Ideology shapes trust in scientists and attitudes towards vaccines
during the COVID-19 pandemic

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Abstract

The paper investigates the influence of ideology on trust in scientists. We assume that during a pandemic, ideology is linked to levels of trust in scientists, such that those espousing left- (vs. right-) wing beliefs place more trust in the scientific profession. We posit that the negative perception of scientists, a feature of right-wing narratives in the country of study, underlies this effect. Additionally, we argue that ideology has an indirect impact, via levels of trust in scientists, on beliefs and attitudes towards vaccines and vaccine policy. To test these hypotheses, we conducted three studies (total N = 1155): one pre-pandemic study and two studies during a pandemic. The results confirm the hypotheses; however, we observed varied effects at the outset of the pandemic versus later stages. The findings contribute to the ongoing discussion around the ideological underpinnings of trust in scientists and carry implications for public health measures.

Key words: trust in scientists, right–left wing beliefs, perception of scientists, vaccines beliefs, attitudes and policy acceptance, COVID-19 pandemic

The challenges posed by the coronavirus pandemic have spotlighted the role of science and scientists in society (Shepherd, 2020). Indeed, surveys conducted in many countries suggest that, during a pandemic, people are more likely to listen to expert advice from scientists and put more trust in them than they had previously (Wissenschaft im Dialog/Kantar, 2020; ARC Rynek i Opinia, 2020; Edelman Trust Barometer, 2020). Questions arise, however, as to whether those from opposite ends of the political spectrum look increasingly to academics for advice in equal measure, and whether this trust shapes their responsiveness to public health measures, such as vaccination programmes. In an attempt to answer these questions, we first investigated the role of political ideology in shaping people's trust in scientists. We then tested if the negative perception of scientists as being among the elites (a prominent feature of right-wing narratives in the country of study) underlies the link between ideology and trust in scientists. Finally, we looked into whether ideology has an indirect impact via trust in scientists, on beliefs and attitudes towards vaccines and vaccine policy. We believe that this paper contributes to the discussion surrounding the role of ideology in influencing trust in scientists, and as a consequence, beliefs and attitudes towards vaccines, and the relevant associated policies. Importantly, as there is limited data on trust in scientists and attitudes towards vaccinations in Europe and their relation to political preferences, our analysis significantly extends the current knowledge in this field, which is presently based mainly on studies conducted in the US.

Ideology, threat and trust in scientists

Trust in scientists is a form of institutional trust which denotes beliefs in the expertise and honesty of people working within scientific institutions (Chryssochoidis, Strada, & Krystallis, 2009). Several studies have shown that trust in scientists is the most important heuristic many people use when reporting their opinions on science-related topics (Hmielowski,

Feldman, Myers, Leiserowitz, & Maibach, 2014). Trust is also an important factor affecting risk interpretation and support for policy choices in the face of risks, including risks beyond one's control (Kellstedt, Zahran, & Vedlitz, 2008); the 2020 COVID-19 pandemic is a prime example of such an uncontrollable set of circumstances. Therefore, the higher the perceived risk, the higher an individual's level of trust in the experts on the subject might be. This stems from the fact that scientists are expected to provide reliable knowledge about what to think and how to act, and thereby mitigate risk. Thanks to experts, in a crisis situation, people may also regain their level of control so that the risk is significantly lowered (van Harreveld & Rutjens, 2020; Siegrist & Chetkovich, 2000). Recent studies have lent support to this idea by showing that people in a pandemic group report higher trust in scientists compared to people in a pre-pandemic group (Sibley et al., 2020).

Institutional trust is malleable, and shaped by sociocultural factors and value systems (Colquitt, Scott, & LePine, 2007). It follows then that trust in scientists ought to be linked to the various ideologies held among members of a given society. This can be explained by the observation that people's knowledge on most scientific issues, including climate change or vaccines, is relatively limited (Leiserowitz, Maibach, & Roser-Renouf, 2010). Therefore, the salient values employed to assess the trustworthiness of scientific institutions are likely to be those of agreement and sympathy rather than utilizing carefully reasoned arguments or applying direct knowledge. In addition, the effects of ideology on attitudes towards science and scientists are observed in threat conditions that are conducive to a higher salience of political identity. Threat may lead individuals to display a strong tendency to conform their understanding of various issues, especially complex ones, in accordance with the position of the authorities or groups that they support or belong. During times of social crises (such as pandemics), people's political identities and their associated beliefs cause them to be more sensitive to ideological cues (Kahan, 2017; Hart & Nisbet, 2012; van Bavel & Pereira, 2018; Johnston, Lavine, &

Federico, 2017). Thus, we expect that ideology plays an important role in shaping trust in scientists, particularly during the COVID-19 pandemic (in comparison to the period leading up to the outbreak of the virus).

This brings up the question, however, as to whether any increase in trust in scientists is equally distributed along the political spectrum in the threatening circumstances of a global epidemic. We expect that people espousing left- (and, to a lesser extent right-) wing beliefs would place even greater trust in scientists during a pandemic. This is because the link between ideology and trust in scientists is subject to contextual factors; one such factor is how scientists are variously perceived by those of diverse ideologies. For example, in the US, the increasing distrust among right-wingers towards scientific institutions is partly a reaction to the perceived liberalization of these institutions (Cofnas, Carl, & Woodley of Menie, 2018). Thus, right-wingers may be more distrustful towards the scientific community partly due to the strongly held belief that the scientific establishment has taken a liberal-activist stance, a trend which is seen as coming into conflict with the values of those on the political right. In Poland (the country of study in this paper), scientific institutions are seen as relatively apolitical, neither conservative nor especially progressive, and the scientific community is highly dispersed along the left-right political dimension (Filip, 2019). At odds with this is the official right-wing narrative, boosted by the national media, which promulgates the notion that society is separated into two homogeneous and antagonistic groups, ‘the ordinary people’ versus ‘the corrupt elite’ (Kulas, 2018). According to this narrative, scientists are portrayed as representatives of the privileged and corrupt elites, betraying the nation, and deceiving the public (Michalski, 2018; Janicki, 2017). Therefore, we think that what underlies the lower levels of trust towards scientists, as can be observed among right-wingers (in comparison with left-wingers), is this anti-elitist sentiment rather than any perceived liberalization of the scientific institutions themselves. In light of all this, we suggest that these anti-elitist attitudes, characteristic of right-

wingers in Poland, may lead to lower levels of trust in scientists among right-wingers (vs. left-wingers) during a world-wide health crisis such as a pandemic.

Summing up, we posit that the heightened threat induced by the COVID-19 crisis has produced a rise in political identity salience. This increased salience in political identity in turn leads to right-wingers (vs. left-wingers) trusting scientists even less than was previously the case. The source of their distrust stems from their perception of scientists as elitist, a perception that is a component of a populist (right-wing) political narrative in the country of study. However, this negative perception becomes even more prominent (or more activated in people's minds) in threat conditions to such an extent that it influences the levels of trust in scientists.

