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A Brief Retrospective: Belief Systems and Psychological Traits Contributing to the Spread of COVID-19 in the United States

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This paper reviews recent research on cognitive factors associated with the poor response to the COVID-19 health crisis in the United States. First, group-level predictors were explored, with studies revealing that religious affiliation and conservative political orientation were associated with a failure to comply with medical recommendations. In order to explain these links, individual-level traits were further investigated. Studies indicated that a tendency towards conspiratorial thinking and susceptibility to fake news along with cognitive style, particularly intuitive processing, were forms of motivated cognition related to disbelief in science and a reluctance to follow precautions of medical experts. Additionally, research revealed that cognitive ability has been shown to be related to the two group-level predictors, religious and political orientation, as well as belief revision, which in turn influences one's ability to problem-solve in response to novel challenges like the COVID-19 pandemic. Other aspects of cognitive ability such as neurological efficiency and working memory function were explored in regard to how they impact one's ability to weigh evidence, process new information, and update one's views. While none of these variables alone can fully explain the disregard and disbelief many American citizens displayed in response to the pandemic, taken together, the convergence of factors was likely to have influenced health outcomes across the nation, thereby contributing to the spread of the virus.

Keywords: COVID-19, cognitive style, belief revision

By the time you are reading this paper, the world will have a better understanding of the scope of the COVID-19 pandemic that emerged in 2020 than we did when the paper was written. Nonetheless, it is clear as we write that the pandemic will be viewed in the future as one of the deadliest outbreaks in centuries and that

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it will likely have killed more Americans in a single year than any event in United States history. It also seems clear that the nation did not handle the crisis well and that the death toll was far higher than it could have been. While the most important contributions to mitigating the crisis were no doubt made by the medical community, it is incumbent upon us to examine the psychological conditions that may have played a role in exacerbating the issue, such as widespread disbelief in science and a public that may have been too readily accepting of misinformation.

Citizens must have a certain baseline of scientific literacy in order to make sound decisions regarding health and political issues involving science (Sherkat, 2011), yet trust in science and medicine in the United States has plummeted over the last several decades. In the 1970s, 53% of respondents reported having a great deal of confidence in medicine (Burge, 2020). This dropped to 38% by 2018. Americans may have lost trust in medicine as a result of losing trust in a broader range of societal institutions, particularly government and public education, leading to outcomes such as a reluctance to expand health care and decreased funding for higher education. People's mistrust of science and medicine, which instilled a tendency to ignore health advice from experts, created a situation where the nation became especially vulnerable to disease outbreak. When false information or mixed messages were delivered from politicians viewed as "outsiders" and media sources that the public *did* trust, this ultimately led to the scenario we witnessed in 2020, with large portions of the country ignoring or denying the existence of the pandemic.

A successful response to the pandemic would have required the dissemination of accurate information *and* a public that understands and accepts that information (Parmet and Paul, 2020). Without public trust in science, citizens simply would not follow public health recommendations that could have mitigated the spread of the virus. Unfortunately, anti-vax culture and climate science denial foreshadowed the responses we witnessed to the COVID-19 epidemic. Public resistance to health measures likely stemmed from two sources, the first being a top–down dynamic with people distrusting medical advice because of contradictory information and outright falsehoods that political figures spread, at times willfully, due to partisan agendas. The second is a bottom–up dynamic from a widespread view that individual opinions on any subject should hold more weight than scientific evidence and the advice of experts. This is magnified by the vast amount of misinformation available on the internet paired with a populace that often may not have the background knowledge to discern between accurate, useful information and misinformation. Distrust is then sown via the viral spread of false or contradictory information on social media. As in the example of parents refusing vaccinations for their children, public health decisions are ultimately made based not on science but on values and preferences.

Undoubtedly, the spread of misinformation and the penchant for certain segments of the public to accept and propagate incorrect information are intertwined

with subjective belief systems such as religious and political orientation. Thus, while the response to the virus may have been the most egregious example of science denial, it manifests in other important ways. For instance, De Keersmaeker and Roets (2017) suggest that the dissemination of fake news had an impact on the outcome of the 2016 presidential election, and this would have consequences not just for the government's handling of the pandemic but also for a wide range of policy outcomes over the next four years. Additionally, it is likely that the spread of misinformation had a substantial influence on a large segment of the population refusing to accept the outcome of the 2020 election, subsequently affecting the ability of the next administration to enact policy. Because we have seen the profound and large-scale effects of the public's willingness to accept misinformation, as well as its cost in human lives, it is worthwhile to explore the reasons why seemingly rational adults in a modern world, where valid information is so readily available, would choose instead to believe and disseminate disinformation that proved to be so damaging to the nation.

Group-Level Predictors: Religious and Political Orientation

Two group-level predictors associated with disbelief in science and in turn COVID-19 responses are religious and political orientation, which are themselves highly correlated (Cuevas and Dawson, 2020; Jost, Glaser, Kruglanski, and Sulloway, 2003). While each of these belief systems help to form individual identity, group affiliation, shared beliefs, and values ultimately define them (Burris and Jackson, 2000; Mason and Wronski, 2018; Park and Bowman, 2015). Individuals view themselves as part of these groups based on common characteristics and thus form in-groups based upon them. The collection of characteristics may be reflective of liberal, conservative, Catholic, or Protestant ideologies, as well as many others, in addition to a host of more specific subgroups. As such, group members often display common beliefs and behaviors, and these trends have emerged across many research studies on (dis)belief in science and the propensity for accepting disinformation as valid. In practical terms this has translated to problematic pandemic responses.

Religious Belief

Broadly, religious orientation has been found to have implications on health outcomes (Pesta, McDaniel, and Bertsch, 2010; Reeve, 2009). For instance, some fundamentalist denominations discourage members from seeking medical interventions or resist treating women's health issues. And because religious teachings are often in conflict with established science, this may further deter believers from embracing science-based medicine such as vaccinations or blood transfusions. Reeve (2009) found that, across 192 countries, religious belief was positively

associated with infant and maternal mortality rates and negatively related to life expectancy. Overall, it was determined that religious belief had a negative effect on health outcomes. Such effects seemed to have been magnified in 2020 because religious belief tends to become more intensified during times of upheaval, such as pandemics, due at least in part to mortality salience (DeFranza, Lindow, Harrison, Mishra, and Mishra, 2020; Weise, Arciszewski, Verlhiac, Pyszczynski, and Greenberg, 2012). As would be predicted, across the world religious gatherings became hotspots for the spread of COVID-19.

