



# Going Viral: How Fear, Socio-Cognitive Polarization and Problem-Solving Influence Fake News Detection and Proliferation During COVID-19 Pandemic

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In times of uncertainty, people often seek out information to help alleviate fear, possibly leaving them vulnerable to false information. During the COVID-19 pandemic, we attended to a viral spread of incorrect and misleading information that compromised collective actions and public health measures to contain the spread of the disease. We investigated the influence of fear of COVID-19 on social and cognitive factors including believing in fake news, bullshit receptivity, overclaiming, and problem-solving—within two of the populations that have been severely hit by COVID-19: Italy and the United States of America. To gain a better understanding of the role of misinformation during the early height of the COVID-19 pandemic, we also investigated whether problem-solving ability and socio-cognitive polarization were associated with believing in fake news. Results showed that fear of COVID-19 is related to seeking out information about the virus and avoiding infection in the Italian and American samples, as well as a willingness to share real news (COVID and non-COVID-related) headlines in the American sample. However, fear positively correlated with bullshit receptivity, suggesting that the pandemic might have contributed to creating a situation where people were pushed toward pseudo-profound existential beliefs. Furthermore, problem-solving ability was associated with correctly discerning real or fake news, whereas socio-cognitive polarization was the strongest predictor of believing in fake news in both samples. From these results, we concluded that a construct reflecting cognitive rigidity, neglecting alternative information, and black-and-white thinking negatively predicts the ability to discern fake from real news. Such a construct extends also to reasoning processes based on thinking outside the box and considering alternative information such as problem-solving.

**Keywords:** COVID-19, fake news, problem-solving, fear, xenophobia, overclaiming, bullshit receptivity, socio-cognitive polarization

## INTRODUCTION

“If it bleeds, it leads” cites a well-known mantra of journalism. When a story involves deaths or injury of some kind, it is more likely to be discussed on the media, to receive a higher number of clicks on the internet and be shared. News stories are often reported in a sensationalist form tailored to trigger an emotional response which can influence our ability to reason. Recent studies on the impact of misinformation during the COVID-19 pandemic highlight how unreliable and inflammatory information (Gallotti et al., 2020) may have threatened public health in several countries by altering individuals’ perception of risk behaviors (Oh et al., 2020). For example, it appears that at the beginning of the pandemic the population was divided between those who were seriously concerned and reacted by seeking information and those who thought that COVID-19 was “no more than the flu” and thus resisted taking safety measures. Stanley et al. (2020) found that analytic thinking, measured via the Cognitive Reflection Test (CRT: Frederick, 2005), was a predictor of believing the pandemic was a hoax and resisting the adoption of safety measures like social-distancing and hand-washing to mitigate spread. A pandemic is a prototypical situation wherein collective behavior directly impacts the health and safety of every member of the group. Consequently, the belief in and proliferation of fake news during a global pandemic is a significant concern that can exacerbate a public health emergency. Indeed, misinformation has been instrumentalized by pushing divisive political ideologies with the consequence of preventing cooperation among individuals (Stella et al., 2018). In the present investigation, we attempted to gain a better understanding of specific social, cognitive, and emotional factors that contribute to individuals’ tendency to believe in and share fake news during the early height of the COVID-19 pandemic in Italy and the United States.

Why does negative news echo faster than positive news? To answer this question, we highlight two components of news that contribute to its appeal: *alertness*, and *informativeness*. A first component that may explain why people are so attracted to negative news, whether it is fake or real, is that news tends to be *alerting* by inducing fear. From an evolutionary framework, fear makes people more sensitive to potential threats (Ohman and Mineka, 2001; Schaller et al., 2003; Balzarotti and Ciceri, 2014). Our cognitive system is particularly tuned toward potential sources of threat such as negative events, which, in most situations, are “more salient, and generally efficacious than positive events” (Rozin and Royzman, 2001, p. 297). Given its specific relevance to survival, human cognitive processing of negative stimuli is more elaborate, detailed, and complex compared to positive stimuli [i.e., negativity bias, see Rozin and Royzman (2001)]. Moreover, memories for negative information form more quickly and are more easily retrieved (Kensinger et al., 2006, 2007). A pandemic is a prototypical scenario that engenders a great deal of unresolved fear and anxiety that can leave people in a constant state of high alert. In parallel to the immune system, animal species have developed specific cognitive and behavioral responses that help us avoid infections (Schaller and Park, 2011). This disease-avoidance system drives both explicit and implicit

safety measures against infection (e.g., increased hand-washing; Fleischman et al., 2011). For example, in response to fear people tend to be socially avoidant and less tolerant of foreigners, and are in general more xenophobic (Navarrete et al., 2007; Mortensen et al., 2010; Schaller and Park, 2011). Following this perspective, we predicted that fear of COVID-19 should relate to seeking out information about the disease, proactively taking actions to reduce the chances of being infected, and sharing as much information as possible.

A second factor involved in the proliferation of news is the need for *information*, which is especially pertinent during global crises such as the COVID-19 pandemic. Confirmed coronavirus (COVID-19) cases increased exponentially first in China, followed by Italy, Spain, central Europe, and then the United States, culminating in a worldwide public health emergency. From the earliest days of the outbreak, misinformation about COVID-19 circulated widely across social media, radio, talk shows, and national news media (Frenkel et al., 2020; Pennycook et al., 2020). Seeking out information can help resolve uncertainty during a time of heightened anxiety (e.g., Webster and Kruglanski, 1994; Kossowska and Bukowski, 2015). The limited amount of reliable scientific information during the beginning of the COVID-19 outbreak likely encouraged people to search for explanations that did not yet exist as the science underlying the biology and spread of the virus was still being investigated. This void of scientific consensus may have opened a wide avenue for the spread of pseudo-scientific and outright false information. In the context of threat, where feelings of uncertainty and fear make it difficult to anticipate or plan actions, people compulsively search for explanations and tend to base them on readily accessible pieces of information (Hogg and Adelman, 2013; Kossowska and Bukowski, 2015). Such a lack of reliable information, together with the fear of infection, might have compelled people toward pseudo-profound existential beliefs, as well as overclaiming confidence in unreliable information to make up for a lack of reliable information and overcome uncertainty-induced anxiety. Therefore we hypothesized that fear of COVID-19 should predict a greater likelihood of believing fake news, in particular COVID-related fake news; second we predict it would relate to individual’s propensity to judge pseudo-profound statements as profound (measured by the Bullshit Receptivity Questionnaire; Pennycook et al., 2015) and the tendency for people to “self-enhance” when asked about their familiarity with general knowledge questions (Pennycook and Rand, 2017) assessed using the overclaiming scale (Paulhus et al., 2003). Moreover, we predicted that those with higher bullshit receptivity and worse overclaiming accuracy would be more likely to believe in fake news.

From the existing literature, we know that individual differences in thinking and reasoning modulate individuals’ propensity to believe in fake news. Specifically, there is a positive correlation between solving the CRT and discerning fake from real news (e.g., Pennycook and Rand, 2017). Dispositionally analytical thinkers are, indeed, more resistant to believing fake news (e.g., Pennycook and Rand, 2017, 2019), but were also more likely to avoid safety measures at the beginning of the COVID-19 pandemic (Stanley et al., 2020). Stuppel et al. (2017)

examined the role of “cognitive miserliness” as a determinant of poor performance on the CRT. According to the cognitive miserliness perspective, people often respond incorrectly on CRT items because they are “unwilling to go beyond the default, heuristic processing and invest time and effort in analytic, reflective processing” (p. 1). Additionally, reduced inhibitory control is found to be associated with lower CRT performances (Oldrati et al., 2016). Solving a problem entails being able to go beyond the first interpretation of a problem, accrue information, and incubate with potential solutions until the most appropriate solution is reached. The ability to detect fake from real news might also rely on mechanisms involved in problem-solving. This perspective finds support in a recent demonstration that people share false information about COVID-19 because they fail to think sufficiently about the accuracy of news content (Pennycook et al., 2020). In light of previous studies showing that stress, high risk-taking and anxiety of running out of time deteriorate creativity, and problem-solving performance (Salvi et al., 2016a; Salvi and Bowden, 2019; Duan et al., 2020) we hypothesized that the problem-solving performance would relate to a greater likelihood of detecting fake news, whereas fear of COVID-19 would lead to worse problem-solving performance.