Ideology, trust in scientists and attitudes towards vaccines

Trust in scientists is especially essential nowadays as it shapes the general responsiveness to the many extraordinary public health measures which have a substantial impact on the spread of COVID-19; these measures include: the isolation of those testing positive, contact tracing, quarantines imposed on persons suspected of being infected, epidemiological surveillance and the prohibition of mass gatherings, to name but a few (Taylor, 2019; Plohl & Musil, 2020). This trust may also be of particular importance in the case of beliefs and attitudes pertaining to vaccines, and the acceptance of vaccination policies. Recently, many countries across the globe have witnessed the development of anti-vaccination movements (Hussain, Ali, Ahmed, & Hussain, 2018) and a rise in the number of parents/patients who delay or refuse protective vaccination (Wallinga, Levy-Bruhl, Gay, & Wachmann, 2001; Gangarosa et al, 1998; de Figueiredo et al., 2016; CBOS, 2017). The lack of acceptance of vaccination programmes results in increased risks of contracting a disease, a drop in the population's resistance and the danger of countries developing epidemic centres. Clearly, future medical interventions would be facilitated by gaining greater knowledge around

optimizing strategies to increase the levels of vaccination in the population. Despite the development of effective vaccines against SARS-CoV-2, opposition to vaccination could amplify outbreaks, as happened for measles in 2019 (see Stoffels, 2020).

Although the benefits of vaccination are within the domain of strong scientific and medical consensus, the public's attitudes can be influenced by various factors, one of which is ideological stance (Kahan, 2017). Other factors include the tendency to believe in conspiracies, to support a free-market ideology and liberalism (Lewandowsky, Gignac, & Oberauer, 2013), and religiosity (Rutjens, Heine, Sutton, & van Harreveld, 2018; Rutjens, Sutton & van der Lee, 2018). An individual's tendency to be high in reactance, to show high levels of disgust toward blood and needles, and to hold strong individualistic/hierarchical worldviews also contribute to these attitudes (Hornsey, Harris, & Fielding, 2018). Recently, Baumgaertner and colleagues (2018), using a nationally representative internet survey in the U.S., demonstrated that political ideology has a direct effect on vaccine choice. In particular, conservative respondents were less likely to express pro-vaccination beliefs than liberal ones. It was also found that ideology has an indirect effect on the respondents' declared willingness to be immunized via trust in governmental medical experts. Interestingly, however, other analysis conducted on European data collected in March 2019, showed that the link between ideology and vaccine attitudes is non-significant (Czarnek, Kossowska, & Szwed, 2020a). Nevertheless, analysis of data from the Welcome Global Monitor (Welcome Trust, 2018) revealed that trust in scientists is highly correlated with positive attitudes towards vaccination (Czarnek, Kossowska, & Szwed, 2020b). Neither of these studies elucidate the nature of the relationship between ideology and trust, the subject of this paper. In this study, we theorised that ideology has an indirect effect on beliefs and attitudes towards vaccines. In other words, the ideology variable should predict trust in scientists, which in turn may help explain individual-level variation with regards to attitudes about vaccine choice.

Overview of the studies

In our research program, we test the hypothesis that during a pandemic, in contrast to pre-pandemic times, political ideology is positively associated with trust in scientists, such that those espousing left- (vs. right-) wing beliefs¹ are more trustful (Hypothesis 1). This is because the effects of ideology on attitudes towards science and scientists are being observed in threat which makes political identity salient, but not when threat is absent. We also hypothesize that the mechanism responsible for the effect that during the pandemic, trust in scientists is higher among left-wingers than right-wingers, lies in the negative perception among right-wingers of scientists, a view which sees them as being representatives of the elites (Hypothesis 2). Furthermore, we expect that ideology has an indirect effect on beliefs and attitudes towards vaccines (Hypotheses 3). The itself ideology is associated with trust in scientists, which, in turn, has knock-on effects on vaccine attitudes.

To test the hypotheses, we conducted three studies: two studies during the COVID-19 pandemic and one study before the pandemic. In addition, in Study 2, we investigated if right-wing ideology is negatively related to trust in scientists and attitudes towards vaccines. In Study 3, we aimed at replicating the results of Study 2 to verify whether the effects persisted beyond just the time of the onset of the pandemic. We also measured beliefs around vaccines and

¹ Although the differentiation between the two strands of political beliefs (cultural and economic) seems to better explain ideology in modern societies (e.g., Feldman & Johnston, 2014; Malka et al., 2014), in this paper, we focus solely on the cultural dimension of political beliefs. This is because they seem to be the primary dimension of political ideology and are also more predictive of value conflicts and attitudes toward various groups than economic beliefs (e.g., Crawford, Brandt, Inbar, Chambers, & Motyl, 2017), and because, importantly, in the Polish context, the ‘culture war’ seems to be focused around issues related to cultural or moral (e.g., abortion, LGBTQ+ rights) rather than economic issues. Furthermore, we follow the European tradition, since the time of the French Revolution, that ideological opinions that express the long-lasting ideological divide concerning preferences for change versus stability have been classified in terms of a left-right rather than a conservatism–liberalism dimension (Jost, Federico & Napier, 2009).

support for vaccine policy. Finally, we carried out preliminary testing for the mechanism responsible for the link between ideology and trust, i.e., the perception of scientists-as-elites.

In all the studies, we controlled for age, gender, level of education, political knowledge, and the level of fear of being infected by SARS-CoV-2². On reporting each study, the means, standard deviations, correlations between variables, and regression analyses are presented in Supplementary Material in Tables S1, S2, and S3 respectively.

This program of studies was approved by the Institutional Review Board of the Institute of Psychology, Jagiellonian University. All participants gave informed consent to participate in the survey and could halt their participation at any point in proceedings. Study 3 was preregistered. All materials, scripts and data to replicate the results of all of the studies are available on our OSF page (<https://osf.io/bst9g/>). Information on determining sample sizes as well as data about political identification in all of these studies is presented in the Supplementary Material (Tables S4 and S5).

Study 1

This study was completed between February 24th and 27th 2020, before the official start-date of the COVID-19 pandemic in Poland (March 17th; the first coronavirus case in Poland was confirmed on March 4th) and so was treated as a pre-pandemic study. It is entirely possible that a small number of people might have sensed the impending crisis, but the vast majority

² In our preregistration of Study 3, no plan had been made to analyze participants' response to the question concerning the threat of being infected by SARS-CoV-2. However, to be consistent with the analysis of Study 2, we decided to include this variable into the analysis. The results of the analysis without this covariate saw no change. In addition, although attitudes towards vaccines was shown to be influenced by religiosity (Rutjens, Heine, Sutton, & van Harreveld, 2018), this variable was not controlled for because in the Polish context, religiosity is a part of right-wing cultural beliefs. In fact, the Cultural Beliefs Scale that we used to measure ideology, included the Religious Fundamentalism subscale (which was shown to be correlated highly with religiosity, $r = .78$; see: Czarnek et al., 2017).

were unaware of any imminent risks or held out hope that the pandemic would not reach them (Doliński et al., 2020).

Participants

Our sample consisted of 353 Polish participants (136 males, 173 females, and 44 who did not provide a response; $M_{age} = 41.77$, range: 22-73; $SD_{age} = 12.06$) who were recruited via Research Online using semi-quota sampling by age, gender, education and political affiliation to represent the Polish adult population for the mentioned variables. To safeguard the quality of the data, participants were excluded from further analysis if they completed the survey in too short a time (<250 sec). Based on this criterion, the data of 41 participants was removed before analysis. Thus, the final sample consisted of 312 Polish participants (129 males, 169 females, and 14 who did not provide a response; $M_{age} = 41.98$, range: 22-73; $SD_{age} = 12.11$), with various levels of education: vocational ($N = 29$), high school education ($N = 79$), students ($N = 11$), and higher education ($N = 179$). All participants were paid a base rate of approximately \$2.50 (10 PLN) for participation in the study.