As the virus spread throughout the United States, researchers began to investigate how individuals' behaviors may have contributed to the outbreak. In order to explore the relationship between religiosity and adherence to health guidelines, DeFranza et al. (2020) used a novel approach and measured changes in pollutant levels across 53 populous metropolitan areas which were then compared to religious density in those areas. Pollutant levels are a strong indicator of vehicular movement and industrial activity and thus offer a reflection of how closely residents followed shelter-in-place guidelines. DeFranza et al. found that shelter-in-place directives were significantly related to pollutant levels, and when directives were initiated pollutants dropped. However, there was a positive relationship between pollutants and religiosity when shelter-in-place directives were initiated, indicating that increased religiosity was related to less adherence to shelter-in-place guidelines. Even after controlling for political orientation, religiosity remained a significant predictor of pollutant levels, and the relationship suggested that vehicular movement actually *increased* in densely religious areas during that time. So there is evidence that religiosity not only has a negative impact on broad health outcomes but that it may have been a factor in increasing the spread of the virus when those in religious communities tended to disregard health guidelines. The question remains as to why such a relationship exists.

It has been suggested that any conflict between science and religion is unidirectional, with science simply attempting to discover objective explanations for natural phenomenon from a neutral perspective while religious proponents foster conflict by disputing those findings based on subjective beliefs (Cuevas, 2016). This is fueled by confirmation bias, where the religious believer chooses to accept only those ideas that conform to preexisting beliefs. Epistemologically, religious belief and scientific accounts serve a similar function in that they ostensibly offer ways to help people understand the world, yet may contrast with each other because both provide competing explanations for natural occurrences (Hunsberger and Jackson, 2005; McPhetres, Jong, and Zuckerman, 2020). Consequently, over the years some states have implemented educational policies that deemphasize scientific findings on topics such as evolution and climate change while attempting to provide credence to religiously based concepts. Such policies underscore deep divides that speak to trust in science and are linked to levels of scientific literacy.

While Americans' trust in science and medicine has dropped over the last half century, the effect has been particularly pronounced among the most religious. For instance, among evangelicals, the number of respondents who reported having a great deal of confidence in medicine dropped precipitously, from 60% to 32% (Burge, 2020). During that time, their trust in people in general also dropped. As a reflection of their societal views, 81% of evangelicals believe that crime has increased in the last 25 years, which is factually incorrect and could indicate a willingness to accept misinformation. While the declining trust in other people and distrust in medicine were correlated among most groups, for evangelicals, the increase in mistrust of medicine was most pronounced. It has been speculated that evangelicals, who have a core belief in end time prophecies, may be looking for evidence that society is declining, signaling the coming of the apocalypse. Plagues are one of the characteristics of Biblical end times, so among evangelicals, distrust in medicine may have dovetailed with religious expectations, culminating in the decision not to alter their lifestyles in response to COVID-19 and instead trust that their God would protect them. Those with more extreme beliefs may have embraced the thought of end times, while more moderate believers may have simply trusted that God would shield them from severe consequences of the virus.

Attitudes towards science may be particularly acrimonious in the United States, which could explain the difficulties the nation faced in regard to containing the spread of COVID-19. McPhetres et al. (2020) recently examined the relationship between religiosity and attitudes towards science and found that religiosity was negatively related to interest in and attitudes about science for United States participants. Greater religiosity predicted more negative attitudes towards science, and this relationship held even when controlling for a host of demographic variables, including education. When similar analyses were conducted with participants from other countries, the relationship was weaker and in some cases there was a weak positive correlation between the two variables. This suggests that the negative relationship may be more pronounced in the United States which could explain why that population fared worse than those in most other countries in response to the pandemic. The findings indicate that the negative association between religiosity and attitudes towards science may be the result of sociocultural and historical influences, such as the existence of a substantial overlap between fundamentalism and political conservatism.

Beyond negative attitudes and the lack of trust that religious individuals place in science and medicine, numerous studies have revealed an inverse relationship between religiosity and science literacy (Lynn, Harvey, and Nyborg, 2009; McPhetres et al., 2020; Sherkat, 2011; Stankov and Lee, 2018; Stoet and Geary, 2017; Zuckerman, Li, Lin, and Hall., 2019). Recently, based on their analyses of data from 50 countries, Stoet and Geary (2017) found that higher levels of religiosity were strongly and consistently associated with lower levels of performance in both science (r_s = −.65, −.74, −.73 across three measurements over a 15-year period,

$p < .001$ for each) and math ($r_s = -.68, -.74, -.72$ across three measurements over a 15-year period, $p < .001$ for each). They concluded that religious belief tends to displace secular education with religious teachings, though in the United States religious belief systems may negatively impact educational policies and practices that affect all students rather than just those who are religious. Similarly, Stankov and Lee (2018) collected data from a large sample across 33 countries using a range of assessments, including math and science, in addition to religiosity measures. They found that religiosity was negatively related to both math ($r = -.477$, $p < .05$) and science knowledge ($r = -.536$, $p < .001$).

Previously, Sherkat (2011) had determined that religious beliefs were significant predictors of scores on science exams, with those who viewed the Bible as literal truth scoring the lowest, followed by those who viewed it metaphorically, with the highest scorers being those who viewed it as a book of fables. Correspondingly, sectarian Protestants scored the lowest and nonbelievers scored the highest, with religious belief explaining 13% of the variance in science scores. When controlling for region (Southern residence), results indicated that regional differences in scientific literacy were largely due to the concentration of sectarians and fundamentalists in the South. While many sociological theories hold that variables such as education and socio-economic level are the main drivers of scientific literacy, this research showed that even when controlling for a host of variables, the magnitude of the effect of religious belief is substantial. Nine years before the 2020 COVID-19 outbreak, Sherkat seemed to predict the public health crisis that would arise when he wrote, "Given the low levels of scientific literacy prevalent among fundamentalist and sectarian Christians, they may have difficulty understanding public issues related to scientific inquiry and pedagogy, and they may have a limited capacity to understand technical information regarding their own health and safety" (p. 1146).

Political Orientation

Political orientation is a second group-level predictor that recent research has revealed to likely have impacted public health outcomes of the pandemic in the United States. Partisan identity affects how people process and respond to information, including information about health care, and thus influences how people view and respond to a crisis (Clinton, Cohen, Lapinski, and Trussler 2020). Since the beginning of the pandemic there was a clear divide between Republicans and Democrats, with the former tending to resist health precautions and the latter taking the virus more seriously. In June of 2020, drawing from a large random sample of 4,708 adults, Pew found that 61% of responding Republicans and right-leaning independents believed that the worst had passed (which turned out to be incorrect) despite contradictory projections from those in the medical field, whereas only 23% of Democrats believed that (Pew Research

Center, 2020). Similarly, 45% of Republicans were concerned about unknowingly spreading COVID, and only 35% worried that they would need to be hospitalized if infected, while 77% of Democrats were concerned, and 64% worried they may be hospitalized.