To date, research on fake news has focused predominately around the 2016 US presidential election. Liberals and conservatives differ in cognitive style and the latter appear to fail at discerning fake from real news within a political context (Pennycook and Rand, 2017; Pennycook et al., 2018). There is scientific literature showing that political ideology is associated with cognitive rigidity/flexibility and different problem-solving styles, where liberalism is associated with a problem-solving style oriented toward insight, and conservatism toward step-by-step processing (Salvi et al., 2016b). Interestingly, insight problem-solving appears to lead to higher accuracy on problem-solving tasks, rely on brain regions responsible for novel and original associations and may also be involved in fake news detection (e.g., Salvi et al., 2016a, 2020; Shen et al., 2017; Cristofori et al., 2018; Danek and Salvi, 2018; Laukkonen et al., 2020). Additionally, there is evidence that conservatives and liberals differ in creativity (Dollinger, 2007). Overall, conservatives appear to be more structured, rigid, and prefer more direct answers, whereas liberals have more tolerance for ambiguity and complexity and tend to show greater openness (Jost et al., 2003). Conservatives present higher perceptual rigidity for example and appear to be more influenced by figures’ global shapes as well as contextual information than liberals (Caparos et al., 2015). This difference is also reflected in neurocognitive functioning: Liberalism is associated with stronger anterior cingulate activity suggesting that liberals have a higher sensitivity for monitoring response conflict, whereas right-wing orientation is associated with greater neural sensitivity to fear and larger amygdala volume (Amodio et al., 2007; Jost and Amodio, 2011). These differences in problem-solving accuracy and the capacity to handle complexity may help explain people’s ability to assess conflicting information provided by media outlets.

Recent studies investigating social media content have demonstrated that accounts with a high “bot score” (indexing the likelihood of being a bot, or fake account) promulgate

conspiratorial narratives charged with alt-right ideology and are specifically oriented toward hateful and polarizing political ideologies (Stella et al., 2018; Ferrara, 2020). During the COVID-19 pandemic, hateful bots have been found to be more successful in attracting followers compared to counter-hate bots. Hateful and counter-hate bots appeared to interact and engage extensively with one another, promoting a culture of racism against Asians (Ziems et al., 2020). Because of the association between conservatism, rigidity in overall reasoning, and previous evidence on believing in fake news, we hypothesized that conservatism would predict fake news beliefs also in our dataset.

Tolerance of ambiguity is a well-established trait of personality known to predict creativity and problem-solving (Merrotsy, 2013). The Multidimensional Attitude Toward Ambiguity Scale (Lauriola et al., 2016) detects three different dimensions of intolerance for ambiguity: the affective (Discomfort with Ambiguity), cognitive (Moral Absolutism/Splitting), and epistemic (Need for Complexity and Novelty) components. Budner (1962) defined ambiguous situations or contexts as those which “cannot be adequately structured or categorized by an individual because of the lack of sufficient cues” (Budner, 1962, p. 30). Ambiguous situations are those which could be unclear, confusing, or interpreted in more than one way. Those who are intolerant of ambiguity tend to resort to black-or-white solutions and are distinguished for their quick and overconfident judgment, even at the neglect of reality (Frenkel-Brunswick, 1949). By contrast, those who are tolerant of ambiguity are attracted to situations they find ambiguous, challenging, and interesting. They are also individuals who score highly on the openness to experience and sensation-seeking behavior scales (McLain, 1993, 2009; Caligiuri et al., 2000; Lauriola et al., 2007). Individuals with low tolerance of ambiguity present an aversive reaction to ambiguous situations because the lack of information makes it difficult to evaluate risk and thus make decisions. These scenarios are perceived as a source of discomfort and people react to a perceived threat with stress, avoidance, delay, suppression, and denial (Budner, 1962; MacDonald, 1970; McLain, 1993; Furnham and Ribchester, 1995; Iannello et al., 2017). The tolerance of ambiguity scale negatively correlates with authoritarianism (MacDonald, 1970) and ethnocentrism (O’Connor, 1952) and positively with openness (Bardi et al., 2009) extraversion, and “novelty-seeking” (Rajagopal and Hamouz, 2009). Therefore, we hypothesized that intolerance of ambiguity, specifically captured by absolutism, could be associated with believing in fake news.

Xenophobia, specifically toward patients and Chinese visitors, is a final factor linked to the recent spread of anti-Asian hate seen during the COVID-19 pandemic (Ziems et al., 2020). On January 24, 2020, the fake news that “Chinese passengers from Wuhan with fever escaped the quarantine at Kansai International Airport” (Kansai International Airport., 2020) was spread through multiple social media channels. Despite Kansai International Airport denying that took place, xenophobia against Chinese people rapidly spread in Japan and all around the world. #*ChineseDon’tComeToJapan* started trending on Twitter, while “Chinese visitors [were being] tagged as dirty, insensitive, and even bioterrorists” (Shimizu, 2020).

Xenophobia has never been studied concerning fake news. Considering its relation to fear (see above) and potentially cognitive rigidity, we hypothesized xenophobia may play a part in the discernment of fake from real news, particularly COVID-19 news.

The shared literature on emotional, social, and cognitive factors underlying, political conservatism, intolerance for ambiguity, and xenophobic reactions suggest that people who score higher in these measures may be less likely to handle complexity and thus fail to seek out alternative explanations when assessing news. As such, we believe these factors share a common theoretical ground and belong to the same construct which we define as *Socio-Cognitive Polarization* (SCP; a factor capturing absolutism/intolerance of ambiguity, xenophobia, and conservative political ideology). Therefore, we hypothesized that they would be highly correlated to each other and would negatively predict the ability to discern fake from real news.

In sum, in this study, we sought to understand the potential role of a range of emotional, social, and cognitive factors underlying the infodemic during the early height of the COVID-19 pandemic. To this end, we investigated how fear of the COVID-19 pandemic is related to information seeking and proactive health behavior, fake news detection and sharing, propensity toward pseudo-profound beliefs, overclaiming false information, and problem-solving. We also investigated how these factors uniquely predict participants' ability to discern fake from real news. In particular, we expected that fear of COVID-19, problem-solving, and Socio-Cognitive Polarization would uniquely predict fake news detection and sharing. We administered a survey to participants from two countries that registered the highest case and death counts associated with COVID-19 during the early peak of the pandemic: Italy and the United States. The participants included a set of news headlines split by news-type (COVID-19-related or neutral) and veracity (fake or real); a series of questions to assess COVID-related fear and information-seeking proactivity; problem-solving tasks including the CRT and a set of visual and semantic puzzles (i.e., Rebus puzzles: MacGregor and Cunningham, 2008; Salvi et al., 2015a,b); and a series of scales measuring bullshit receptivity, propensity toward overclaiming, political ideology, xenophobia, and absolutism (See **Figure 1** for a summary of the experimental hypotheses).

## METHODS

### Pre-registration

We report materials used, our target sample size, how we determined data exclusions, our primary hypotheses, and our plan for primary analyses in our OSF preregistration available online (<https://osf.io/tsvg5>). Our materials and datasets can be found at our OSF preregistered project online (<https://osf.io/4pd2u>). In this paper we discuss only the first hypothesis of the preregistered study. Results of hypotheses number two and three will be published separately.