Measures & Procedure

Ideology

The participants' political beliefs were assessed with the Political Beliefs Questionnaire³ (PBQ; Czarnek, Dragon, Szwed, & Wojciszke, 2017), which is comprised of Cultural (Cronbach's $\alpha = .88$) and Economic Beliefs subscales (Cronbach's $\alpha = .86$). The questionnaire consisted of 9 items per cultural dimension and 10 per economic dimension, with 5-point answer scales (from 1 = "Strongly disagree" to 5 = "Strongly agree"). The higher the average score, the more right-wing the beliefs are in the domains of culture or the economy. Both subscales were moderately negatively correlated ($r = -.24$, $p < .001$). It is worth noting that the

³ The items translated into English are presented at OSF <https://osf.io/mvkjw/>.

negative correlations between cultural and economic beliefs are not unusual among Polish samples, or indeed in other contexts (e.g., Czarnek, Szwed, & Kossowska, 2019; Malka, Lelkes, & Soto, 2017). In all the studies, the results reported will be confined to the Cultural Beliefs subscale.

Trust in scientists

We probed our participants about the degree to which they trust scientists using a series of questions from McCright and others (2013): *How much do you distrust or trust scientists to:* (1) create knowledge that is unbiased and accurate?; (2) create knowledge that is useful?; (3) advise government officials on policy?; (4) inform the public on important issues?, with 5-point answer scales (from 1 = “completely distrust” to 5 = “completely trust”). The responses to these questions were averaged (Cronbach’s $\alpha = .86$); the higher the index, the higher the trust placed in scientists.

Political Knowledge

As political knowledge may be partly responsible for the different effects of ideology, we decided to control for this variable. We used a civics-type list of questions identical to those previously used on the official exit examination at the end of secondary level education in Poland (in Polish: *matura*). A participant could score a maximum of 20 points by answering all questions correctly. We provide a full list of the questions in the Supplementary Materials (Table S6).

The participants completed an online survey, starting with the Political Beliefs Questionnaire and Political Knowledge test. Following this came the questions on trust in scientists. At the end, they were asked for their age, gender, level of education, political affiliation, and then thanked and debriefed them.

Results & Discussion

As expected, we did not find any relationship between ideology and levels of trust in scientists ($b = -0.03$, $SE = .05$, $p = .598$, 95% CI $[-.12; .07]$; with an ΔR^2 of .042). This is in line with the assumption that the effects of ideology on attitudes towards scientists are observed when political identity is salient. In the pre-pandemic period, when no threat was present, individuals' political identity was un-activated in their minds, and thus did not exert any influence on levels of trust in scientists.

Study 2

The aim of Study 2, carried out in the period March 14th to 18th 2020, at the outset of the COVID-19 pandemic in Poland, was to test the role of ideology in shaping trust in scientists during a pandemic. We expected that ideology would be related to the levels of trust in scientists during a pandemic (vs. beforehand), and that those espousing left- (vs. right-) wing beliefs would be more trustful towards the scientific profession. In addition, we tested to ascertain whether ideology has an indirect effect on beliefs and attitudes towards vaccines. The ideology variable should predict trust in scientists, which in turn may help explain individual-level variation with regards to attitudes about vaccine choice.

Participants

Our sample consisted of 426 Polish participants (173 males, 252 females, and 1 other; $M_{age} = 37.39$, range: 18-79; $SD_{age} = 16.55$) were recruited via Pollster Research Institute using semi-quota sampling by age, gender, education and political affiliation to represent the Polish adult population for the abovementioned variables. As in Study 1, the data of 35 participants was excluded since they completed the survey too rapidly (<250 sec). Thus, the final sample consisted of 391 Polish participants (161 males, 229 females, and 1 other; $M_{age} = 37.86$, range: 18-79; $SD_{age} = 16.86$), with various levels of education: vocational ($N = 76$), high school

education ($N = 93$), students ($N = 110$), and higher education ($N = 112$). All participants were paid a base rate of approximately \$2.50 (10 PLN) for participation in the study.

Measures & Procedure

We applied the same measures of trust in scientists (Cronbach's $\alpha = .81$), and political knowledge as in Study 1. Ideology was also measured in a manner identical to that in Study 1 with a questionnaire that contains Cultural (Cronbach's $\alpha = .89$) and Economic Beliefs subscales (Cronbach's $\alpha = .85$). Both subscales were moderately negatively correlated ($r = -.29$, $p < .001$), as before. Additionally, because of the coronavirus outbreak we asked each participant: *To what extent are you afraid of being infected with SARS-CoV-2?* On a scale of 1-10 (1- I'm not afraid at all; 10- I'm extremely afraid). We also checked whether ideology differentiated the responses to this question. A significant regression equation was found ($b = 0.74$, $F(1,388) = 35.12$, $p < 0.001$; with an ΔR^2 of .083) revealing that right-wingers were more afraid of being infected in comparison to left-wingers.

Vaccines beliefs and attitudes

We measured vaccine beliefs and attitudes using statements from the Eurobarometer 91.2 (a public opinion survey run in EU member states; European Commission, 2019). The statements were the following: *It is important for everybody to have routine vaccinations; Not getting vaccinated can lead to serious health issues; Vaccination of other people is important to protect those that cannot be vaccinated (e.g. new-born children, the immunosuppressed or very sick people); Vaccines can often produce serious side-effects* and *Vaccines are rigorously tested before being authorised for use*. Participants responded on 5-point response scales (from 1 = “completely disagree” to 5 = “completely agree”). Although we followed Eurobarometer's classification of the items, taking into the account the high internal consistency of the items, we created the index by averaging all the items ($M = 4.20$, $SD = 0.78$, Cronbach's $\alpha = .86$); the

higher the index; the more positive vaccine beliefs and attitudes were. The separate analysis for beliefs about vaccines, and attitudes towards vaccines are presented in the Supplementary Materials (Table S7).

The participants completed an online survey, initially with the Political Beliefs Questionnaire, Trust in scientists, and Political Knowledge tests. After this were the responses concerning vaccines. Lastly, they were asked for their age, gender, level of education, political affiliation, questioned on their fear of being infected by SARS-CoV-2, and then thanked and debriefed.

Results & Discussion

Trust in scientists: Study 1 & 2 comparison

To determine if the effects of ideology on trust in scientists in Studies 1 and 2 differed from each other, we ran a regression with interaction terms (using the PROCESS macro model 1; Hayes 2013). In the model tested, we used political ideology as a predictor, the time of the study (0- pre-COVID-19 outbreak, 1- during the outbreak) served as moderator, and trust in scientists was made a dependent variable; the continuous variables, i.e., political ideology and trust in scientists, were mean-centred before analysis.

There was a non-significant main effect of ideology on trust in scientists ($b = 0.09$, $SE = .10$, $p = .360$, 95% CI $[-.10; .28]$); however, the effect of the time of the study on trust in scientists was positive and significant ($b = 0.53$, $SE = .18$, $p = .004$, 95% CI $[.17; .89]$), indicating that overall trust in scientists increased at the onset of the pandemic, compared to the pre-pandemic period. Finally, the interaction effect of ideology and the time of the study on trust in scientists was also significant ($b = -0.13$, $F(1,688) = 4.27$, $p = .039$, with an ΔR^2 of .0054)]; it showed that the relationship between ideology and trust in scientists was non-significant before the outbreak ($b = -0.04$, $SE = .04$, $p = .418$, 95% CI $[-.12; .05]$), whereas this

relationship was significant during the outbreak ($b = -0.16$, $SE = .04$, $p < .001$, 95% CI $[-.25; -.08]$).