By the end of the year those trends continued and Republicans showed less concern as the pandemic persisted, despite increasing infections and deaths. By December 2020, only 37% of Republicans were concerned about getting COVID-19 (Funk and Tyson, 2020). Yet 66% of Democrats were concerned. While Democrats and Republicans were equally likely to view COVID-19 as a threat to the economy (86% vs 83% respectively), Democrats were nearly twice as likely to view it as a major threat to public health (84% vs 43%). Democrats were also more likely to report having trust in scientists than Republicans were (55% vs 22%). This number has been increasing among Democrats and decreasing among Republicans, with trends among Republicans mirroring those of evangelicals.

People's willingness to follow health precautions fell along similar partisan lines. Flaskerud (2020) argues that wearing a mask became symbolic of trust in science and medicine, an indication of one's level of acceptance or rejection of experts, as well as Democratic or Republican affiliation. Mask use became politicized even though many jobs require masks (e.g., house painters, surgeons), yet many on the political right denied the ability of masks to offer protection. Just 55% of Republicans reported being bothered by those around them not wearing masks, compared to 87% of Democrats (Funk and Tyson, 2020). These statistics are not surprising considering that Democrats were more likely to believe their actions could affect the spread of the virus than Republicans were (73% vs 44%) [Pew Research Center, 2020]. As such, Republicans were more comfortable engaging in indoor activities such as frequenting salons, restaurants, and parties. Ultimately, partisanship was considered to be the most important factor in one's comfort levels in engaging in in-person activities.

These numbers also translated to people's views on returning to school and work. Republican parents favored in-person return to work and school in the fall of 2020 at much higher rates and were more concerned with economic and social impacts than health related ones (Horowitz, 2020). Specifically, nearly half of Republican and right-leaning independents supported in-person instruction while only 6% of Democrats did. Democrats were more likely to believe the risk to students and teachers (82% and 81% respectively) should be given primary consideration while fewer Republicans agreed (37% and 35%).

Similar to the previously mentioned study on the physical mobility of religious individuals in response to shelter-in-place directives (DeFranza et al., 2020), another recent study examined social mobility according to party affiliation. Clinton et al. (2020) drew upon a large sample of 1,135,638 individuals over most of the 2020 year and found that Democrats were 13% less likely to be socially mobile compared to independents, while Republicans were nearly 28% more

likely to be socially mobile. Democrats were more concerned with contracting COVID-19 across the duration of data collection. Concerns along partisan lines were similar early, but Democrats maintained their vigilance while Republicans became increasingly less concerned. By approximately six months into the pandemic (June), 40% of Republicans reported being concerned as opposed to 80% of Democrats. While all respondents reported increasing their social mobility over time, Republicans increased the most by far (75% vs 47% for Democrats) and were more likely to increase their mobility than any other group. The analyses controlled for age, race, education, income, gender, employment status, and population density, so those variables do not explain the relationship. The relationship held no matter whether the state's governor was a Democrat or Republican, if the area was rural or mostly urban, and regardless of how heavily the state was affected by the outbreak. In short, across the entire country Democrats responded similarly with substantial concern and less social interaction, and Republicans showed a lack of concern and a great deal of social mobility.

Taken together, the data suggest a situation wherein the spread of the virus was driven in large part by those who eschewed health precautions such as mask wearing and social distancing, and these individuals in turn tended to be religious individuals, particularly evangelicals, and Republican partisans who tended to have low levels of trust in science and medicine. The question of why this dynamic was so prevalent among these groups remains, however. Some research findings tend to imply this should *not* have been the case. For instance, both religious belief (Devine, 2012; Hall, Matz, and Wood, 2010; Jackson and Hunsberger, 1999; Jost et al., 2003) and right wing political orientation (Cuevas and Dawson, 2020; Jost et al., 2003; Weise et al., 2012) have been linked to authoritarianism across many studies. In practical terms, individuals who are high in authoritarian traits should be more likely to adhere to rules (Weise et al., 2012) and social norms (Jost et al., 2003) and thus follow official guidelines such as stay-at-home directives and mask mandates. Likewise, both religious belief and political conservatism are associated with mortality salience (Devine, 2012; Harmon–Jones, Greenberg, Solomon, and Simon, 1996; Kunzendorf, 2015), which should have been particularly prevalent during a pandemic and would potentially cause individuals to act more cautiously.

In regard to authoritarian traits, because religious believers and conservatives already maintained a lack of trust in science and medicine, perhaps they did not view those in the medical community — such as public health officials and the CDC — as authority figures, and instead deferred to a presidential administration that often downplayed the severity of the virus, at times directly contradicting the conclusions from the scientific community. In terms of the fear and anxiety normally associated with mortality salience, due to the low levels of trust in science paired with misguided concerns about fraud or profiteering, it may have been that instead of looking to health officials for guidance, people in these groups chose to put their trust in a deity to protect them. While these are possible explanations

for the trends that emerged relative to group affiliation, we next consider individual traits that may influence disbelief in science, conspiratorial thinking, and the willingness to accept misinformation.

Individual-Level Explanations: Motivated Cognition

The question of why some individuals choose to believe misinformation and reject accurate information has perhaps never been more relevant than in the response to the COVID-19 pandemic in 2020. We previously focused on how trends among groups may have influenced public health outcomes during that time. But from a psychological perspective, there is the need to explore the cognitive traits that might lead the individual to adopt such views and why information may be processed in such a way that it ultimately handicapped our ability to deal with the pandemic.

As noted, there has been a trend in the United States for citizens to show a growing disbelief and distrust in science, but that cannot happen in a vacuum. If scientific explanations are rejected, other alternate explanations must take their place. For some, this void may be filled with misinformation, propaganda, and what has become known as fake news in the era of social media. Those prone to conspiratorial thinking may be especially vulnerable. The events of 2020 appear to have created the perfect storm for conspiratorial thinking to prevail. In 2017, De Keersmaeker and Roets noted that social media allows for misinformation to spread in unprecedented ways, which could create compounding problems in the future. More recently, Pennycook and Rand (2019a) warned of the substantial threat that fake news poses, as became apparent during the 2016 presidential election when it influenced voting patterns and may have affected the outcome of the election. Thus, the environment was ripe for large swaths of the public to fall prey to readily available and widely disseminated misinformation.