## Participants

Five hundred and sixty-five Italian and American volunteers participated in the study and completed the news and problem-solving portions of the survey (excluding outliers). The complete demographic characteristics of the respondents are available in the **Supplementary Table 1**. The two samples did not differ for age ( $t_{(560)} = 0.43$ ;  $p = 0.669$ ) and gender ( $X^2 = 0.03$ ;  $p = 0.985$ ), yet differed significantly in marital status and level of education (**Supplementary Table 1**). Because these differences suggest our samples reflect different populations, we decided to analyze and report the results of the two samples separately.

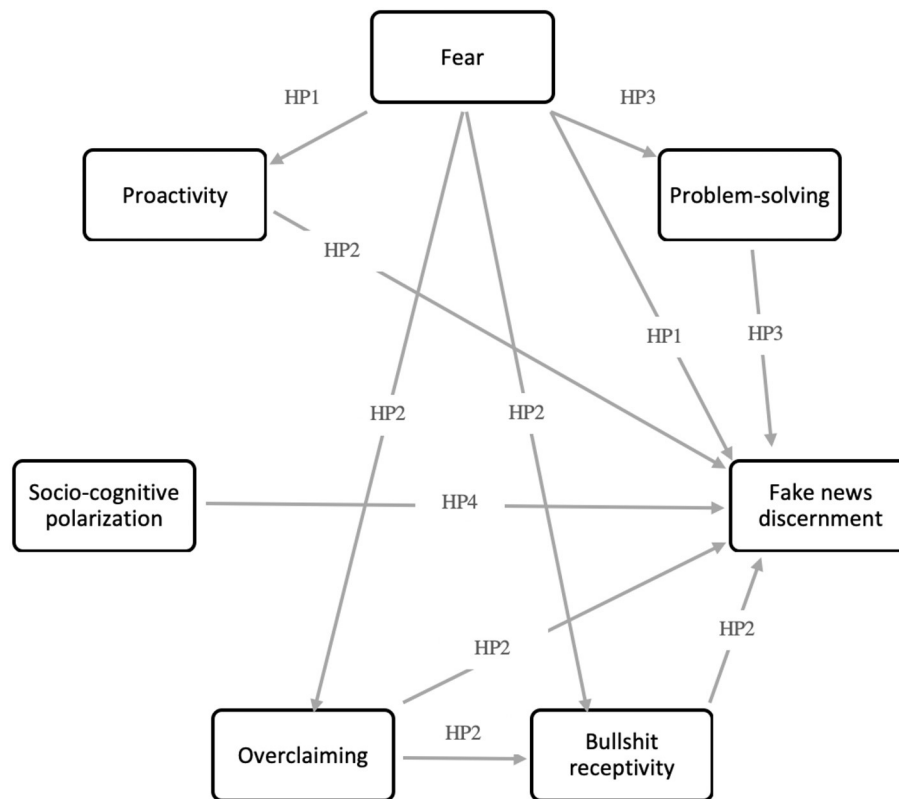
### Italian Sample

Out of three-hundred and twelve participants who completed at least 50% of the study, three-hundred native Italian speakers completed all news and problem-solving items. Eight outliers were removed for performing three standard deviations away from the mean on our fake news variables, leaving us with a final sample of two-hundred-and-ninety-two participants (210 females, average age = 37.79, SD = 16.06). Missing values for nineteen participants (who failed to complete at least one item of the remaining scales) were imputed using the mean values across subjects for the respective variable. Participants were distributed as follows: 51.7% from Milan; 18.8% from Bergamo city<sup>1</sup>; 14.8% from other cities in the Lombardy region; 10.2% from other northern and central regions (Emilia Romagna, Liguria, Piemonte, Toscana, Trentino Alto Adige, Veneto); 2.8% from southern regions (Calabria, Campania, Sicilia).

### American Sample

Out of three-hundred and forty-three participants who completed at least 50% of the study, two-hundred and seventy-five native American English speakers completed the news and problem-solving items. Two outliers were removed for performing at least three standard deviations away from the mean on our fake news variables, leaving us with a final sample of two-hundred and seventy-three participants (198 females, average age = 38.8, SD = 16.38). Missing values for twenty-one participants (who failed to complete at least one item of the remaining scales) were imputed using the mean values across subjects for the respective variable. Participants were distributed as follows: 35.2% from the state of Texas; 12.8% from the state of New York; 15.5% from Midwestern states (Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, Ohio, Wisconsin); 13.6% from Western states (Arizona, California, Colorado, Hawaii, Idaho, New Mexico, Oregon, Utah, Washington), 13.2% from other Southern states (Arkansas, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Virginia, West Virginia); 9.9% from other Northeastern states (Connecticut, Maine, Massachusetts, New Jersey, Pennsylvania, Rhode Island).

<sup>1</sup>Among all the Italian cities Bergamo counted the highest number of deaths for COVID-19.



**FIGURE 1** | Summary of our hypotheses and results. \*\*significance at  $p < 0.01$ ; \*\*\*significance at  $p < 0.001$ .

## Sample Size Estimation

Based on data from previous studies investigating the relationship between fake news discernment and social and cognitive variables (Pennycook and Rand, 2019), we performed statistical power analyses for sample size estimation. Power analysis (at an alpha = 0.05 and power = 0.90) revealed that our final sample of participants (273 Americans; 292 Italians) is higher than the projected sample size ( $N = 255$ ) needed to obtain the meaningful effect size for weak correlations ( $r = 0.20$ ; GPower 3.1 software), as well as the projected sample size ( $N = 247$ ) needed to obtain the meaningful effect size for weak to moderate increase in  $R^2$  for fixed multiple linear regression with 8 tested predictors ( $f^2 = 0.08$ ; G Power 3.1 software).

## Procedure

Data were collected in Italy and the US during the COVID-19 pandemic peaks (Italy: 3–24 April 2020; US: 14–28 April 2020). Qualtrics online survey platform (www.qualtrics.com), hosted on the University of Texas at Austin and Università Cattolica del Sacro Cuore of Milan servers, was used to distribute the survey. Participants were recruited via email invitations, advertisements on social media platforms, as well as psychology and creativity associations' websites. Participation was voluntary. All

participants gave written informed consent. Each session lasted ~40 min.

## Measures

After providing information about demographics (age, gender), marital status, level of education, type of news sources they consulted to seek information about COVID-19 (Supplementary Table 1), and political orientation, participants completed the online survey, which assessed fake news discernment, COVID-19-related fear and proactivity, bullshit receptivity, overclaiming tendencies, problem-solving, and socio-cognitive polarization. Clusters of individual sub-measures, which were theoretically similar and moderately to highly correlated ( $r \geq 0.2$ ), were collapsed into higher-order factors by z-scoring individual measures and averaging across a specific factor. Our factor reduction procedure left us with a total of 10 predictor variables for our primary analyses: 3 demographic factors (age, sex, and level of education); 3 COVID-19 factors (COVID-19 fear, proactivity, and city case count); and 4 socio-cognitive factors (bullshit receptivity, overclaiming, problem-solving and socio-cognitive polarization). Correlation matrices for each collapsed factor can be found in the (Supplementary Table 2).

## Fake-News Discernment

To measure the ability to judge the accuracy of COVID-19-related and neutral news headlines, 12 legitimate-looking news articles, inspired by news and titles found online, were created from scratch following the methodology of Pennycook and Rand (2017, 2019) (see **Figure 2**). The news articles were presented in a dedicated section of the survey. Six news headlines were factually accurate (real news) and six were false (fake news). The articles covered COVID-19-related news 50% of the time, whereas in the other 50% they covered more general topics, namely technology, nature, and employment (COVID-19 vs. neutral content). The news articles were balanced for credibility, plausibility, and sensationalism, through preliminary testing on a sample of 24 participants. Each headline was presented in the format of online newspaper headlines and it included a sensationalist headline, a thumbnail image, and a preview text from the article, while the sources were identical for each headline to control for source-bias.

