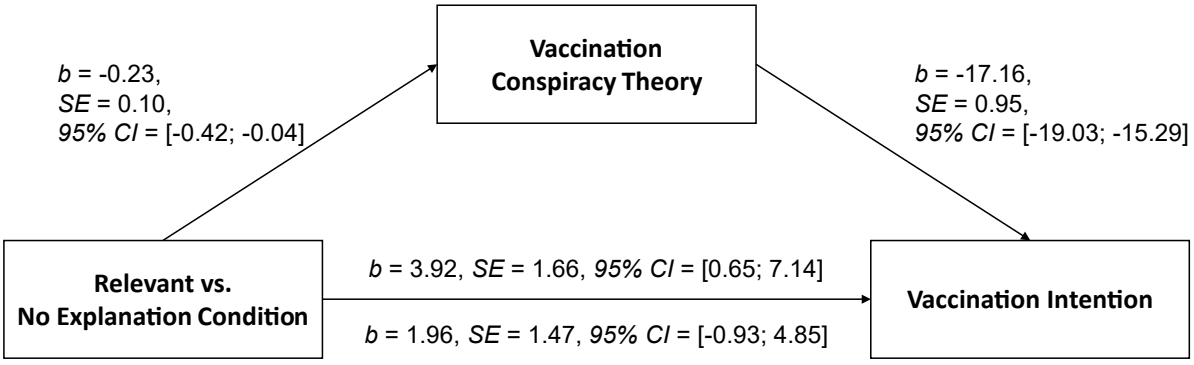

Figure 1. Mediation Model of Explanation Type Predicting Vaccination Intention Through Agreement with a Covid-19 Vaccination Conspiracy Theory

Note. N = 250; 10,000 bootstrap samples.

Mediation Analyses

As an exploratory analysis, we tested whether the agreement with a Covid-19 vaccination conspiracy theory explained the effect of the *relevant explanation* condition on vaccination intention, hereby only including the *relevant (+1) and no (-1) explanation* condition (following Jolley & Douglas, 2017). Indeed, agreement with a vaccination conspiracy theory mediated the effect of explanation type on vaccination intention (see Figure 1).

Discussion

In a preregistered experiment, we showed that an intervention addressing uncertainties regarding the new mRNA vaccine by providing relevant explanations decreased subsequent agreement with a Covid-19 vaccination conspiracy theory and, by doing so, increased vaccination intentions compared to reading only facts potentially inducing uncertainty or an irrelevant explanation and said facts. Our intervention was based on two different strategies: Addressing motives/needs underlying conspiracy theories (here, the need for certainty regarding the vaccination) and doing so before the individual engages with a conspiracy theory (one important aspect of inoculation). Extending existing methods of intervention, we show that combating vaccination conspiracy theories does not only work when people can be warned about the specific content of known conspiracy theories but also in situations where information counteracts uncertainty providing grounds for the belief in conspiracy theories (e.g., questions like: “Why was the development so fast?”, “Why a new method?”). Unlike inoculation, the explanations did not argue against any alleged cover-ups by the pharma industry and the government but provided information about the mechanism of the mRNA vaccine, how long this method has been used, and why the approval of the vaccine is faster than usual. Overall, the explanation addressed conspiracy theories by addressing existing uncertainty rather than existing conspiracy theories.

Providing a relevant explanation had a broader effect on the agreement with a Covid-19 vaccination conspiracy theory as well as vaccination intention—independent of the conspiracy mentality of the individuals. This is noteworthy because it broadens the potential target group of this intervention beyond those who have a general tendency to believe in conspiracy theories.

Future research might look at whether a general reduction of feelings of uncertainty has similar effects on beliefs and intentions in the domain of vaccination.

One limitation of the study is that the observed effect size of the intervention is relatively small (i.e., they only explained 1.1% and 1.5% of the variance). Still, we are convinced that even small effects can make a valuable contribution in the current context (Funder & Ozer, 2019). Moreover, the intervention was very brief (< 2 minutes), and increasing the dosage might increase the effect size. The study was conducted using a sample representative of the (German) population regarding age, gender, and county of residence, which is important for drawing practical conclusions. However, due to the form of recruiting (online) and this being a scientific study, we might have still only reached a specific population. Additionally, vaccination intentions were only investigated after reading the explanations. Thus, despite random assignment to conditions, we cannot control if intentions already differed before.