Conspiratorial Thinking and Susceptibility to Fake News

Studies have shown that approximately one third of the population harbor a variety of conspiracy theories (Dagnall, Drinkwater, Parker, Denovan, and Parton, 2015), a substantial number that could cause grave issues if enough people adopted similar misinformation during a time of crisis, as was the case in 2020. Douglas, Sutton, and Cichocka (2017) contend that current psychological research on why people are drawn to conspiracy theories suggests that such beliefs satisfy three different types of social psychological motives: epistemic, existential, and social. Epistemic motives reflect the need for causal explanations to reduce uncertainty, find meaning, and defend existing beliefs. To satisfy this motive, in 2020, people may have reinforced their existing beliefs that science could not be trusted and in turn denied the existence or seriousness of the virus as a way to

reduce uncertainty. Existential motives are derived from our need to feel safe and secure as well as to exert some control over the environment. People are more likely to turn to conspiracy theories as explanations when they feel threatened or feel a loss of control over their circumstances. Counterintuitively, existential motives can make it *less* likely for people to take actions that might enhance their safety, such as if they assert their autonomy and liberty by refusing vaccines, the use of masks, and social distancing. Social motives allow conspiracy theorists to view themselves as virtuous and strengthen their in-group bonds while attributing blame for negative outcomes to others, in this case China for "creating" the virus or politicians for "harming" the economy due to shelter-in-place directives. The tendency towards this motive can be particularly strong if the individual or in-group feels threatened and thus takes the stance defensively because they feel victimized, which could explain the armed protests that occurred in several states in response to stay-at-home orders.

Currently, it appears that none of these three sources of motivation is actually beneficial to the believers in improving their condition or mitigating their fears or concerns, so the conspiratorial thinking becomes a never-ending, circular process (Douglas et al., 2017). In fact, it can have the opposite effect when conspiratorial claims erode the person's social capital and further marginalize the individual, which may feed social and existential motives as the person seeks out others with similar views. Yet conspiracy theories allow people to protect cherished beliefs and are stronger among people who commonly seek meaning and patterns in the environment, particularly believers of paranormal phenomenon, such as religious believers, one of the groups most likely to ignore health precautions during the pandemic. The propensity for believing such misinformation was also found to be high in Republicans (Pennycook and Rand, 2019a), the other group found to be most resistant to measures meant to reduce the spread of the virus.

However, conspiratorial thinking differs from other forms of causal explanation in that it is speculative and resistant to falsification (Douglas et al., 2017). Correcting or replacing misinformation is not always possible given the expanse of the internet, as conspiracy theorists can always find sources that confirm their suspicions, no matter how much they lack credibility (Pennycook and Rand, 2019a). Warnings may be effective when fake news is identified, but these may also have a negative effect because people may see other fake news as being accurate if it has not been identified and tagged with a warning, known as the "implied truth effect" (i.e., it has not already been fact-checked and disproven, so it must be true). Pennycook and Rand recently tested how well approximately 2,000 participants could identify fake news sources, and this was compared to fact-checkers' ratings. The fact-checkers achieved very high interrater reliability among each other and rated mainstream news sources much higher in credibility than hyper-partisan and fake news sites. There was surprisingly high agreement between the fact-checkers and laypeople, though Democrats were significantly

better at discerning the quality of the news sources than Republicans and their views correlated more strongly with those of the fact-checkers. Participants were more trusting of sources they were familiar with, indicating that familiarity is a necessary quality but it is not sufficient to build trust on its own. One possible explanation for the differences along partisan lines was motivated reasoning, which occurs when individuals seek to justify prior beliefs, and Republicans may have rated less credible sites more highly because those particular sites aligned with their views.

Unfortunately, however, fake news stories on social media are more likely to go viral than real news stories (Pennycook and Rand, 2019b). As individuals are exposed to the variety of information on social media, much of which is not accurate, they are more likely to believe false information if they have been exposed to it previously and are familiar with it. The "illusory truth effect" (p. 186) suggests that repetition of a claim leads to rapid and fluent processing, facilitating belief regardless of the accuracy of the claim. Even informing people about the inaccuracy of information does not mitigate this effect because the low-level processing (fluency) overrides the high-level processing (analytic thinking) in this case. A term that applies to this that has recently been coined in research is "bullshit receptivity" which is indicative of one's ability to use high level processing to detect false information. In a series of three experiments with over 1600 participants, Pennycook and Rand (2019b) found that perceived accuracy of fake news was positively correlated with receptivity to pseudo-profound bullshit (profound-sounding nonsensical information) but negatively correlated with analytic thinking ability. Receptivity to fake news and pseudo-profound bullshit was at least partially due to the ability to detect bullshit, suggesting that some individuals had difficulty in filtering out false information when first encountering it. Removing the source had no effect so the results were not dependent on subjects assessing the quality of the source. Subjects rated familiar headlines as more accurate (the illusory truth effect), and bullshit receptivity was associated with the willingness to share fake news while analytic thinking ability was negatively associated with that tendency. This suggests that the susceptibility for falling prey to misinformation may go beyond motivated cognition (i.e., confirmation bias) and additionally be related to cognitive ability and processing idiosyncrasies.

A number of studies have investigated whether conspiratorial thinking is related to mental health issues or problematic psychological characteristics. These have found conspiratorial thinking to be linked to delusion-prone ideation (Bronstein, Pennycook, Bear, Rand, and Cannon, 2019), schizotypy (Dagnall et al., 2015), narcissism (Douglas et al., 2017), and paranoia (Dagnall et al., 2015; Douglas et al., 2017), which would likely account for a very small portion of the population, though potentially comprise the most extreme believers. Bronstein et al. (2019) found that delusion-prone individuals may be particularly susceptible to believing fake news and endorsing ideas considered to be on a continuum with

psychotic symptoms. This tendency may be due to deficits in certain traits such as analytic thinking and actively open-minded reasoning and increases the likelihood that they will accept a range of implausible assertions. Active open-minded thinking refers in part to the ability to weigh evidence and assess the credibility of new information.

Dagnall et al. (2015) came to a similar conclusion regarding schizotypy, a condition with many overlapping features with delusion-prone ideation characterized by suspicion, magical thinking, social anxiety, and paranoia. Individuals with schizotypy tend to hold stronger beliefs in the paranormal and thus may be highly religious. Dagnall et al. found that conspiratorial thinking was positively associated with schizotypy, delusional ideation, and paranoia. Paranoia and conspiracist thinking may be associated due to an inability to navigate cause and effect relationships, the same difficulties that an individual with deficits in active open-minded reasoning would have. Because cause and effect relationships are difficult for those with schizotypy to identify, it is also common for those who ascribe to conspiracy theories to hold ideas that are contradictory to each other. For instance, one might simultaneously believe that COVID-19 was a hoax and also that the virus was created by China as a biological weapon. Rather than a person adhering to a single conspiracy theory, an individual will often hold an overarching belief system or worldview that predisposes them to believe conspiracy theories in general. Thus, the belief in conspiracy theories may have allowed the individual to have an internally coherent thought process that is also a flawed process in regard to weighing external evidence.