Furthermore, on examining the change in trust for left- and right-wingers ($-1SD$, $+1SD$) separately, it was revealed that trust in scientists increased significantly during the outbreak compared to the pre-pandemic period among left-wing adherents ($b = .32$, $SE = .12$, $p = .006$, 95% CI $[.09; .55]$); however, this increase was non-significant among right-wing adherents ($b = 0.07$, $SE = .13$, $p = .584$, 95% CI $[-.18; .33]$).

The results are depicted in Figure 1.

Ideology, trust and vaccines

To test our prediction that trust in scientists mediates the effects of ideology on beliefs about, and attitudes towards, vaccines, we used the PROCESS macro (Hayes 2013, model 4 with 20,000 bias-corrected bootstrap samples, all variables were mean-centred prior to analysis). It emerged that ideology served as the predictor, trust in scientists served as the mediator, and the vaccine beliefs and attitudes index served as the dependent variables. The conceptual model is depicted in Figure 2.

The results demonstrated that right-wing ideology was negatively associated with trust in scientists ($b = -0.14$, $SE = 0.04$, $p = .001$, 95% CI $[-.22, -.06]$), and trust in scientists, in turn, was positively associated with the vaccine beliefs and attitudes index ($b = 0.24$, $SE = 0.05$, $p < .001$, 95% CI $[0.14, 0.34]$). The (standardized) indirect effect exerted between ideology and the vaccine beliefs and attitudes index through trust in scientists was negative ($\beta = -0.04$, $SE = 0.02$, 95% CI $[-.08, -.01]$). Similarly, the direct effect of ideology on attitudes toward vaccines was negative ($b = -0.12$, $SE = 0.04$, $p = .005$, 95% CI $[-.20, -.04]$). The details of the results are presented in Supplementary Materials in Table S7 and Figure S1.

Summing up all the findings in Study 2, they indicate that trust in scientists increases during a pandemic compared to pre-pandemic measurements. This is presumably because

scientists are expected to provide reliable knowledge about what to think and how to act, and this knowledge is especially important during a pandemic since it may potentially mitigate risks. Moreover, by virtue of this expert knowledge, people may restore their level of control, a sense of which is significantly lowered in a crisis. Importantly however, the results indicate that during the COVID-19 outbreak (unlike the pre-pandemic period), the relationship between ideology and trust in scientists became significant. Furthermore, we observed that trust in scientists is lower among right-wingers than among left-wingers. We suggest that the threat posed by COVID-19 might have led individuals to display a strong tendency to conform their opinions about scientists and its role in dealing with pandemic in accordance with the position of the authorities or groups that they support or belong to. As important component of right-wing (but not left-wing) beliefs is a negative perception of scientists, this negativity might affect our findings. It is worth noting, in line with threat sensitivity theory (Hibbing et al., 2013), we found that right-wing adherents' fear of being infected by SARS-CoV-2 is greater than for left-wing participants. These two phenomena: (i) right-wingers trusting scientists less than left-wingers, while (ii) fearing infection to a greater degree, warrants closer examination. In the subsequent study, we decided to focus on the preliminary testing of the mechanism responsible for right-wingers trusting scientists less than left-wingers.

In addition, in line with expectations, we ascertained that trust in scientists mediates the link between ideology and beliefs and attitudes around vaccines, i.e. left-wing beliefs are linked to higher levels of trust in scientists, and higher levels of trust are in turn associated with more positive beliefs and attitudes towards vaccines. Our findings also demonstrate that ideology has a direct effect on the vaccine beliefs and attitudes index. In particular, right-wingers are less likely to express pro-vaccination beliefs and attitudes than left-wing individuals. This might be as a result of public discussion about anti-vaccination viewpoints that have recently taken place among right-wing leaders in Poland (Kość, 2020).

Study 3

Study 3 was performed in the period June 1st - 4th, 2020 following the initial relaxation of restrictions related to COVID-19. In this study, we intended to replicate the results of Study 2, showing that, during a pandemic, political ideology shapes the level of trust in scientists. We also expected that this relationship is negative, i.e., right-wing adherents trust in scientists less than left-wing adherents. Above and beyond this, the main goal of Study 3 was to examine the mechanism responsible for this effect, based on the hypothesis that the perception of scientists as members of the elite, a notion associated with right-wing ideology, makes right-wingers more distrustful of scientists than left-wingers are. As previously, we also planned to confirm that higher levels of trust in scientists are related to more positive beliefs and attitudes towards vaccination and the relevant policies. The study hypotheses along with the plan of analysis have all been pre-registered at OSF <https://osf.io/sg64e>.

Participants

The recruitment of 376 participants (189 males, 187 females; $M_{age} = 33.89$, range: 18-90; $SD_{age} = 11.77$) was carried out via the Pollster Research Institute using semi-quota sampling by age, gender, education and political affiliation to represent the Polish adult population for the variables mentioned above. As in previous studies, we excluded 7 participants who completed the survey in too little time (<250 sec). Thus, the final sample is comprised of 369 Polish participants (186 males, 183 females; $M_{age} = 33.79$, range: 18-60; $SD_{age} = 11.47$), with various levels of education: vocational ($N = 57$), high school education ($n = 129$), students ($N = 24$) and higher education ($N = 159$). All participants were paid a base rate of approximately \$2.50 (10 PLN) for participation in the study.

Measures & Procedure

Once again, our participants were queried about the degree of trust they place in scientists using the same methods as before, but with an additional three new items: (1) “Do

scientists act for the good of all?”, (2) *“Are scientists telling the public the truth?”*, and (3) *“Do you, in general trust, scientists?”* (Cronbach’s α for all questions measuring trust in scientists was .91).

The same measure of beliefs ($M = 7.70$, $SD = 0.99$, Cronbach’s $\alpha = .89$), and political knowledge was used as in Studies 1 and 2. Moreover, we added 3 more items assessing attitudes toward vaccination policy to those items measuring vaccine beliefs and attitudes already used in Study 2. Specifically, we posed the following three statements related to the policy: (1) “It is the state and not the parents who should decide if a child should be vaccinated”; (2) “Children who have not been vaccinated should not have access to kindergartens and schools”; (3) “Every person living in Poland should undergo mandatory vaccination against SARS-CoV-2 as soon as the vaccine is available”. We chose to add these 3 items prompted by the findings from some studies that have revealed that what is most divisive is not the characterization of the problem itself but the proposed solutions associated with the problem (Campbell & Kay, 2014). However, in light of the high internal consistency of these items, we created an index by averaging all the items ($M = 3.51$, $SD = 0.93$, Cronbach’s $\alpha = .87$); the higher the index, the more positive the beliefs and attitudes are towards vaccines and vaccine policy. The separate analysis for beliefs about vaccines, as well as attitudes towards vaccines and vaccine policy, are presented in Supplementary Materials (Table S8).

As before, we also asked participants about their anxiety related to COVID-19: *To what extent are you afraid of being infected with SARS-CoV-2?* (1 = I’m not afraid at all; 10 = I’m extremely afraid). A univariate linear regression⁴ was calculated to predict the fear of being

⁴ In addition, as we expected that the fear of being infected in the later stages of the outbreak would have decreased compared to the beginning of the outbreak, we conducted an univariate regression analysis with the time of the study as predictor (coded: 1 – the beginning of the outbreak [March 2020], 2- in the later stages of the outbreak [June 2020]) and the fear of being infected as dependent variable. We found that the time of the study was negatively related to threat of being infected by SARS-CoV-2 ($b = -0.74$, $SE = 0.17$, $p < .0001$, 95% CI [-1.08, -.41]); in other words, in June 2020 (Study 3) people’s fear of being infected was much lower than in March 2020 (Study 2).

infected by SARS-CoV-2 based on ideology. A significant regression equation was found ($b = 0.42$, $F(1,363) = 10.43$, $p = 0.001$, with an R^2 of .028) showing that right-wingers were more fearful of being infected.