We also included a condition (*irrelevant explanation*) in which participants read the facts after reading a neutral text about yeast dough. Agreement with a Covid-19 vaccination conspiracy theory and vaccination intentions in this condition was in-between the two other conditions. In fact, comparing the two conditions, which included explanations (i.e., *relevant* or *irrelevant*) to the *no explanation* condition also yielded a significant contrast, indicating that reading a text alone significantly decreased agreement with a vaccination conspiracy theory and increased vaccination intentions (see Supplement, Table S4), which was in line with an additional hypothesis that was also preregistered. One possible explanation is that reading a detailed explanatory text–no matter if about the vaccination or yeast dough–might have induced analytical thinking, thereby decreasing subsequent agreement with a vaccination conspiracy theory (Swami et al., 2014). It might also be that participants did not ponder on the uncertainty-inducing facts as much due to reading a text. As different interpretations are possible, we did not emphasise this finding here. It deserves further research, potentially uncovering additional ways of decreasing the impact of conspiracy theories. In regard to the analyses here, excluding the *irrelevant explanation* condition and only comparing the *relevant explanation* condition with the *no explanation* condition, if anything, increased effect sizes, while comparing the *irrelevant explanation* condition with the *no explanation* condition did not yield a significant difference (see Supplement, Table S5 and S6). This difference makes it likely that the difference between presenting an (*irrelevant* or *relevant*) *explanation* and presenting no explanation reported above is driven by the relevant (and not the *irrelevant*) *explanation* condition.

Our study shows that providing explanations regarding (new) vaccines is important. In light of findings from inoculation theory (Lewandowsky & Cook, 2020; Maertens et al., 2020; Roozenbeek & Van der Linden, 2019), this might especially (or even only) be successful when participants were not confronted with the conspiracy theory yet. Once individuals have a strong opinion about the topic, it is very hard to change (Jolley & Douglas, 2017). This fact might also explain why attempts of reaching vaccination sceptics by providing scientific explanations one year (or more) after vaccination conspiracy theories have spread do not seem to reach the target population to the aspired extent, although conclusions here are clearly beyond the scope of this study.

In line with the rule that scientific communication should only present "fact-checked" information, all information presented in the study was based on scientific grounds. However, our study also shows that presenting short facts in some cases is not enough or might even give rise to uncertainties around an issue (here, a new vaccine). Since we did not have a condition

without those short facts, we can only speculate here, but as the short sentences were around critical issues, presenting (only) these might have even increased uncertainty regarding this new vaccination method. This bears implications for science communication as it emphasises the importance of providing (detailed) explanations in cases where true, but short facts leave room for speculation and, thus, uncertainty.

There are many studies indicating that people who believe in conspiracy theories are less likely to be reached with rational information (Pytlik et al., 2020; Swami et al., 2014). Our study suggests that this is not always the case. While it might be harder to reach individuals once a strong opinion is formed (Jolley & Douglas, 2017), it seems possible to do so at an early stage with explanations tailored towards addressing uncertainties in a situation where questions and scepticism abound. Thus, by identifying topics of uncertainty, potential future conspiracy theories might be anticipated and addressed before they gain popularity.

Notes

1. Please note that the condition labels differ from the preregistration, in order to better capture what was manipulated.
2. The supplement material can be found under https://doi.org/10.47368/ejhc.2022.201.

Funding

The authors received financial support by a grant by the Deutsche Forschungsgemeinschaft to the last author (DFG: SA800/17-1).

Conflict of Interest

The authors do not declare any conflict of interest.

References

Abalakina-Paap, A. M., Stephan, W. G., Craig, T., & Gregory, W. L. (1999). Beliefs in conspiracies beliefs. *Political Psychology*, *20*(3), 637-647. https://doi.org/10.1111/0162-895X.00160

Aiken, L. S., West, S. G., & Reno, R. R. (1991). *Multiple regression: Testing and interpreting interactions*. Sage.

Banas, J. A., & Miller, G. (2013). Inducing resistance to conspiracy theory propaganda: Testing inoculation and metainoculation strategies. *Human Communication Research*, *39*(2), 184-207. https://doi.org/10.1111/hcre.12000

Compton, J., Van der Linden, S., Cook, J., & Basol, M. (2021). Inoculation theory in the post-truth era: Extant findings and new frontiers for contested science, misinformation, and conspiracy theories. *Social and Personality Psychology Compass*, *15*(6), Article: e12602. https://doi.org/10.1111/spc3.12602

Douglas, K. M., Sutton, R. M., & Cichocka, A. (2017). The Psychology of Conspiracy Theories. *Current Directions in Psychological Science*, *26*(6), 538-542. https://doi.org/10.4324/9781315525419