Cognitive Style: Analytic vs Intuitive Thinking

While conditions such as delusion-prone ideation and schizotypy are linked to conspiratorial thinking and a tendency to adopt implausible beliefs, they must be considered relatively rare and would comprise only a small proportion of national trends in 2020. Thus, they cannot explain the widespread acceptance and dissemination of misinformation that we witnessed that year. Motivated cognition, in terms of epistemic, existential, and social motivation described here, no doubt plays a large role in that response. However, recent research has revealed that cognitive style may also have a substantial influence on how individuals process and subsequently remember and view information. Cognitive style is related to cognitive ability, but is more a function of how people approach problem solving and the processing of new information, and consequently may be viewed as something of a midpoint between motivated cognition and cognitive ability.

Cognitive style in this context refers to one's propensity to use either an intuitive approach to problem solving, or in contrast, an analytical approach. This is explained by Dual-Process Theory, with Type 1 representing intuitive thinking and Type 2 representing deliberative/analytic thinking, and people differ in their

willingness and propensity for engaging in the latter (Gervais, 2015; Pennycook, Ross, Koehler, and Fugelsang, 2017). Type 1 thinking takes priority much of the time, yet Type 2 can override Type 1 when problem solving is necessary (Gervais, 2015). Intuitive-style thinkers tend to rely on instinctive responses when making decisions, while the analytic thinkers would use a more logical, critical, and rational approach (Cuevas and Dawson, 2020). While both styles may have benefits in certain contexts, they are not equivalent in terms of guiding individuals to make accurate choices. Those who use an analytic process are more likely to arrive at correct conclusions while those who use an intuitive process are more likely to come to conclusions that seem to be correct based on their initial reactions and worldview but are nonetheless factually incorrect (Cuevas and Dawson, 2020; Shenhav, Rand, and Greene, 2011).

In regard to the widespread responses to the COVID-19 pandemic we witnessed in the United States, cognitive style is relevant because while Type 2 thinking correlates with an acceptance of science and lower receptivity to false information (Pennycook, Ross, Koehler, and Fugelsang, 2016), Type 1 thinking tends to be associated with the acceptance of conspiracy theories, a rejection of science, and an inability to effectively weigh evidence (Dagnall et al., 2015). For example, Gervais (2015) investigated whether cognitive style was related to acceptance of science, specifically the principles of evolution. Many scientific concepts, such as evolution, may be difficult to grasp intuitively while supernatural ones are readily accepted that way. However, because concepts such as creationism are not universally accepted, it suggests that, at least for some people, Type 2 thinking can override Type 1 so that the individual arrives at a different, more scientifically sound conclusion. Participants were tested on their acceptance of scientific conclusions and on the Cognitive Reflective Task, which is designed to assess whether individuals think intuitively or analytically. Results showed that the more analytical thinking a participant displayed, the more likely they were to endorse evolution. Analytic thinking continued to be a significant predictor even when religiosity, religious upbringing, and political conservatism were entered as covariates. Somewhat surprisingly, it did not require a great deal of analytic thinking to override intuitive processes as the test items only require k-12 math abilities. If, in 2020, a large portion of the population was predisposed to default to Type 1 thinking and reject scientific propositions, this may have led to a reluctance towards the measures necessary to stem the virus and instead an acceptance of intuitive, yet unsupported assumptions such as the assertion that their religious belief would insulate people from harm.

A growing body of research has revealed that one's inclination towards an intuitive cognitive style, as opposed to an analytic or reflective cognitive style, is positively correlated with religious belief and receptivity to false information (Cuevas, 2013; Norenzayan and Gervais, 2013; Pennycook et al., 2016; Zhong, Cristofori, Bulbulia, Krueger, and Grafman, 2017; Zuckerman, Silberman, and

Hall, 2013), both of which contributed to hampering the response to the 2020 health crisis. Two recent empirical studies reinforced earlier conclusions regarding the association between intuitive thinking and religious belief and found them to be strongly related (Pennycook et al., 2016; Zuckerman et al., 2019). Pennycook et al. further note that the results were consistently proportional, with the stronger the religious belief, the lower the scores were on analytic thinking tasks. In their meta-analysis, they also found that 31 of 35 studies showed similar findings regarding the negative correlation between analytic thinking and religious belief ($r = -.183$, $p < .001$, $N = 15{,}078$, $k = 31$).

A more recent empirical study similarly indicated that not only was intuitive thinking related to religious belief but that the magnitude was also a factor in that the stronger the religious belief, the less likely the individual was to engage in analytic thought processes (Bronstein et al., 2019). Furthermore, dogmatism and fundamentalism were both positively correlated with belief in fake news, while analytic thinking was correlated with belief in real news. Analytic thinking is related to the ability to detect conflicts in reasoning, and deficits in conflict detection ability may promote dogmatism and fundamentalism. Individuals who hold more extreme religious beliefs may begin their information search by focusing on less reliable sources of information. Then, when they encounter contradictory but more accurate information, the inability to navigate and process conflicting information may limit them from updating their views. An example of this may have been that early in 2020, health officials advised the public that mask wearing was not necessary before revising their recommendations later to include mask wearing as among the most important preventative measures. Those individuals prone to Type 1 thought processes, who were also likely to be high in fundamentalism, may have been unable or unwilling to update their views on mask wearing, and thus eschewed the precaution. While some people commonly argue that science cannot be believed because findings at times contradict previous ones and that instead they rely on their own "research" to draw conclusions, this line of reasoning is likely an extension of confirmation bias and intuitive thinking rather than the analytic thinking they suggest it is.

Other recent studies have linked an intuitive cognitive style to the second main group-level predictor explored here, political orientation, specifically political conservatism (Gervais, 2015; Pennycook and Rand, 2019a, 2019b). Pennycook and Rand (2019a) assessed left-leaning and right-leaning participants' tendency for Type 1 and 2 thought processes and their ability to discern fake news from accurate information. The researchers found that analytic thinking, as determined by the Cognitive Reflective Test, was positively correlated with discernment while conservatism was negatively associated with discernment. There was also an interaction effect with analytic ability being more strongly related to discernment for Democrats than for Republicans, suggesting that analytic thinking seemed to assist with discernment more for liberals than conservatives.

In a second paper that year, Pennycook and Rand (2019b) note that "Humans are cognitive misers, in that resource-demanding cognitive processes are typically avoided" (p. 187), with some individuals more miserly than others. "Reflective impulsivity" implies a reluctance to think analytically, and individuals who display reflective impulsivity tend to have difficulty recognizing a lack of reflection on their part and as such rarely alter existing beliefs. Political misconceptions may be especially resistant to belief revision, and if, as suggested, conservatives are more likely to use a Type 1 intuitive approach, they would be more likely to both hold and maintain political and scientific misconceptions. Indeed, Type 1 thinkers are more susceptible to fake news, while Type 2 thinkers are more likely to seek out higher quality sources of information. Acceptance of misinformation may thus be a function of both a willingness to accept it due to confirmation bias and an inability to detect it and filter it out.