For each news article, participants were asked: (1) if they were familiar with the article (response options: “No”; “Unsure”; “Yes”); (2) how accurate they believed the article was (a 5 points scale ranging from “Not at all accurate” to “Very accurate” was used); and (3) if they would share that article on social media (response options: “I would never share it online” (these data were removed from the analyses); “No”; “Maybe”; “Yes”). To make sure participants would not use any internet source to search for the answers, the news articles appeared on the screen for a maximum of 45 s. A discernment index, representing the ability to discern fake from real news, was calculated, following Pennycook and Rand’s (2019) procedure, by subtracting the perceived accuracy of fake news from perceived accuracy of real news and dividing by 4. The discernment index ranges from  $-1$  (i.e., complete belief in fake news and disbelief in real news) to  $1$  (i.e., complete belief in real news and disbelief in fake news), with  $0$  indicating no discernment between fake and real news. Similarly, a social-media sharing discernment index was calculated by subtracting willingness to share fake news from the willingness to share real news and dividing by 3. Individual discernment indices were computed for COVID-19-related news and neutral news.

## COVID-19 Variables

Information about the type of news sources participants normally consulted to learn about COVID-19 was collected using a multiple answer question (options: daily or online newspapers, TV news, social media or news aggregates, government websites, radio, or podcasts).

Participants answered 6 questions about their perception, emotions, and behaviors toward COVID-19. More precisely, they were asked to rate, on a scale from  $0$  (low) to  $100$  (high), the perceived severity of COVID-19, the negative arousal associated with the possibility of being infected, and the perceived likelihood to be infected. Participants were also asked to evaluate the frequency of their proactive information-seeking behaviors to face the pandemic (i.e., search for more information and take actions to reduce their chances of infection) on a 7-point Likert scale. Individual Perceived Severity and Arousal scores were

collapsed into one “COVID-19 fear” factor in the analysis, whereas proactivity scores were treated as a separate “proactivity” factor in the analysis.

Data about the spread of COVID-19 during the studied period (March 27–April 28, 2020), and more precisely country, state, and city-specific confirmed case and death counts, were retrieved from the Italian Civil defense COVID-19 database (GitHub, 2020b) and the New York Times COVID-19 database (GitHub, 2020a). On the last day of data collection, death counts reached 25,969 for Italy and 53,034 for the U.S. Daily counts of positive cases in each city were used as the “cases” factor in the analyses since we expected a local index of COVID-19 would be the best metric of environmental severity (see **Supplementary Table 1**).

## Bullshit Receptivity Score (BRS)

The propensity to judge pseudo-profound statements as profound was measured using the Bullshit Receptivity Questionnaire by Pennycook et al. (2015). Pseudo-profound bullshit is defined by the authors as seemingly impressive assertions, which are presented as true and meaningful but are actually vacuous sentences with no discernible meaning (e.g., “Interdependence is rooted in ephemeral actions”). The scale includes actual profound statements (e.g., “All endings are also beginnings. We just don’t know it at the time”) and non-profound, mundane statements, which reported simple facts (e.g., “Some things have distinct smells”). An Italian version of the scale was created by translating the original statements and then verifying them with a back translation. Participants were asked to rate each statement on their profundity on a 5-point Likert scale ( $1 =$  Not at all profound;  $5 =$  Very profound). Individual scores for bullshit, profound and mundane statements were computed (For the Italian translation see **Appendix 1**).

## Overclaiming

Overclaiming is considered the tendency for people to “self-enhance” when asked about their familiarity with general knowledge questions (Pennycook and Rand, 2017). A shortened version of the Paulhus et al. (2003) overclaiming questionnaire was included in the survey. We administered a list of 13 different items with which participants had to rate their familiarity on a 7-point Likert scale ( $1 =$  Never heard of it;  $7 =$  Very familiar). While 11 items indicated factual physical sciences topics, historical events, or historical figures, 2 foils were designed to detect if participants lied about their knowledge or overclaimed. The items of the original scale were translated into Italian. To avoid participants researching the items on the Internet, the 13 questions were timed 60 s. A general knowledge score, consisting of the number of real items that received a score  $\geq 4$  (i.e., hits) and an overclaiming score, consisting of the number of foils which received a score  $\geq 4$  (i.e., false alarms), were computed. Finally, an accuracy score was calculated by subtracting the number of false alarms from the number of hits (Paulhus et al., 2003). A higher accuracy score indicates a lower tendency to overclaim.



## Problem-Solving

The problem-solving measures the performance of two cognitive tasks: a rebus puzzle-solving task (MacGregor and Cunningham, 2008; Salvi et al., 2015b) and four problems from the CRT (Frederick, 2005; Thomson and Oppenheimer, 2016).

### Rebus Puzzles

Participants were administered 20 rebus puzzles taken from MacGregor and Cunningham (2008) and Salvi et al. (2015b). To solve each rebus puzzle, subjects had to merge verbal and visual clues to make a common phrase, such as: “Cycle, Cycle, Cycle”; solution: “Tricycle.” These problems are solved through either insight or a step-by-step process. Subjects were asked to produce a text string response for each rebus and to self-report the problem-solving method they used to solve each rebus. The results on insight problem-solving during the COVID-19 pandemic will be reported separately from the present report.

### CRT

Participants were administered four Cognitive Reflection Test problems (CRT; Frederick, 2005). CRTs are deceiving problems that are designed to elicit an immediate, yet incorrect, response. After further consideration, the correct solution becomes more apparent. The four problems were taken from Frederick (2005) and Thomson and Oppenheimer (2016), and more precisely the “bat and ball,” “machines,” “lily pads,” and “Emily’s” problem were selected. The Italian version of the problems was taken from Baldi

et al. (2013). Each participant’s percentage of correctly answered CRT items was calculated.

## Socio-Cognitive Polarization (SCP)

The SCP factor included measures of absolutism (Lauriola et al., 2016), xenophobia (van der Veer et al., 2013), and conservatism (Robinson et al., 1999; Salvi et al., 2016b).

### Absolutism

The Multidimensional Attitude Toward Ambiguity Scale (MAAS; Lauriola et al., 2016), which measures individual differences in tolerance vs. intolerance of perceived ambiguous stimuli, was administered to the participants. The 30-item version of the scale, which had both an Italian and American adaptation (Lauriola et al., 2016), was used. Responses were provided on a 7-point Likert scale (1 = Strongly disagree; 7 = Strongly agree). The Moral Absolutism/Splitting subscale, a measure of rigid and stereotyped “black-and-white” thinking (e.g., “There’s a right way and a wrong way to do almost everything”), was of primary interest in the present investigation.

### Xenophobia

Hostility and fear toward immigrants were assessed using the 14-item Xenophobia Scale created by van der Veer et al. (2013). Participants indicated their level of agreement with statements such as “Interacting with immigrants makes me uneasy” on a 7-point Likert scale (1 = Strongly disagree; 7 = Strongly agree). The

items of the scale were translated in Italian and then verified by a back-translation.

### Conservatism

Political ideology was measured by two 7-point Likert scales (Robinson et al., 1999; Salvi et al., 2016b). Participants were asked to indicate their level of agreement with the following statements: “I endorse many aspects of conservative political ideology” and “I endorse many aspects of liberal political ideology.” The conservatism score was calculated by subtracting the score for liberalism from the score for conservatism.