Perception of scientists-as-elites

To measure the perception of scientists as being among the elite of the country of study, we used the following questions: “The scientific community in Poland is more privileged than it should be”, “Scientists in Poland are part of our country's elite, and are not interested in the needs of ordinary citizens”, “Scientists earn too much”, and “The main motivation of scientists is a financial one” (1 = completely disagree, 5 = completely agree, Cronbach's $\alpha = .75$; the higher the score, the more scientists are perceived to be a part of the elites). For exploratory purposes, we also applied additional measures for the perception of scientists' goals, conspiracy beliefs, the perception of the political beliefs of scientists, and the perception of scientists' warmth and competence. The description of the scales and the results of these dimensions are presented in Supplementary Materials (Table S8).

The study was conducted online. Participants were first asked to give a consent agreement, then responded to questions about their political beliefs (PBQ), their trust in and perception of scientists, took the political knowledge test, and stated their beliefs and attitudes towards vaccination. Finally, they responded to the questionnaire about scientists' goals, and the Generic Conspiracist Beliefs Scale. At the end, they were asked about their age, gender, level of education, affiliation, fear of being infected by SARS-CoV-2, and then thanked and debriefed.

Results & Discussion

Trust and ideology before and during the COVID-19 outbreak

To test if the effect of ideology on trust in scientists differed significantly between the studies, we ran a regression with interaction between ideology and the time of the study (using

model 1 in the PROCESS macro; Hayes 2013). We used the ideology measure as a predictor, the time of the study (0 - pre-COVID-19 outbreak [February 2020], 1 – the beginning of the outbreak [March 2020], 2 - in the later stages of the outbreak [June 2020]; dummy coded, pre-COVID-19 outbreak data was used as a reference group) as a moderator, and trust in scientists as a dependent variable. Political ideology and continuous control variables and were mean-centred before the analysis.

The effect of ideology on trust in scientists ($b = -0.03$, $SE = .05$, $p = .447$, 95% CI $[-.12; .05]$) was non-significant. We found a negative effect related to the time of the study, when Study 2 (March 2020) was compared to the reference group ($b = -0.12$, $SE = .06$, $p = .041$, 95% CI $[-.24; -.01]$), but non-significant when Study 3 (June 2020) was compared to the reference group ($b = -0.09$, $SE = .06$, $p = .109$, 95% CI $[-.21; .02]$). Furthermore, the overall interaction effect of ideology and study number was significant ($b = -0.12$, $F(2,1046) = 3.23$, $p = .040$, with an ΔR^2 of .0037), revealing that the relationship between ideology and trust in scientists was non-significant before the outbreak (Study 1: $b = -0.03$, $SE = .05$, $p = .447$, 95% CI $[-.12; .05]$), whereas this relationship was negative and significant during the outbreak (Study 2; $b = -0.16$, $SE = .04$, $p < .001$, 95% CI $[-.24; -.08]$; Study 3; $b = -0.13$, $SE = .04$, $p = .001$, 95% CI $[-.21; -.05]$).

Although the relationship between ideology and trust in scientists was also negative at the later stage of pandemic (Study 3), this time when examining the change in trust for left- and right-wingers (-1SD, +1SD) separately, it revealed that trust in scientists decreased significantly during the outbreak compared to the pre-pandemic period among right-wingers ($b = -0.03$, $SE = .05$, $p = .52$, 95% CI $[-.12; .06]$), but this change was non-significant among left-wingers ($b = -0.13$, $SE = .04$, $p < .001$, 95% CI $[-.21; .04]$). When comparing Study 2 and 3, the interaction between ideology and the time of the study (Study 2 and Study 3) turned out to be non-significant ($b = .01$; $SE = .05$; $p = .84$, 95% CI $[-.10; .12]$).

The results are depicted in Figure 1.

Perception of scientists-as-elites

To test whether the perception of scientists as elitist mediates the effects of ideology on trust in scientists, we used the PROCESS macro (Hayes 2013, model 4 with 20,000 bias-corrected bootstrap samples; political ideology, perception of scientists-as-elitist, and continuous control variables were mean-centred prior to analysis). Ideology served as a predictor, the perception of scientists-as-elitist as a mediator, and trust in scientists as a dependent variable.

We found that ideology was positively associated with the perception of scientists as members of the elite ($b = 0.27$, $SE = 0.04$, $p < .001$, 95% CI [.20, .35]), which, in turn, was negatively associated with trust in scientists ($b = -0.21$, $SE = 0.06$, $p = <.001$, 95% CI [-.33, -.10]). The indirect effect (standardized) was negative ($\beta = -0.07$, $SE = 0.03$, 95% CI [-.13, -.02]) and the direct effect of ideology on trust in scientists was non-significant ($b = -0.07$, $SE = 0.05$, $p = .105$, 95% CI [-.16, .02]). The detailed results are presented in Supplementary Material in Table S10 and displayed in Figure S2.

Vaccines beliefs, attitudes and policy

To test our hypothesis that trust in scientists mediates the effect of ideology on beliefs about vaccines and attitudes to the relevant policies, we used the PROCESS macro (Hayes 2013, model 4 with 20,000 bias-corrected bootstrap samples; all variables, i.e., political ideology, trust in scientists and vaccine index were mean-centred prior to analysis). Ideology served as the predictor, trust in scientists as the mediator, and vaccine-related attitudes as the dependent variable (we repeated the analysis for vaccine-related beliefs and policy). Ideology served as the predictor, trust in scientists as the mediator, and the index of beliefs and attitudes toward vaccines and vaccine policy as the dependent variable.

Ideology was negatively associated with trust in scientists ($b = -0.13$, $SE = 0.04$, $p = .002$, 95% CI $[-.22, -.05]$), which in turn, was positively associated with vaccine beliefs and attitudes index ($b = 0.40$, $SE = 0.05$, $p = <.001$, 95% CI $[0.29, 0.50]$). The (standardized) indirect effect was negative ($\beta = -0.06$, $SE = 0.02$, 95% CI $[-.10, -.02]$). The direct effect of ideology on the vaccine index was also negative ($b = -0.22$, $SE = 0.04$, $p < .001$, 95% CI $[-.30, -.13]$). The results are presented in more depth in Supplementary Material (Table S8 and Figure S3).

Summarising all these results, in line with our expectations, Study 3, which was conducted in the midst of the COVID-19 pandemic (at the beginning of the relaxation of the COVID-19-related lockdown), revealed that ideology was associated with trust in scientists. It seems that the threat level associated with the pandemic, although weaker at this time, still modified the link between ideology and trust. It strengthens our hypothesis that conditions of threat cause ideological identity salience; hence, ideology may have an impact on the perception of and trust in scientists.

It is worth noting, however, that although the relationship between ideology and trust in scientists was still negative during this later stage of the pandemic, on this occasion, when examining the change in trust for left- and right-wingers separately, we saw that trust in scientists had decreased significantly during the outbreak (Study 3) compared to the pre-pandemic period (Study 1) among those on the right but this change was non-significant among those on the left. This finding seems to be in line with the popular (in Poland and elsewhere) right-wing conspiracy-prone worldview which alleges that scientists are deliberately claiming that COVID-19 pandemic poses a danger to people's health for their own advantage (e.g., to further their career, to obtain funding, to gain prestige in society) (Imhoff & Lamberty, 2020).