Ultimately, an intuitive cognitive style predicts disbelief in science, religious belief, conservatism, and belief in fake news, all of which appeared to be contributing factors in exacerbating the spread of COVID-19 within the United States in 2020. Those prone to Type 1 processing strategies are more likely to be religious and conservative, the two large groups that studies indicated were most likely to disregard health precautions during the pandemic (Clinton et al., 2020; DeFranza et al., 2020). Type 1 thinkers are also more likely to reject science (Gervais, 2015) and to accept fake news (Pennycook and Rand, 2019b). Cognitive style and the propensity for conspiratorial thinking and susceptibility to fake news may be two distinct explanations for the responses we witnessed; it is likely that these are separate characteristics yet they may have considerable overlap with many people displaying traits of both. These combined factors may explain why a large portion of the population chose to view the outbreak as a hoax or as no more dangerous than the flu and were willing to spread misinformation that proved fatal to so many.

Individual-Level Explanations: Cognitive Ability

Motivated cognition likely played a role in people's responses to the pandemic in several main ways: subjective views such as religious and political beliefs may have encouraged confirmation bias by reinforcing a mistrust in science, in turn fueling conspiratorial thinking as an alternate explanation. Additionally, those who were more likely to hold those religious and political beliefs were also more likely to revert to Type 1 intuitive thought processes in deciding how to respond to health recommendations, an approach that is particularly ill-suited for understanding complex medical and scientific information. But another variable that potentially contributed to large-scale outcomes was cognitive ability.

One question is whether all people have the same capacity to revise their beliefs based on newer, more accurate information, such as when updated

COVID-19 guidelines were released, and cognitive ability may be crucial in this regard (De Keersmaeker and Roets, 2017). One of the many important aspects of cognitive ability is to inhibit and override previously learned information. On the other hand, conspiratorial thinking is negatively correlated with analytical thinking ability and education level, which in turn are related to cognitive ability, and those who indulge in such beliefs may lack the capacity to recognize and critically examine the logical shortcomings in the theories they espouse (Douglas et al., 2017). They tend to overestimate the likelihood of multiple events being related and lend more weight to anecdotal experiences. So, for instance, if an individual had attended a large family gathering recently without contracting the virus, they may conclude that such gatherings would always be safe and continue to engage in them without realizing that those family members would come in contact with a myriad of people who could have infected them between gatherings.

Historically, cognitive ability has been linked to a number of variables potentially related to the health outcomes witnessed in 2020. Over the last century, empirical research has shown that general intelligence predicts a wide variety of life outcomes including educational attainment, professional accomplishment, income levels (and conversely poverty), and public health (Reeve, 2009). The g-nexus represents the central aspect of general intelligence that serves as the focal point for these different outcomes. One reason IQ is thought to impact health is because more intelligent individuals may more effectively evaluate complex information such as statistical evidence regarding cancer, viruses, or nuances about contagions and vaccinations. Conversely, low general intelligence predicts an array of maladaptive behaviors that could have negative health consequences, beyond the socio-economic factors that are more commonly attributed to health outcomes.

In an analysis of 192 countries, Reeve (2009) found that national IQ was positively correlated with national health indicators. When controlling for economic variables, IQ was negatively correlated with infant and maternal mortality ($r = -.69$, $p < .01$ and $r = -.65$, $p < .01$ respectively), and HIV/AIDS deaths ($r = -.47$, $p < .01$), while positively associated with life expectancy ($r = .75$, $p < .01$). Religious belief was positively associated with infant and maternal mortality, and negatively related to life expectancy. When IQ levels were controlled for, religious belief was unrelated to health outcomes, suggesting that intelligence levels play a central role in the relationship between the variables. This supports the concept of a g-nexus in that differences in *g* translate to individual differences in how successful people are in navigating complex cognitive challenges that impact health. As a result, high-g is associated with beneficial health outcomes while low-g is associated with greater risks and more negative outcomes due in large part to difficulties in processing and utilizing information about science and health care.

Religious Belief and Political Orientation

Both of the group-level predictors discussed earlier that were associated with non-compliance with COVID-19 health directives, religious belief and conservatism, have also been linked to cognitive ability. While evolutionary psychology has traditionally portrayed religious belief as a product of social cognition (Cuevas, 2008; Zhong et al., 2017), ample evidence has emerged indicating that religious belief is also clearly linked to cognitive ability. Research has consistently revealed that a negative correlation exists between intelligence and strength of religious belief, which holds true across a range of cultures and countries (Pesta et al., 2010; Stankov and Lee, 2018; Zuckerman et al., 2013). These trends have appeared across varying age ranges, including adults (Kanazawa, 2010; Lewis, Ritchie, and Bates, 2011; Sherkat, 2011) and adolescents (Nyborg, 2009), as well as across all 50 states (Pesta et al., 2010). Furthermore, Lynn et al. (2009) found that individuals tend to become less devout as they mature and develop cognitively.

Two recent studies have provided additional evidence of this relationship. In a replication of their earlier research (i.e., Zuckerman et al., 2013), Zuckerman et al. (2019) conducted a meta-analysis of 83 studies to determine whether the previously established negative association between intelligence still held after including additional, newer studies or if the relationship had weakened over the prior decade. Across the 83 studies, there was a consistent, significant negative relationship as well as in 20 new studies they included: $r = -.20$, $p < .001$ in college samples and $r = -.23$, $p < .001$ in non-college samples. Thus, the relationship continues to exist and is not growing weaker as society modernizes. When examining data from 192 countries, Reeve (2009) similarly found that IQ was negatively correlated with religious belief across the entire sample, ($r = -.60$, $p < .01$). Zuckerman et al. (2019) contend that intelligence tends to breed rationality, and thus those high in intelligence are more likely to seek scientific rather than religious explanations.

Neurological research also illustrated how cognitive ability is associated with religious belief. Studies have revealed how diminished function in certain cerebral regions was related to increased or more extreme beliefs. For instance, individuals have been shown to have less activity in the dorsolateral prefrontal cortex when experiencing spiritual experiences, while in contrast, the area is strongly activated in skeptics (Cristofori, Viola, Chua, Zhong, Krueger, Zamboni, and Grafman, 2015). The dorsolateral prefrontal cortex is thought to be involved with inhibiting irrational thoughts and enabling logical thinking. As a result, this suggests that diminished executive function may be associated with conspiratorial thinking. Similarly, Zhong et al. (2017) determined that damage to the prefrontal cortex was related to both higher levels of fundamentalism and lower levels of intelligence. Because the prefrontal cortex is activated during tasks that involve evaluation and doubting of beliefs, how well that area functions can influence beliefs (Asp, Ramchandran, and Tranel, 2012). If it is damaged or its function is

diminished, the individual would have difficulty identifying invalid premises and stimulating doubt for illogical assertions that should be rejected, thereby suppressing belief revision.