## STATISTICAL ANALYSES

### Overview

Our primary analyses investigate the relationship across our COVID-19-related factors (fear of COVID, COVID-19 information proactivity, city case count at the time of taking the survey), demographic factors (age, sex, education), cognitive factors (BRS, overclaiming accuracy, and problem-solving), and fake news factors (discernment, familiarity, and sharing). Secondary analyses probe the relation between problem-solving and SCP on fake news discernment in the context of the COVID-19 pandemic. Because we had reason to suspect our samples represented different populations (i.e., large differences in the level of education and in the type of news sources where they sought information about COVID-19; see **Supplementary Table 1**), separate correlations and regressions were performed for each sample.

### COVID-19 and Socio-Cognitive Analyses

To test our series of hypotheses relating fear of COVID-19 to fake news discernment, sharing, proactive behaviors, BRS, and overclaiming, we initially performed correlations across COVID-19 factors (fear, proactivity, and city case count), fake news factors (discernment, familiarity, and sharing), and BRS and overclaiming factors. We tested our hypotheses that fear of COVID-19 would predict worse performance on problem-solving tasks by conducting a univariate regression between COVID-19 fear and problem-solving (with age, sex, and education as covariates) in each sample. The effect of type of news on discernment was analyzed through planned pairwise *t*-tests in each sample.

### Fake News Discernment Regressions

To test our hypotheses that fear of COVID-19, problem-solving, and SCP would uniquely predict fake news discernment in each sample, we broadened our analyses with a series of planned univariate and multivariate regressions. Our reasoning for implementing multivariate regressions is to capture the strongest and most unique predictors of fake news discernment among the variables of interest by taking into account covariance and collinearity across all factors. We first performed bivariate correlations between each predictor and type of news discernment before fitting linear regressions using the generalized linear model `glm()` function in R3.6.3 (R Development Core Team., 2008) to determine how well

each factor predicts fake news discernment. Our rationale for presenting correlations and univariate results is to illustrate the strength of each predictor when other factors are not taken into account. This was followed by a multiple stepwise regression in which fake and neutral discernment were separately regressed onto all COVID-19-related and cognitive factors, again using the `glm()` function with forward and backward selection in R3.6.3 (R Development Core Team., 2008). All regressions included sex, age, and education as covariates.

Given the widely recognized limitations of stepwise regression (Whittingham et al., 2006), we sought to isolate the most unique predictors of fake news discernment by fitting a cross-validated LASSO, or penalized regression, using the `cv.glmnet()` function (Friedman et al., 2010) in R3.6.3 (R Development Core Team., 2008). This method works by adding a L1-penalization term to the regression equation (Tibshirani, 1996), where larger  $\lambda$ -values correspond to the shrinking of more regression coefficients to zero. LASSO regression penalizes collinear coefficients and retains variables that most uniquely predict the outcome variable, thereby avoiding overfitting and multicollinearity [for a broader overview, see Gillespie et al. (2018), Yankov et al. (2019)]. We bootstrapped the `cv.glmnet()` function 1,000 times and extracted the  $\lambda$  with the smallest error deviance between predicted and actual observations. We applied each unique  $\lambda$  to final penalized regressions to identify the subset of factors most strongly predictive of fake news discernment. We executed this procedure four times, once for each unique fake news discernment variable (news type  $\times$  country).

## RESULTS

In support of our hypothesis that COVID-19 fear would predict likelihood to share news, we found that COVID-19 fear positively correlates with willingness to share both COVID-19 [ $r = 0.15$ , 95% CI = (-0.05, 0.35),  $p = 0.01$ ] and neutral [ $r = 0.17$ , 95% CI = (0.07, 0.45),  $p = 0.01$ ] news in the American sample (see **Table 1**). Importantly, the positive correlation indicates that COVID-19 fear relates specifically to willingness to share real news above and beyond fake news, contrary to our hypothesis that fear would make people more likely to share fake news. Additionally, in support of our hypothesis that proactivity (i.e., seeking information and taking safety measures) would relate to better discernment of fake news, we find that proactivity positively correlates with fake news discernment for COVID-19 [ $r = 0.15$ , 95% CI = (-0.05, 0.34),  $p < 0.05$ ] and neutral [ $r = 0.15$ , 95% CI = (-0.06, 0.34),  $p < 0.05$ ] news, as well as fear of COVID-19 [ $r = 0.31$ , 95% CI = (0.16, 0.42),  $p < 0.01$ ] in the American sample. As predicted, BRS negatively correlates with both fake news discernment for COVID-19 [ $r = -0.13$ , 95% CI = (-0.32, 0.07),  $p < 0.05$ ] and neutral [ $r = -0.14$ , 95% CI = (-0.34, 0.06),  $p < 0.05$ ] news, as well as positively correlates with COVID-19 fear [ $r = 0.16$ , 95% CI = (-0.04, 0.36),  $p < 0.05$ ] in the American sample. This finding is in support of our hypothesis that those who score higher on BRS would in turn be less likely to detect fake news and that fear would be positively related to bullshit receptivity. BRS negatively correlates with overclaiming accuracy



$[r = -0.18, 95\% \text{ CI} = (-0.37, 0.02), p < 0.05]$  in the American sample, suggesting those who are more likely to appraise pseudo-profound beliefs as profound are also more likely to overclaim the accuracy of unreliable information. Finally, overclaiming accuracy positively correlates with fake news discernment for COVID-19  $[r = 0.20, 95\% \text{ CI} = (0.0, 0.39), p < 0.05]$  in the American sample, suggesting a relationship between two variables that rely on scrutinizing potentially false information.

In the Italian sample, proactivity positively correlates with fake news discernment  $[r = 0.18, 95\% \text{ CI} = (-0.03, 0.36), p < 0.01]$  and sharing  $[r = 0.18, 95\% \text{ CI} = (0.07, 0.44), p < 0.01]$  of COVID-19 news. Interestingly, COVID-19 fear positively correlates with proactivity in both the American sample  $[r = 0.31, 95\% \text{ CI} = (0.19, 0.41), p < 0.001]$  and the Italian sample  $[r = 0.36, 95\% \text{ CI} = (0.18, 0.52), p < 0.001]$ , highlighting a potentially beneficial role of COVID-19 fear on COVID-19-related information seeking. Similarly to the American sample, BRS positively correlates with COVID-19 fear  $[r = 0.17, 95\% \text{ CI} = (-0.03, 0.36), p < 0.05]$  in the Italian sample, supporting our hypothesis that fear would be positively related to receptivity of pseudo-profound statements. In the Italian sample BRS also correlates with proactivity  $[r = 0.17, 95\% \text{ CI} = (-0.07, 0.33), p < 0.05]$ . From our results fear and fake news discernment did not significantly correlate in either sample. Contrary to our hypothesis that COVID-19 fear would be related to worse fake news discernment, there was no significant correlation in either sample between COVID-19 fear and fake news discernment variables. Notably, participants were more likely to discern COVID-19 fake news than neutral fake news in both samples (USA:  $t_{(269)} = 10.524, p = 0.001$ ; Italy:  $t_{(299)} = 18.554, p < 0.001$ ), suggesting a greater awareness of COVID-19 vs. neutral content during the pandemic.

### COVID-19 and Problem-Solving

In support of our hypothesis COVID-19 fear negatively predicted performance on problem-solving tasks in both the American  $[\beta = -0.20, 95\% \text{ CI} = (-0.3, -0.1), p < 0.01]$  and Italian  $[\beta = -0.24, 95\% \text{ CI} = (-0.33, -0.14), p < 0.001]$  samples, while other predictors (age, education, number of cases) were insignificant (see **Figure 3**).