However, to understand why right-wing adherents, although more fearful of being infected by SARS-Cov-2 than left-wingers, were still more sceptical towards scientists, we tested if the perception of scientists-as-elites may be responsible for this effect. In line with

expectations, we demonstrated that this perception, a feature associated with right-wing ideological narratives, is associated with less trust in scientists among right-wingers (vs. left-wingers). Although, Study 3 is correlational, the support of this effect also comes from another experimental study in which the perception of scientists as “elitist” versus “the ordinary people” was manipulated (see [REDACTED]). Moreover, in line with the results of Study 2, we ascertained that trust in scientists mediates the link between ideology and beliefs/attitudes around vaccines and vaccine policy, in this way: left-wing beliefs are linked to higher levels of trusts in scientists and higher levels of trust are in turn associated with more positive beliefs and attitudes towards vaccines and vaccine policy. Again, we found that ideology also has a direct effect on vaccine beliefs, and attitudes towards vaccines and vaccine policy, with right-wingers being less positive towards pro-vaccination beliefs and attitudes and vaccine policy than left-wing individuals.

General Discussion

In this paper, we provide support for the hypothesis that in the conditions of threat related to the COVID-19 pandemic, ideology is an important predictor of trust in scientists, doing so by comparing pre-pandemic and pandemic attitudes and beliefs. We also found that in threat conditions, right- (vs. left) wing adherents place less trust in scientists, even though their fear of being infected by SARS-Cov-2 is greater. We also demonstrate that the mechanism responsible for this effect is the perception of scientists as elitist, a perception that is characteristic of right-wingers, but not of left-wingers. Finally, we found that where an individual sits on the left-right ideological spectrum predicts their level of trust in scientists; this in turn helps to explain individual-level variation with regards to attitudes about vaccine choice. We have also shown that ideology has an additional direct effect on vaccine beliefs, as well as attitudes towards vaccines and vaccine policy, with right-wingers being less positive towards pro-vaccination beliefs, attitudes and vaccination policies than left-wing individuals.

The findings of our studies are in line with results from many recent surveys that have shown that an increase in trust in scientists appears to occur during a public health crisis. We observed it at the beginning of the outbreak, but not at the later stage of pandemic, during relaxation period. This is due to the fact that the public tends to look to academics for guidance, believing that scientists can control and mitigate the risks associated with the pandemic. Significant decrease in trust in scientists during the relaxation period during the pandemic seems to be in line with the popular (in Poland and elsewhere) right-wing conspiracy-prone worldview which alleges that scientists are deliberately claiming that COVID-19 pandemic poses a danger to people's health for their own advantage.

However, what is more important for the main argument of this paper, the threat level created by the health crisis intensifies the link between ideological positions and trust in scientists. This stems from the fact that threat conditions increase ideological identity salience; thus, identity-related beliefs have a role to play in shaping social perception (e.g. Kahan, 2017). Still, it transpires that people from opposite ends of the political spectrum do not increasingly seek the advice of academics in equal measure. We demonstrated across these studies that people espousing right- (and, to a lesser extent left-) wing beliefs tend to put less trust in scientists during a pandemic. It is especially important to understand the mechanism underlying this effect since previous studies have already demonstrated that right-wing adherents are indeed more sensitive to threat (Hibbing et al, 2013). Thus, one would expect that the pandemic-related threat would more strongly affect those on the right. We claimed, and tested in a preliminary manner, that, although threat conditions induce political identity salience, identity-related ideological beliefs about scientists might attenuate trust in the scientific profession. Our findings indicate that this, in fact, appears to be the case for individuals on the ideological right.

Currently in Poland, in the present political climate, one central theme of right-wing narratives is that of anti-elitism, i.e. the perception that certain groups, especially those possessing high status and considerable influence, are corrupt, disloyal and deceitful towards ‘ordinary people’. We established that scientists as a group, who are widely perceived as a privileged and elitist echelon of society, may well evoke lower levels of trust among those who support right-wing narratives. In other words, a negativity bias, manifested as the ideologically-driven perception of scientists-as-elites, is salient among right-wingers. This perception is responsible for the disproportionately lower increase in trust in scientists that occurred during the pandemic among right-wingers (in contrast to left-wingers). Interestingly, the other dimensions of perception with regards to scientists produced no significant effects (warmth, perceived political orientation of scientists) or produced negligible and irrelevant effects (competence or threat to values). However, we should also point out that the perception of ‘scientists-as-elites’ is typical for the current Polish context and might not be universally associated with right-wing narratives in other contexts. For example, in the US context, the increasing distrust among right-wingers towards scientific institutions reflects the fact that those on the right of the spectrum perceive scientists as liberal-activists. As a result, they may also experience value conflicts arising from these beliefs, and thereby trust scientists less (Cofnas et al, 2018).

During an acute public health crisis, such as the COVID-19 pandemic, trust in scientists seems to be critical, as it shapes the responsiveness of the populace to public health measures, for instance, vaccination. We believe that trust in scientists may impact the extent to which governments and individuals respect the recommendations of science and science-based announcements. While we are accustomed to vaccination playing a vital role in managing seasonal influenza, it will play an even more central role in managing the current and subsequent pandemics. Thus, it is imperative that we fathom the attitudinal and motivational

roots of the scepticism surrounding vaccination in order to have a greater understanding of people's behaviour. Also, greater knowledge concerning the most effective strategies for increasing the levels of vaccination in the population would facilitate future medical interventions. Previous studies have focused on psychological reactance, injection phobia, ideology, conspiracy thinking, and religiosity (e.g., for an overview: Taylor, 2019). We, however, focused on trust in scientists, and, in line with previous analyses (Czarnek et al., 2020a; Baumgaertner et al., 2018), showed that trust in scientists is highly related to positive attitudes towards vaccines. Our current analysis went further, by not only replicating the previously described effect, but by showing that scepticism about vaccines is associated with trust in scientists as influenced by ideology. In other words, a person's ideology impacts their level of trust in scientific expertise such that they may selectively accept information related to vaccine risks and benefits in ways that reflect their ideology. Our results are also in line with the study by Baumgaertner and others (2018), showing that ideology has two routes by which it can affect people's attitude to vaccination: one is direct, independent of trust, while the other operates via trust. This is also in line with the recent analysis by Czarnek and others (2020b), conducted on European data from March 2019. Notably, our studies are also based on European samples, thus contribute relevant knowledge to the field, which more typically uses data collected in the US context (see Cheon, Melani, & Hong, 2020).

The studies reported here have several limitations. First, although social identity salience is a presumed mechanism through which the threat of COVID-19 exacerbates the link between ideology and trust in scientists, we did not test this mechanism directly in this series of studies. We believe, however, that it requires further investigation. Also, further testing is needed to answer the question as to whether the effects described above are related to this specific type of threat (i.e. that of the COVID-19 pandemic) or whether links between ideology and trust in scientists are more or less pronounced in the circumstances of other health-related

threats and crises. Similarly, it would be of interest to test if the pattern of higher trust on the political left and lower trust on the political right with respect to scientists varies when focusing on life-sciences, or on other domains of science. In addition, it could prove insightful to test if the patterns observed in the domain of vaccines, may extend across various other science-related domains, e.g., climate change or nanotechnology. We also think that the fluctuation in trust in scientists over time is worth testing further. Although we demonstrated that trust in scientists changed as a function of time, from a peak at the beginning of the pandemic and declined at the later stages, a systematic longitudinal approach would help to observe the dynamics of changes in trust in scientists, and any related factors. Finally, an important limitation is the reliance on online samples. Still, samples such as these have been shown to be just as effective at capturing psychological phenomenon as traditional convenience samples (e.g., student populations; Behrend, Sharek, Meade, & Wiebe, 2011). Moreover, an appropriate procedure was used to allow us to exclude participants who devoted little attention to the collection tool (Chandler, Mueller, & Paolacci, 2014).