Ecker, U. K. H., Lewandowsky, S., Swire, B., & Chang, D. (2011). Correcting false information in memory: Manipulating the strength of misinformation encoding and its retraction. *Psychonomic Bulletin and Review*, *18*(3), 570-578. https://doi.org/10.3758/s13423-011-0065-1

Funder, D. C., & Ozer, D. J. (2019). Evaluating effect size in psychological research: Sense and nonsense. *Advances in Methods and Practices in Psychological Science*, *2*(2), 156-168. https://doi.org/10.1177/2515245919847202

Heiss, R., Gell, S., Röthlingshöfer, E., & Zoller, C. (2021). How threat perceptions relate to learning and conspiracy beliefs about COVID-19: Evidence from a panel study. *Personality and Individual Differences*, *175*(January), Article: 110672. https://doi.org/10.1016/j.paid.2021.110672

Hofstadter, R. (1964). The paranoid style in American politics. *Harper's Magazine*, *11*. https://harpers.org/archive/1964/11/the-paranoid-style-in-american-politics/

Hornsey, M. J., Harris, E. A., & Fielding, K. S. (2018). The psychological roots of anti-vaccination attitudes: A 24-nation investigation. *Health Psychology*, *37*(4), 307–315. https://doi.org/10.1037/hea0000586

Imhoff, R., & Bruder, M. (2014). Speaking (un-) truth to power: Conspiracy mentality as a generalised political attitude. *European Journal of Personality*, *28*, 25-43. https://doi.org/10.1002/per.1930

Imhoff, R., Dieterle, L., & Lamberty, P. (2021). Resolving the puzzle of conspiracy worldview and political activism: Belief in secret plots decreases normative but increases nonnormative political engagement. *Social Psychological and Personality Science*, *12*(1), 71-79. https://doi.org/10.1177/1948550619896491

Jolley, D., & Douglas, K. M. (2014). The effects of anti-vaccine conspiracy theories on vaccination intentions. *PLoS ONE*, *9*(2), Article: e89177. https://doi.org/10.1371/journal.pone.0089177

Jolley, D., & Douglas, K. M. (2017). Prevention is better than cure: Addressing anti-vaccine conspiracy theories. *Journal of Applied Social Psychology*, *47*(8), 459-469. https://doi.org/10.1111/jasp.12453

Kijewski, L. (2021, March 31). EU fails to achieve March vaccination goals amid looming third wave. *Dpa*. https://www.dpa-international.com/topic/eu-fails-achieve-march-vaccination-goals-amid-looming-third-urn%3Anewsml%3Adpa.com%3A20090101%3A210331-99-44060

Lantian, A., Muller, D., Nurra, C., & Douglas, K. M. (2017). "I know things they don't know!" The role of need for uniqueness in belief in conspiracy theories. *Social Psychology*, *48*(3), 160-173. https://doi.org/10.1027/1864-9335/a000306

Lewandowsky, S., & Cook, J. (2020). *The conspiracy theory handbook*. 1–12. Center for Climate Change Communication, George Mason University. http://sks.to/conspiracy

Lewandowsky, S., Ecker, U. K. H., Seifert, C. M., Schwarz, N., & Cook, J. (2012). Misinformation and its correction: Continued influence and successful debiasing. *Psychological Science in the Public Interest, 13*(3), 106-131. https://doi.org/10.1177/1529100612451018

Maertens, R., Anseel, F., & Van der Linden, S. (2020). Combatting climate change misinformation: Evidence for longevity of inoculation and consensus messaging effects. *Journal of Environmental Psychology*, *70*, Article: 101455. https://doi.org/10.1016/j.jenvp.2020.101455

McGuire, W. J. (1961). The effectiveness of supportive and refutational defenses in immunizing and restoring beliefs against persuasion. *Sociometry*, 24(2), 184-197. https://doi.org/2786067

Newheiser, A. K., Farias, M., & Tausch, N. (2011). The functional nature of conspiracy beliefs: Examining the underpinnings of belief in the Da Vinci Code conspiracy. *Personality and Individual Differences*, *51*(8), 1007-1011. https://doi.org/10.1016/j.paid.2011.08.011

Pummerer, L., Böhm, R., Lilleholt, L., Winter, K., Zettler, I., & Sassenberg, K. (2022). Conspiracy theories and their societal effects during the COVID-19 pandemic. *Social Psychological and Personality Science*, *13*(1), 49-59. https://doi.org/10.1177/19485506211000217

Pytlik, N., Soll, D., & Mehl, S. (2020). Thinking preferences and conspiracy belief: Intuitive thinking and the jumping to conclusions-bias as a basis for the belief in conspiracy theories. *Frontiers in Psychiatry*, *11*, Article: 568942. https://doi.org/10.3389/fpsyt.2020.568942