### Fake News Discernment Regressions

In the American sample, COVID-19 fake news discernment significantly correlated with all the cognitive factors in the hypothesized directions (**Table 2**). In both the univariate and multiple stepwise regressions, the most unique cognitive predictors of COVID-19 discernment were SCP  $[\beta = -0.22, 95\% \text{ CI} = (-0.3, -0.1), p < 0.001]$  and overclaiming  $[\beta = 0.16, 95\% \text{ CI} = (0.06, 0.26), p = 0.01]$  and the most unique COVID-19 predictor was proactivity  $[\beta = 0.13, 95\% \text{ CI} = (0.03, 0.23), p < 0.01]$ . The LASSO identified SCP as the most unique (negative) predictor of COVID-19 discernment. In both univariate and multiple stepwise regressions, the most unique cognitive predictors of neutral discernment were SCP  $[\beta = -0.13, 95\% \text{ CI} = (-0.22, 0.02), p < 0.05]$  and problem-solving accuracy  $[\beta = 0.24, 95\% \text{ CI} = (0.14, 0.35), p < 0.001]$ , the most unique COVID-19 predictor was proactivity  $[\beta = 0.14, 95\% \text{ CI}$

$= (0.05, 0.26), p < 0.05]$ , and the most unique demographic predictor was age  $[\beta = 0.18, 95\% \text{ CI} = (0.08, 0.28), p < 0.01]$ . The LASSO identified problem-solving as the most unique (positive) predictor of neutral discernment. In support of our hypotheses, these results suggest that while BRS and overclaiming accuracy are both related to how likely participants were to detect fake news, SCP and problem-solving ability are the strongest predictors of participants' ability to detect fake news. Specifically, SCP predicts believing in fake news headlines, whereas problem-solving predicts fake news detection in the American sample.

In the Italian sample, the factors that predict COVID-19 discernment were proactivity  $[\beta = 0.19, 95\% \text{ CI} = (0.1, 0.29), p < 0.01]$  and age  $[\beta = 0.14, 95\% \text{ CI} = (0.04, 0.23), p < 0.05]$ , with the LASSO identifying proactivity as the most unique (positive) predictor (see **Table 3**). The sole factor that predicted neutral discernment is SCP  $[\beta = -0.21, 95\% \text{ CI} = (-0.31, -0.11), p < 0.001]$ , which the LASSO identified as the most unique (negative) predictor. These results suggest that, similarly to the American sample, SCP predicts believing in fake news headlines (specifically neutral fake news) in the Italian sample.

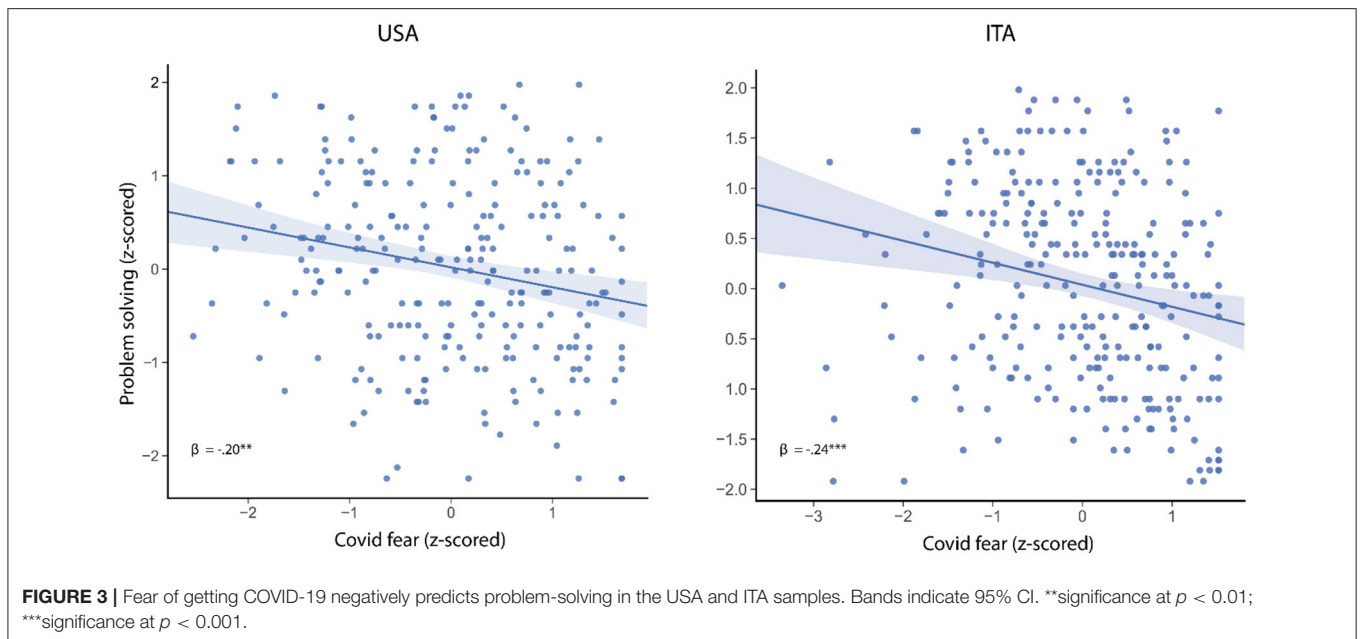
## DISCUSSION

The COVID-19 pandemic provided a natural context to study the critical impact of fear on how people seek, believe, and share information. Several aspects of human interaction with the media exacerbated fear during the COVID-19 pandemic. When the infection started to spread in Europe, especially in Italy, media reports adopted sensationalistic titles that tend to attract the most attention [e.g., on February 26, 2020 CNN titles "CDC official warns Americans it's not a question of if coronavirus will spread, but when" (McLaughlin and Almsay, 2020); or "Like a wartime curfew: Inside Italy's coronavirus quarantine zone," *The Telegraph*, on February 24 (Oliphant et al., 2020); "There is no truce," *La Repubblica*, on March 13, 2020 (Bocci et al., 2020)]. Even if little was known about the virus, such titles may have contributed to a state of alertness that drove people's behavior. The circulation of fake news and misleading information accelerated right after the beginning of the coronavirus outbreak (Chakravorti et al., 2020; Cinelli et al., 2020; Taylor, 2020). This spread of false narratives (e.g., implausible cures; Sommer, 2020), conspiracy theories (Ellis, 2020), and hate (Ferrara, 2020) favored attitudes and behaviors that undermine the governments' efforts to implement prevention measures (Abd-Alrazaq et al., 2020). The rapid and massive spread of misinformation has grown to such an extent that it has been referred to it as an "infodemic" ("We're not just fighting an epidemic; we're fighting an infodemic" - World Health Organization., 2020), underlining the serious consequences of misinformation during the management of the viral outbreak. Information reliability becomes crucial when events that threaten many human lives take place (such as a pandemic or a natural catastrophe) since they impact the effectiveness of adopted safety measures (Zarocostas, 2020). The case of the COVID-19 pandemic is a clear example of such an event. Our theoretical background frames the belief in and sharing of fake news in the

**TABLE 1** | Absolute correlation coefficients (Pearson's  $r$ ) for fake news and covid factors for the USA (lower diagonal) and ITA (upper diagonal) samples.