Despite these limitations, our findings carry some practical implications by providing insights into the mechanism responsible for the link between ideology and trust in scientists. As such, they may be helpful in shaping individual responsiveness to recommendations from scientific agencies, a factor which might have a far-reaching impact on the spread of COVID-19. Official recommendations for protective measures (such as vaccines) might not be followed by people who do not place trust in scientists and medical institutions disseminating these recommendations. Thus, trust in scientists needs to be more squarely addressed in future vaccine campaigns. Stakeholders could also facilitate an honest public discussion about the different competing views around vaccines and other scientific topics, minimizing the likelihood that trust in scientists is reduced, a reduction which might well have the detrimental effect of intruding upon and distorting health-related decision making.

References

- ARC Rynek i Opinia (2020). Koronawirus: Najbardziej ufamy lekarzom. Retrieved from: <https://arc.com.pl/Koronawirus-najbardziej-ufamy-lekarzom-blog-pol-1585326759.html>
- Baumgaertner B., Carlisle, J.E., Justwan, F. (2018). The influence of political ideology and trust on willingness to vaccinate. *PLoS ONE* 13, e0191728. <https://doi.org/10.1371/journal.pone.0191728>
- Behrend, T.S., Sharek, D.J., Meade, A.W. et al. (2011). The viability of crowdsourcing for survey research. *Behavioral Research Methods*, 43, 800. <https://doi.org/10.3758/s13428-011-0081-0>
- Campbell, T. H. & Kay, A. C. (2014) Solution aversion: on the relation between ideology and motivated disbelief. *Journal of Personality and Social Psychology* 107, 809–824. <https://doi.org/10.1037/a0037963>
- CBOS (2017). *Polacy o obowiązku szczepienia dzieci. Kominikat z badań nr 100/2017.* https://www.cbos.pl/SPISKOM.POL/2017/K_100_17.PDF
- Chandler, J., Mueller, P. & Paolacci, G. (2014). Nonnaïveté among Amazon Mechanical Turk workers: Consequences and solutions for behavioral researchers. *Behavior Research Methods*, 46, 112–130. <https://doi.org/10.3758/s13428-013-0365-7>
- Cheon, B. K., Melani, I., & Hong, Y. (2020). How USA-Centric Is Psychology? An Archival Study of Implicit Assumptions of Generalizability of Findings to Human Nature Based on Origins of Study Samples. *Social Psychological and Personality Science*. <https://doi.org/10.1177/1948550620927269>
- Chryssochoidis, G., Strada, A., & Krystallis, A. (2009). Public trust in institutions and information sources regarding risk management and communication: towards integrating extant knowledge, *Journal of Risk Research*, 12, 137–185, DOI: 10.1080/13669870802637000
- Cofnas, N., Carl, N. & Woodley of Menie, M.A. (2018) Does Activism in Social Science Explain Conservatives' Distrust of Scientists? *American Journal of Sociology*, 49, 135–148. <https://doi.org/10.1007/s12108-017-9362-0>
- Crawford, J. T., Brandt, M. J., Inbar, Y., Chambers, J. R., & Motyl, M. (2017). Social and economic ideologies differentially predict prejudice across the political spectrum, but social issues are most divisive. *Journal of Personality and Social Psychology*, 112, 383–412. doi: 10.1037/pspa0000074

- Czarnek, G., Dragon, P., Szwed, P., & Wojciszke, B. (2017), Kwestionariusz przekonań politycznych: Własności psychometryczne, *Psychologia Społeczna*, 41, 205-222.
- Czarnek, G., Kossowska, M., & Szwed, P. (2020a). *Trust and attitudes towards: Study Reports*. <https://doi.org/10.31234/osf.io/dpa35>
- Czarnek, G., Kossowska, M., & Szwed, P. (2020b). *Political ideology and attitudes towards: Study Reports*. <https://doi.org/10.31234/osf.io/uwehk>
- Czarnek, G., Szwed, P., & Kossowska, M. (2019). Right- and left-wing prejudice toward dissimilar groups in cultural and economic domains. *European Journal of Social Psychology*, 49(4), 807–823. doi: 10.1002/ejsp.2548
- Doliński, D., Dolińska, B., Zmaczyńska-Witek, B., Banach, M., & Kulesza, W. (2020). Unrealistic Optimism in the Time of Coronavirus Pandemic: May It Help to Kill, If So—Whom: Disease or the Person? *Journal of Clinical Medicine*, 9, 1464.
- de Figueiredo, A., Johnston, I. G., Smith, D. M. D., Agarwal, S., Larson, H. J., & Jones, N. S. (2016). Forecasted trends in vaccination coverage and correlations with socioeconomic factors: a global time-series analysis over 30 years. *The Lancet Global Health*, 4(10), e726–e735. [https://doi.org/https://doi.org/10.1016/S2214-109X\(16\)30167-X](https://doi.org/https://doi.org/10.1016/S2214-109X(16)30167-X)
- Edelman Trust Barometer, (2020). Coronavirus Special Report. Retrieved from: https://www.edelman.com/sites/g/files/aatuss191/files/2020-03/2020%20Edelman%20Trust%20Barometer%20Coronavirus%20Special%20Report_0.pdf
- European Commission, Eurobarometer 91.2, (March 2019). Kantar Public, Brussels [Producer]; GESIS, Cologne [Publisher]: ZA7562, dataset version 1.0.0, doi:10.4232/1.13318
- Feldman, S. & Johnston, C. (2014). Understanding Political Ideology. *Political Psychology*, 35, 337-358. doi:10.1111/pops.12055
- Filip, G. (2018) Uniwersytet apolityczny *Forum akademickie*, 11.