Cognitive ability has also been shown to be associated with political orientation. Research has indicated that liberal political beliefs are positively correlated with IQ, while conservative beliefs are negatively correlated to IQ (Reeve, 2009). Additionally, damage to the prefrontal cortex, which is so vital to intelligence and logical thought processes, has been linked to high levels of authoritarianism (Asp et al., 2012). Efficient executive function in areas of the prefrontal cortex allow the individual to successfully process nuance, to weigh a variety of different perspectives, and to exhibit cognitive flexibility, whereas authoritarianism is associated with just the opposite: simplistic, binary thought processes and cognitive rigidity. In another study, neurologists found that damage to the prefrontal cortex predicted extreme right wing political beliefs among a sample of patients with traumatic brain injury (Cristofori et al., 2015). Patients with diminished function in the area were found to have difficulties making political judgments and were more likely to be accepting of extreme political positions than healthy controls. This is not to say that political orientation is the result of brain injury but that more efficient executive function in certain parts of the prefrontal cortex may allow the individual to successfully consider a wide range of perspectives, whereas limited function may predispose one to more extremist views.

Other areas of the brain have also been shown to be related to political orientation. Kanai et al. (2011) used MRI scans to compare the neural structures of participants with different political beliefs. They found that the gray matter in two distinct regions of the brain were correlated with political orientation. Liberals showed greater neural activity and increased gray matter in the anterior cingulate cortex, which is associated with conflict monitoring and tolerance for uncertainty. These cognitive skills are necessary for problem solving, belief revision, and understanding nuance, all of which would serve one well in navigating complex health information. In contrast, conservatives were revealed to have a greater amount of gray matter volume in the right amygdala, which is associated with fear responses, and individuals with larger amygdala are more sensitive to fear.

In sum, evidence indicates that cognitive ability and cerebral function appear to be related to both religious and political orientation, and those in turn were determined to be prominent predictors of how people responded to the 2020 COVID-19 pandemic. Additionally, high levels of functional ability allow for enhanced rational thinking, higher-order problem solving, and belief revision, traits that would serve one well in the face of societal tumult. However, low levels of functional ability may make one more susceptible to believing false information, to propagating conspiracy theories, and less likely to update beliefs based on new evidence. These traits could have been particularly crippling in response to an extended medical crisis.

Belief Revision

If indeed cognitive ability can affect health outcomes and the way people responded to the COVID-19 crisis in 2020, it is also worthwhile to examine how that ability may influence belief revision more specifically. Because a pandemic of this nature had not been encountered in a century, since the Spanish flu in 1918, the conditions were unlike anything that nearly any living American had ever experienced. Thus, people's understanding of social environments, hygiene, everyday behaviors, risk assessment, and a host of other aspects central to daily life would need to be revised. Those individuals with a limited grasp of areas such as biology, epidemiology, virology, immunology, or pulmonology, which no doubt would comprise the vast majority of us, would need to update our knowledge of those fields in order to successfully respond and make the most prudent choices. So one relevant question is whether cognitive ability could influence one's capacity to make such changes to our understanding.

De Keersmaeker and Roets (2017) tested how cognitive ability affected one's ability to correct misinformation. Participants in the experimental group received negative information about a hypothetical person and then, later, updated information they were told was more accurate. When they were asked about their views of the person afterwards, an interaction effect emerged (cognitive ability x evaluation), and those with high cognitive ability had views that were no different from those in a control group who had received no negative information at all, suggesting that they had updated their beliefs based on the latest, revised information. However, those with low cognitive ability revealed significantly more pessimistic views about the subject, indicating that their views were based on the initial, false information, and had not been updated as a result of the new, more accurate information. It must be noted that the researchers controlled for authoritarianism and personality factors, which suggests the results were due to actual differences in cognitive ability rather than ideology or personality tendencies. This study shows that views cannot be changed simply by presenting more accurate information and expecting those views to then be revised and that the influence of lingering false information is at least partially attributable to cognitive ability. This could explain the effects of fake news on those who only frequent unreliable "news" sources. If they encounter the misinformation first, and if they also do not have sufficient cognitive ability for adequate belief revision, then those views may never get updated regardless of factual information they later encounter.

In order to recognize one's own limitations in knowledge, a certain amount of competence is necessary (Pennycook et al., 2017). Thus, those with low levels of competence are unlikely to realize it, commonly described as the Dunning–Kruger effect, which is a specific manifestation of metacognition. People in the bottom quartile of logical reasoning and those prone to Type 1 thinking tend to overestimate their performance while those on the upper end tend to underestimate it.

If they overestimate their knowledge, they are less likely to see the need to revise their thinking because they are more likely to believe they are already correct. When individuals contend that they have high levels of knowledge that they actually do not, it is known as overclaiming (Atir, Rosenweig, and Dunning, 2015; Pennycook and Rand, 2019b), which is particularly prevalent among those with low cognitive ability.

Several recent studies have examined this effect. Pennycook et al. (2017) found that self-evaluations were weakly correlated with actual knowledge levels, and that the lower the knowledge level, the greater the individual tended to overestimate their knowledge, with those who scored lowest tending to wildly overestimate their own understanding. The results supported the basic premise of the Dunning–Kruger effect. Pennycook et al. concluded that low ability level/Type 1/intuitive thinkers seem to be unaware of their relative level of performance and their inability to engage in Type 2 thinking, while those who tend to be Type 2 thinkers are more aware of their strengths and weaknesses. Atir et al. (2015) investigated overclaiming by presenting participants with fabricated information they could not possibly have knowledge of and asking them how well they knew the information. They found that self-perceived knowledge positively predicted overclaiming, so the more the participants viewed themselves as knowledgeable about the subject matter the more they claimed to have knowledge they could not possess.

Atir et al. (2015) manipulated participants' perceptions of their own knowledge by giving them either easy quizzes designed to bolster confidence or difficult ones designed to temper confidence, and their subsequent responses regarding self-perceived knowledge reflected the difficulty level of the quizzes. Those in the easy-quiz condition overclaimed more, suggesting that increasing self-perception also increased overclaiming. In making judgments about a topic, people do not simply draw upon existing knowledge that they have, because they are not generally aware of how much knowledge they possess, and instead base their judgments on preexisting self-perceptions about what they think they know. This may lead to confirmation bias in that if they think they know about a topic they may construct a plausible yet incorrect notion about it and feel confident that they are correct. This could have a host of negative effects such as the person adopting inaccurate positions, providing erroneous advice from a self-perceived position of authority, or discouraging others from educating themselves and building an authentic knowledge base.

Similarly, Pennycook and Rand (2019b) found that those who thought analytically were more likely to recognize and reject false information and also less likely to overclaim. Receptivity to fake news and pseudo-profound fabrications was at least partially due to the ability to detect and filter out false information when it was first encoded. This is significant because it suggests that low cognitive ability may present challenges specifically during the encoding process which may make some people more susceptible to accepting false information and subsequently overclaiming.