	1	2	3	4	5	6	7	8	9	10	11
1. discernment COVID-19	–	–0.04	<b>0.23</b>	0.04	<b>0.26</b>	0.06	0.08	<b>0.18</b>	0.05	–0.02	0.05
2. discernment neutral	<b>0.29</b>	–	–0.01	<b>0.34</b>	–0.08	0.09	–0.12	–0.01	0.02	–0.03	0.07
3. familiar covid	<b>0.37</b>	<b>0.13</b>	–	0.02	0.02	0.07	–0.03	0.03	0.03	0.06	–0.02
4. familiar neutral	0.06	<b>0.4</b>	0.03	–	–0.03	<b>0.26</b>	–0.02	–0.04	–0.02	–0.04	0.03
5. share covid	<b>0.15</b>	<b>0.13</b>	<b>0.24</b>	0.06	–	0.02	0.08	<b>0.18</b>	0.04	0.03	0.01
6. share neutral	0.06	<b>0.14</b>	0.04	0.05	<b>0.27</b>	–	–0.01	0.01	–0.01	–0.07	–0.05
7. covid fear	0.09	0.04	0.07	0.06	<b>0.15</b>	<b>0.17</b>	–	<b>0.36</b>	0.04	<b>0.17</b>	0.02
8. proactivity	<b>0.15</b>	<b>0.15</b>	<b>0.16</b>	0.05	0.05	–0.02	<b>0.31</b>	–	0.07	<b>0.13</b>	0.09
9. cases	–0.09	–0.11	0.02	–0.06	–0.04	–0.05	0.06	0.01	–	0.15	0.03
10. BRS	<b>–0.13</b>	<b>–0.14</b>	–0.01	–0.09	0.03	0.02	<b>0.16</b>	0.03	0.1	–	0.08
11. overclaiming	<b>0.2</b>	0.12	0.09	0.11	–0.01	0.07	–0.03	0	0	<b>–0.18</b>	–

Bonferroni corrected for multiple correlations. Significant correlations are in bold. Significant correlations are in bold.  $r > |0.23|$  are statistically significant at  $p < 0.001$ ,  $r > |0.18|$  are statistically significant at  $p < 0.01$ ,  $r > |0.13|$  are statistically significant at  $p < 0.05$ .



context of individuals' need to resolve uncertainty during a time of heightened anxiety where people may be more vulnerable to fake news. This need has been exacerbated in a global pandemic, where scientific consensus and certainty was particularly elusive in the early days of the outbreak. During events like pandemics, fear-driven and instinctive behaviors activate promptly and people may develop more sensitivity to negative and overall novel information to help resolve uncertainty. This natural inclination toward information seeking may become problematic when sources of information contain misleading or outright false news stories.

Within this context, we investigated emotional, social, and cognitive factors that may influence fake news discernment and sharing, specifically the roles of COVID-19-related fear, seeking out information, BRS, overclaiming accuracy, problem-solving accuracy, and socio-cognitive polarization.

Our results showed that fear of COVID-19 is associated with proactive behaviors oriented toward seeking out information about the disease, taking actions to reduce the chances of being infected, and sharing real above and beyond fake news (despite the news sources consulted to gather information about the pandemic). As suggested by the literature, fear alters decision-making processes, and pushes people toward seeking information (Allen et al., 2014; Lin et al., 2014). We believe that the circumstantial lack of knowledge at the beginning of the COVID-19 pandemic did not just push people to seek information, but may have also increased their willingness to share this information over social media. We speculate that people share information because they believe that specific information would be interesting or useful to others. Thus, we conclude that people who took the risk of infection and severity of COVID-19 more seriously felt the urgency to seek out information related to

**TABLE 2** | Correlation, standardized univariate regression, multiple stepwise, and Least Absolute Shrinkage and Selection Operator (LASSO) coefficients for the American sample.

	USA Covid-19 news discernment				USA neutral news discernment			
	Univariate		Multiple regs		Univariate		Multiple regs	
Coefficient	<i>r</i>	$\beta$	$\beta$	LASSO	<i>r</i>	$\beta$	$\beta$	LASSO
<b>Demographics</b>								
Age	0.08				0.12		<b>0.18</b>	
Sex	0.10				-0.02			
Education	0.03				0.00			
<b>COVID-19 factors</b>								
Fear	-0.06	0.00			-0.05	-0.05	-	
Proactivity	<b>0.13</b>	<b>0.13</b>	<b>0.13</b>	-	<b>0.15</b>	<b>0.16</b>	<b>0.14</b>	-
Cases (city)	-0.08	-0.09			-0.11	-0.11		
<b>Cognitive factors</b>								
BRS	<b>-0.15</b>	<b>-0.15</b>	-	-	<b>-0.15</b>	<b>-0.17</b>	-	-
Overclaiming	<b>0.21</b>	<b>0.21</b>	<b>0.16</b>	-	<b>0.12</b>	0.08	-	-
Problem-solving	<b>0.18</b>	<b>0.18</b>	-	-	<b>0.21</b>	<b>0.27</b>	<b>0.24</b>	<b>0.065</b>
SCP	<b>-0.26</b>	<b>-0.26</b>	<b>-0.22</b>	<b>-2.6e-06</b>	<b>-0.16</b>	<b>-0.20</b>	<b>-0.13</b>	-

Predictors in the multiple stepwise linear regression are based on the best fitting solution with forward and backward selection. Significant coefficients are in bold.  $r > |0.23|$  are statistically significant at  $p < 0.001$ ,  $r > |0.18|$  are statistically significant at  $p < 0.01$ ,  $r > |0.12|$  are statistically significant at  $p < 0.05$ .  $\beta > |0.22|$  are statistically significant at  $p < 0.001$ ,  $\beta > |0.13|$  are statistically significant at  $p < 0.01$ , and  $\beta > |0.12|$  are statistically significant at  $p < 0.05$ . All coefficients are standardized.  $\lambda_{\text{covid}} = 0.26$ ;  $\lambda_{\text{neutral}} = 0.16$ .

**TABLE 3** | Correlation, univariate regression, multiple stepwise regression, and Least Absolute Shrinkage and Selection Operator (LASSO) coefficients for the Italian sample.

	ITA Covid-19 news discernment				ITA neutral news discernment			
	Univariate		Multiple reg		Univariate		Multiple regs	
Coefficient	<i>r</i>	$\beta$	$\beta$	LASSO	<i>r</i>	$\beta$	$\beta$	LASSO
<b>Demographics</b>								
Age	<b>0.15</b>		<b>0.14</b>		0.00			
Sex	0.01				-0.06		-0.03	
Education	0.00				0.09		0.014	
<b>COVID-19 factors</b>								
Fear	0.11	0.09		-	-0.11	-0.08	-	-
Proactivity	<b>0.2</b>	<b>0.19</b>	<b>0.19</b>	<b>1.8e-6</b>	0.00	0.01	-	-
Cases (city)	0.05	0.01			0.03	0.03		
<b>Cognitive factors</b>								
BRS	0.01	0.00	-	-	-0.02	-0.01	-	-
Overclaiming	0.04	0.02	-	-	0.07	0.07	-	-
Problem-solving	0.00	0.02	-	-	0.1	0.08	-	-
SCP	0.02	0.02	-	-	<b>-0.21</b>	<b>-0.20</b>	<b>-0.21</b>	<b>-3e-5</b>

Predictors in the multiple stepwise linear regression are based on the best fitting solution with forward and backward selection. Significant coefficients are in bold.  $r > |0.21|$  are statistically significant at  $p < 0.001$ ,  $r > |0.20|$  are statistically significant at  $p < 0.01$ ,  $r > |0.14|$  are statistically significant at  $p < 0.05$ .  $\beta > |0.21|$  are statistically significant at  $p < 0.001$ ,  $\beta > |0.19|$  are statistically significant at  $p < 0.01$ , and  $\beta > |0.14|$  are statistically significant at  $p < 0.05$ . All coefficients are standardized.  $\lambda_{\text{covid}} = 0.20$ ;  $\lambda_{\text{neutral}} = 0.21$ .