- Gangarosa, E. J., Galazka, A. M., Wolfe, C. R., Phillips, L. M., Miller, E., Chen, R. T., & Gangarosa, R. E. (1998). Impact of anti-vaccine movements on pertussis control: the untold story. *The Lancet*, 351(9099), 356–361. [https://doi.org/https://doi.org/10.1016/S0140-6736\(97\)04334-1](https://doi.org/https://doi.org/10.1016/S0140-6736(97)04334-1)
- Hart, P. S., & Nisbet, E. C. (2012). Boomerang Effects in Science Communication: How Motivated Reasoning and Identity Cues Amplify Opinion Polarization About Climate Mitigation Policies. *Communication Research*, 39, 701–723. <https://doi.org/10.1177/0093650211416646>
- Hayes, A. (2013). *Methodology in the social sciences. Introduction to mediation, moderation, and conditional process analysis: A regression-based approach*. NY: Guilford Press.
- Hibbing, J., Smith, K., & Alford, J. (2014). Negativity bias and political preferences: A response to commentators. *Behavioral and Brain Sciences*; 37, 333-350.DOI:10.1017/S0140525X1300280X
- Hmielowski, J. D., Feldman, L., Myers, T. A., Leiserowitz, A., & Maibach, E. (2014). An attack on science? Media use, trust in scientists, and perceptions of global warming. *Public Understanding of Science*, 23(7), 866–883. <https://doi.org/10.1177/0963662513480091>
- Hornsey, M., Harris, J., & Fielding, K. (2018). The psychological roots of anti-vaccination attitudes: A 24-nation investigation. *Health Psychology*, 37, 307-315. <http://dx.doi.org/10.1037/hea0000586>
- Hussain, A., Ali, S., Ahmed, M., & Hussain, S. (2018). The Anti-vaccination Movement: A Regression in Modern Medicine. *Cureus*, 10, e2919. <https://doi.org/10.7759/cureus.2919>
- Imhoff, R., & Lamberty, P. (2020, April 14). A bioweapon or a hoax? The link between distinct conspiracy beliefs about the Coronavirus disease (COVID-19) outbreak and pandemic behavior. <https://doi.org/10.1177/1948550620934692>
- Janicki, M. (2017). Kto w Polsce należy do elity. *Polityka*, 4 Lipca.
- Johnston, C., Lavine, D., & Federico, C. (2017). *Open versus closed: Personality, identity, and the politics of redistribution*. Cambridge: Cambridge University Press.

- Jost, J., Federico, C., & Napier, J. (2009). Political Ideology: Its Structure, Functions, and Elective Affinities. *Annual Review of Psychology*, 60, 307-337.
- Kahan, D. (2017). Misconceptions, Misinformation, and the Logic of Identity-Protective Cognition. *Cultural Cognition Project Working Paper Series No. 164*.
- Kellstedt, P.M., Zahran, S. and Vedlitz, A. (2008), Personal Efficacy, the Information Environment, and Attitudes Toward Global Warming and Climate Change in the United States. *Risk Analysis*, 28, 113-126. doi:10.1111/j.1539-6924.2008.01010.x
- Kossowska, M., Szwed, P., & Czarnek, G. (2020, November 12). *Trust in scientists and attitudes towards vaccines and vaccine policy: The role of perception of scientists as elitists*. <https://doi.org/10.31234/osf.io/xzj9f>
- Kość, W. (2020). Duda taps into anti-vax sentiment ahead of Poland's presidential election. *Politico*. <https://www.politico.eu/article/andrzej-duda-anti-vax-sentiment-polish-election/>
- Kulas, P. (2018) *Antyelitarna narracja współczesnej polskiej prawicy*. „Przegląd Socjologii Jakościowej”, t. 14, nr 4, s. 14–39
- Leiserowitz, A., Maibach, E., & Roser-Renouf, C. (2010) *Climate change in the American Mind: Americans' global warming beliefs and attitudes in January 2010*. Yale University and George Mason University. New Haven, CT: Yale Project on Climate Change. <http://environment.yale.edu/uploads/AmericansGlobalWarmingBeliefs2010.pdf>
- Lewandowsky, S., Gignac, G.E., & Oberauer, K. (2015) Correction: The Role of Conspiracist Ideation and Worldviews in Predicting Rejection of Science. *PLOS ONE*, 10: e0134773. <https://doi.org/10.1371/journal.pone.0134773>
- Malka, A., Lelkes, Y., & Soto, C. (2019). Are Cultural and Economic Conservatism Positively Correlated? A Large-Scale Cross-National Test. *British Journal of Political Science*, 49(3), 1045-1069. doi:10.1017/S0007123417000072
- Malka, A., Soto, C. J., Inzlicht, M., & Lelkes, Y. (2014). Do needs for security and certainty predict cultural and economic conservatism? A cross-national analysis. *Journal of Personality and Social Psychology*, 106, 1031–1051. <https://doi.org/10.1037/a0036170>

- McCright, A., Dentzman, K., Charters, M., & Dietz, T. (2013). The influence of political ideology on trust in science. *Environmental Research Letters*, 8, 044029.
- Michalski, C. (2018). *Liberałowie kontra populiści*. *Newsweek Polska*, 31, 48–50.
- Plohl, N. & Musil, B. (2020) Modeling compliance with COVID-19 prevention guidelines: the critical role of trust in science. *Psychology, Health & Medicine*, DOI: 10.1080/13548506.2020.1772988
- Rutjens, B. T., Heine, S. J., Sutton, R. M., & van Harreveld, F. (2018). Attitudes Towards Science. In E. S. P. Olson (Ed.), *Advances in Experimental Psychology* (Vol. 57, pp. 125–165). Academic Press. <https://doi.org/https://doi.org/10.1016/bs.aesp.2017.08.001>
- Rutjens B.T., Sutton, R.M., & van der Lee, R. (2018). Not All Skepticism Is Equal: Exploring the Ideological Antecedents of Science Acceptance and Rejection. *Personality and Social Psychology Bulletin*, 44, 384-405. doi:10.1177/0146167217741314
- Shepherd, M. (2020). The COVID-19 Coronavirus Pandemic Highlights the Importance of Scientific Expertise, *Forbes*, 14 March.
- Sibley, C. G. (2008). Utilities for examining interactions in multiple regression [computer software]. University of Auckland.
- Sibley, C. G., Greaves, L. M., Satherley, N., Wilson, M. S., Overall, N. C., Lee, C. H. J., . . . Barlow, F. K. (2020). Effects of the COVID-19 pandemic and nationwide lockdown on trust, attitudes toward government, and well-being. *American Psychologist*. <https://doi.org/10.1037/amp0000662>
- Siegrist, M., & Cvetkovich, G. T. (2000). Perception of hazards: The role of social trust and knowledge. *Risk Analysis* 20, 713–719.
- Stoffels, P. (2020). *What You Need to Know About the Latest on the Coronavirus—and a Potential Preventive Vaccine*. Retrieved from: <https://www.jnj.com/latest-news/what-you-need-to-know-about-coronavirus-and-a-potential-johnson-johnson-vaccine>
- Taylor, S. (2019). *The Psychology of Pandemics. Preparing for the Next Global Outbreak of Infectious Disease*. Cambridge: Cambridge Scholar Publishing.
- Van Bavel, J. J., & Pereira, A. (2018). The Partisan Brain: An Identity-Based Model of Political Belief. *Trends in Cognitive Sciences*, 22(3), 213–224. <https://doi.org/https://doi.org/10.1016/j.tics.2018.01.004>
- van Harreveld, F., & Rutjens, B. T. (2020, March 27). The impact of threat to personal control on trust in experts and non-experts communicating about risk. <https://doi.org/10.31234/osf.io/8nq47>

Wallinga, J., Levy-Bruhl, D., Gay, N., & Wachmann, C. (2001). Estimation of measles reproduction ratios and prospects for elimination of measles by vaccination in some Western European countries. *Epidemiology and Infection*, 127, 281-295. doi:10.1017/S095026880100601X

Welcome Trust, (2018). Welcome Global Monitor: How does the world feel about science and health? <https://wellcome.org/sites/default/files/wellcome-global-monitor-2018.pdf>

Wissenschaft im Dialog/Kantar, 2020. *Report*. Retrieved from: <https://www.wissenschaft-im-dialog.de/projekte/wissenschaftsbarometer>

Figures

Figure 1. The relationship between ideology and trust in scientists before and during the 2020 pandemic (Study 1, 2, and 3)

Figure 2. Conceptual model tested in Study 2 and 3. The relationship between political ideology (left-right wing), trust in scientists and positive beliefs and attitudes towards vaccines.