Roozenbeek, J., & Linden, S. Van Der. (2019). The fake news game: Actively inoculating against the risk of misinformation. *Journal of Risk Research*, *22*(5), 570-580. https://doi.org/https://doi.org/10.1080/13669877.2018.1443491

Shapiro, G., Holding, A., Perez, S., Amsel, R., & Rosberger, Z. (2016). Validation of the vaccine conspiracy beliefs scale. *Papillomavirus Research*, *2*(May), 167-172. https://doi.org/10.1016/j.pvr.2016.09.001

Stojanov, A. (2015). Reducing conspiracy theory beliefs. *Psihologija*, *48*(3), 251-266. https://doi.org/10.2298/PSI1503251S

Sullivan, D., Landau, M. J., & Rothschild, Z. K. (2010). An existential function of enemyship: Evidence that people attribute influence to personal and political enemies to compensate for threats to control. *Journal of Personality and Social Psychology*, *98*(3), 434-449. https://doi.org/10.1037/a0017457

Swami, V., Voracek, M., Stieger, S., Tran, U. S., & Furnham, A. (2014). Analytic thinking reduces belief in conspiracy theories. *Cognition*, *133*(3), 572-585. https://doi.org/10.1016/j.cognition.2014.08.006

Tin, A. (2021, July 4th). U.S. falls short of Biden's July 4th COVID-19 vaccine goal. *CBS News*. https://www.cbsnews.com/news/biden-covid-19-vaccine-goal-missed/

Van Elk, M., & Lodder, P. (2018). Experimental manipulations of personal control do not increase illusory pattern perception. *Collabra: Psychology*, *4*(1), 1-22. https://doi.org/10.1525/collabra.155

Van Harreveld, F., Rutjens, B. T., Schneider, I. K., Nohlen, H. U., & Keskinis, K. (2014). In doubt and disorderly: Ambivalence promotes compensatory perceptions of order. *Journal of Experimental Psychology: General*, *143*(4), 1666-1676. https://doi.org/10.1037/a0036099

Van Der Linden, S., Roozenbeek, J., & Compton, J. (2020). Inoculating against fake news about COVID-19. *Frontiers in Psychology*, *11*, Article: 566790. https://doi.org/10.3389/fpsyg.2020.566790

Van Prooijen, A. M., Sparks, P., & Jessop, D. C. (2013). Promoting or jeopardising lighter carbon footprints? Self-affirmation can polarise environmental orientations. *Social Psychological and Personality Science*, *4*(2), 238-243. https://doi.org/10.1177/1948550612450465

Van Prooijen, J.-W. (2020). An existential threat model of conspiracy theories. *European Psychologist*, *25*(1), 16-25. https://doi.org/10.1027/1016-9040/a000381

Van Prooijen, J.-W., & Acker, M. (2015). The influence of control on belief in conspiracy theories: Conceptual and applied extensions. *Applied Cognitive Psychology*, *29*(5), 753-761. https://doi.org/10.1002/acp.3161

Van Prooijen, J.-W., & Douglas, K. M. (2017). Conspiracy theories as part of history: The role of societal crisis situations. *Memory Studies*, *10*(3), 323-333. https://doi.org/10.1177/1750698017701615

Van Prooijen, J.-W., & Jostmann, N. B. (2013). Belief in conspiracy theories: The influence of uncertainty and perceived morality. *European Journal of Social Psychology*, *43*(1), 109-115. https://doi.org/10.1002/ejsp.1922

Author Contributions

Conceptualisation (main idea, theory): Lotte Pummerer
Funding acquisition: Kai Sassenberg
Project administration: Lotte Pummerer, & Kai Sassenberg
Methodology (design, operationalization): Lotte Pummerer & Kai Sassenberg
Data collection: Lotte Pummerer
Data analysis: Lotte Pummerer, Kai Sassenberg, & Kevin Winter
Writing – original draft: Lotte Pummerer
Writing – review & editing: Lotte Pummerer, Kevin Winter, & Kai Sassenberg

Author Biographies

Lotte Pummerer is a PhD student at the Leibniz-Institut für Wissensmedien (IWM). Her research examines belief systems such as conspiracy theories and their social correlates.

Kevin Winter is a postdoctoral researcher at the IWM. His research focuses on how stable attitudes can be changed and on the underlying cognitive mechanisms.

Kai Sassenberg is head of the Social Processes Lab at IWM and professor at the University of Tübingen. His research interests are how motivation and self-regulation affects behaviour in social contexts.