Indeed, a number of studies have shown how working memory limitations may influence false beliefs. Pennycook et al. (2016), note that of the two approaches to processing, Type 1 is intuitive and autonomously cued while Type 2 is reflective and puts a particular burden on working memory. In turn, lower working memory capacity has been linked to the inability to update beliefs in response to new evidence (Bronstein et al., 2019). Brydges, Gignac, and Ecker (2018) explain this at least in part through the Continued Influence Effect. The Continued Influence Effect is when an individual who has been provided with incorrect information uses that information for subsequent reasoning to draw conclusions about events or causality even after they have been made aware that the initial information is inaccurate. They essentially draw upon the initial false information rather than the subsequent accurate information. This can have a substantial negative impact on society considering the proliferation of social media because it can potentially be used to feed misinformation campaigns if those with limited working memory are exposed to false information first.

The Continued Influence Effect may be the result of faulty memory retrieval processes as memories compete for activation during retrieval, regardless of their accuracy (Brydges et al., 2018). Monitoring processes can regulate the encoding of incoming misinformation by tagging or flagging it for doubt or scrutiny, but for those with limited working memory, that function may not be available upon retrieval. Brydges et al. hypothesized that integrating and updating are functions of working memory, so working memory capacity should predict the Continued Influence Effect while short term memory should be relatively unrelated. The researchers confirmed their hypothesis and found that working memory capacity but not short term memory capacity was related to the Continued Influence Effect. Working memory capacity predicted susceptibility to the Continued Influence Effect. This was due to working memory limitations causing a failure to integrate, manipulate, and update information devoted to memory. Essentially, those with low working memory capacity were unable to effectively integrate conflicting pieces of information, then update and revise their understanding accordingly.

Conclusion

Convincing research exists suggesting that religious and conservative political orientation predicted public behavior during the COVID-19 crisis, but we cannot assert that these belief systems were the cause of that behavior. Instead, it is likely that certain psychological characteristics underlie all three variables, resulting in the beliefs and behaviors that were so strongly correlated. Certainly, motivated cognition played a role as those who adhered to certain religious and political ideologies collectively maintained in-groups based on subjective beliefs and ultimately succumbed to confirmation bias, thus rejecting scientific information and medical advice that did not align with their views. This likely fueled the prevalence

of conspiratorial thinking. In other rare cases individuals may have been afflicted by psychological conditions related to similar outcomes, such as delusion-prone ideation, schizotypy, or certain neurological conditions. Yet these conditions no doubt accounted for a very small percentage of those who chose to reject health concerns or viewed the pandemic as a hoax.

As we have shown here, the more likely explanation for the broader swath of the population who discounted COVID-19, thereby increasing its scope, is the interplay between cognitive style and cognitive ability. While cognitive style may be dispositional in that it is defined by whether an individual *chooses* to engage in Type 1 intuitive thinking or Type 2 analytical thinking, which could potentially have detrimental effects in some circumstances, the studies reviewed here indicate that there is a strong relationship between the prevalence of Type 1 thought processes and limited cognitive ability. Those who tend towards Type 1 thinking and who have limited cognitive ability are the most likely to display the Dunning–Kruger effect, thereby overclaiming and insisting on having a level of expertise that they do not possess. Such individuals would be highly resistant to belief revision and analytic thought processes so essential to coping with the circumstances of a pandemic, circumstances that none of us had prior knowledge of or experience with to enable us to navigate without altering our understanding to conform to the new environment. Indeed, one of the reasons that political and scientific debates among laypersons do not change minds is because those who are the most overconfident are least likely to recognize their overconfidence and erroneous conclusions and ultimately acknowledge them.

Looking deeper, we suspect that working memory may be a key aspect of cognitive ability that could determine whether an individual is likely to be susceptible to false information and prone to believing conspiracy theories. It is possible that limited working memory capacity may produce deficits during both encoding and retrieval. During encoding, those without efficient working memory capability may have difficulty recognizing, flagging, and filtering out false information, thereby reverting to Type 1 processes and accepting the premises that align with their subjective belief systems, no matter how implausible. Upon retrieval, when the individual has conflicting propositions to choose from based on information from different sources, low working memory capacity can make it unlikely that the person is able to override initial, false information. Combined, these characteristics could, in turn, be predictive of religious belief and a conservative political orientation, the two group affiliations that were most likely to be associated with the rejection of health precautions and subsequently, the continued spread of the virus. These cognitive characteristics may be especially problematic when those individuals are exposed to social media that is comprised of repetitive, brief soundbites that conform to and seemingly confirm previous notions.

A number of broad approaches to addressing such issues have been proposed. Pennycook and Rand (2019a) found that crowdsourced ratings were

effective in identifying fake and less-than-credible news sources on social media, which could potentially deter the encoding of false information if such ratings and disclaimers were present when individuals first encounter information on a particular topic. It is also possible that different strategies are necessary for individuals who have low cognition abilities if in fact there are material differences in their encoding, retrieval, and belief revision (De Keersmaeker and Roets, 2017), though at this juncture it remains unclear what such interventions may entail. Bronstein et al. (2019) suggest that interventions may be designed to improve analytic thinking which may deter individuals from being susceptible to fake news and better able to discriminate between real and false information. Ideally, this may also extend to limiting conspiracy thinking and the rejection of science. Similarly, Pennycook and Rand (2019b) suggest that education and training may improve people's tendency to think with reflective impulsivity and thus be less susceptible to accepting false information.

However, it is unlikely that interventions could be readily developed to directly improve individuals' working memory capacity if that is the barrier to belief revision. While there are concerning consequences resulting from the inability to suppress or revise false information, if the ability to do so is heavily reliant on working memory, then it may not be easily rectified (Brydges et al., 2018). Nonetheless, given the gravity of the matter, researchers should continue to explore both the causes and potential remedies associated with such psychological characteristics.

In past decades those who engaged in conspiratorial thinking and a rejection of science were often considered harmless oddities, relegated to the fringes of public discourse. As technology has advanced and social media has become more ubiquitous, they have, somewhat paradoxically, enhanced the ability of those on the fringes to more fully engage with broader societal discourse, ultimately propagating the spread of false and at times dangerous information. Such trends can no longer be viewed as innocuous peculiarities. We have seen the detrimental effects that such thinking had in limiting the nation's ability to suppress the spread of the COVID-19 virus in 2020 and in fact seemed to contribute to the crisis. We have further seen violence in the nation's Capitol in 2021 based on similar lines of thinking. The stability of the nation may rest in our ability not just to stem the flow of misinformation but also to deter a broad cross-section of the public from a tendency to believe and act upon such falsehoods.

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