COVID-19 and share real news above and beyond fake news, hoping that circulating information may be helpful to others. This might illustrate a protective benefit to those who appraise the gravity of the pandemic by leading individuals to search for reliable sources of information. This result is in line with intuitive model of prosociality, which suggests that prosocial and helping behaviors often arises from intuitive, yet impulsive system 1 preferences (Shi et al., 2020). However, our results

also reveal that fear of COVID-19 positively correlates with believing in pseudo-profound bullshit and negatively predicts problem-solving ability, which may illustrate adverse effects of fear induced by the distressing context of a pandemic. Although we cannot speculate a causal relationship between the two in our results the link between fear and believing in pseudo-profound statements may suggest that sensitivity to fear is paralleled with believing in meaningless claims, which extends to forms of

misinformation outside of the context of our fake news sample. Contrary to our prediction, the relation between fear and BRS seemed to be unique and independent from variables that have been hypothesized to be related to fear such as fake news discernment and overclaiming.

While we know that people acquire information to reduce fear and anxiety, our study provides evidence that fear leads also to sharing information and overestimating pseudo-profound statements. The relationship between fear, sharing, and bullshit receptivity may be explained by a desire to control the destabilizing lack of meaningful information. This effect might reflect the attitude toward creating spiritual meanings to explain, predict, and have an impression of control during unpredictable catastrophic events. The downside of these circumstances is that such a state reduces analytical thinking and our ability to solve problems. This result is in line with previous studies showing that stress, high risk-taking and anxiety of running out of time deteriorate creativity and problem-solving performance (Salvi et al., 2016a; Shen et al., 2018; Salvi and Bowden, 2019; Duan et al., 2020). Our results showed that problem-solving accuracy (as measured by both CRT and Rebus puzzles) correlates positively with a discerning fake from real news, indicating that an individual's willingness to engage in analytic and reflective thinking is associated with a reduced belief in fake news. In line with other studies, we found that individuals who perform better on the CRT (Bronstein et al., 2019; Pennycook and Rand, 2019), and visual-semantic puzzles (Sindermann et al., 2020) are better able to discern fake from real news. Tackling complicated problems requires continuous reframing and changing the initial representation of a problem to see it under a new light. We speculate that such mental exercise impacts other information processing skills. Thus, the relationship between being a good problem solver and detecting fake news may be explained by the willingness to invest time and effort in going beyond the default information. Problem-solving capacity may engender a greater tendency to question the information in news by investigating its accuracy further.

Our results replicate Pennycook and Rand (2020) findings that overclaiming accuracy and bullshit receptivity positively and negatively predict fake news discernment, respectively—but only in the American sample. This replication underscores a potential underlying feature of analytic thinking across our primary predictors (problem-solving and SCP) and supports our interpretation that those who are more willing to question default narratives, critically appraise a problem, and seek for new information are better suited to discern fake from real news. Finally, while problem-solving positively predicted fake news in the American sample, problem-solving was not a unique predictor of either neutral or COVID-19-related fake news in the Italian sample. Moreover, COVID-19-related fear only correlated with sharing real above and beyond fake news in the American sample. We have reason to believe our two samples represented populations with wide differences in their level of education (with the American sample scoring higher), which may explain the null relationship between problem-solving and fake news discernment in the Italian sample. Interestingly, the Italian sample scored much higher than the American sample

on fear of COVID-19 (see **Supplementary Table 1**), which may have resulted in a ceiling effect, therefore preventing the detection of a relationship between fear and fake news variables in the Italian sample.

Our data indicate that higher levels of SCP (absolutism, conservatism, xenophobia) are associated with reduced fake news discernment. Absolutism refers to an individual's preference for rigid dichotomizations into fixed categories, which results in black-and-white thinking. People who score high in absolutism tend to have a polarized way of thinking by splitting representations of reality into opposite concepts that cannot coexist as distinct features of the same object (i.e., good-bad/right-wrong with no middle ground) (Frenkel-Brunswick, 1951; Budner, 1962; Lauriola et al., 2016). Verifying the news' reliability requires the willingness to go beyond a readily available piece of information, the motivation to search for alternative views on the same issue, and the conviction that beliefs should change according to evidence (Bronstein et al., 2019). Thus, when there are incongruencies within the news they are reading, it behooves individuals to seek more information in external resources for assessment (Edgerly et al., 2020). Following this logic, people who are high on absolutism tend to stick to a single view (Lewandowsky et al., 2012), maintain pre-existing established beliefs when presented with new information (Kruglanski et al., 1993), and are less likely search for alternative information (Ford and Kruglanski, 1995), which is likely to hinder the detection of fake news. Previous research suggests that intolerance for ambiguity is positively related to conservatism (Jost et al., 2003; Jost, 2017). Conservative ideology tends to correlate with preferences toward certainty, simplicity, and closure, and avoidance of uncertainty, novelty, and complexity. Other studies also suggest that conservatives may engage in heuristic/automatic thinking more often than liberals (Jost, 2017), and conservatism is positively related to lower mental effort (Eidelman et al., 2012; Van Berkel et al., 2015). Our results indicate that people who subscribe to conservative viewpoints were more likely to believe fake news, which replicates prior research suggesting that belief in incorrect information is prevalent among conservatives (Kull et al., 2003; Travis, 2010).

Xenophobia is also associated with the tendency to believe in fake news. To the best of our knowledge, there are no studies that demonstrate a relationship between xenophobic attitudes and fake news discernment. However, dogmatism, ethnocentrism, and intolerance for ambiguity are positively correlated [see Furnham and Marks (2013)]. Thus, it is plausible to assume that people reporting a high level of xenophobia are those who tend to be more dogmatic, rigid, and who are less open to considering alternative views, and thus are worse at fake news discernment (Bronstein et al., 2019).

We can conclude that the construct we named socio-cognitive polarization, which reflects cognitive rigidity, neglecting alternative information, and black-and-white thinking negatively predicts the ability to discern fake from real news. Such a construct extends also to reasoning processes, such as problem-solving, where thinking outside the box and consider alternative information is fundamental.

## LIMITS OF THE STUDY

A major strength of this study is that data were collected during the critical early stages of the COVID-19 outbreak in two countries with the highest reported cases and deaths from the disease. However, the samples might not fully representative of the demographics of Italian and US populations. Nevertheless, it is worth noting that the two subsamples were well-balanced in terms of gender and age. The differences between the two subsamples are limited to education level, which, in any case, turned out to be a non-significant predictor of fake news discernment and information sharing, and to the type of news sources most frequently consulted to gather information about COVID-19. On the one hand, it can be argued that different media platforms would vary in terms of effort and actions directed to warn the readers about the potential threat of misinformation. On the other hand, even though Italian participants trusted TV news, whereas American participants preferred social media, predictions about fake news discernment were similar between samples, suggesting different media's responses to the threat of fake news during the pandemic was not a confounding variable in our study. Another limitation is that by administering the study online, we necessarily lose tight experimental control, which can introduce potentially confounding variables (e.g., impossible to know if each subject is fully attending to the experiment while in their home environment). Such caveats are of course true for online studies in general, and not unique to the present study. Another important issue is the current socio-cultural environment independent of the pandemic that could affect people's behavior, such as the impending 2020 US political election. Finally, as every subject is living through the same global pandemic, we do not have a putatively "pandemic free" sample to compare our results. Furthermore, in the present study, we did not measure trait and state levels of non-specific fear, and therefore our analyses regarding fear and fake news discernment, sharing, and problem-solving are limited to COVID-19 specific appraisals. To better understand how fear (or lack thereof) influences peoples' capacity to discriminate fake and real news stories, further research should also compare individuals with high vs. low levels of state or trait fear.

## DATA AVAILABILITY STATEMENT

All data and analysis code are available on our OSF project page (<https://osf.io/4pd2u/>).

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## ETHICS STATEMENT

The studies involving human participants were reviewed and approved by IRB at The University of Texas at Austin. The patients/participants provided their written informed consent to participate in this study.

## AUTHOR CONTRIBUTIONS

This study is the result of 2.5 months of uninterrupted work of all the researchers involved, while they were quarantined for COVID-19. All the researchers contributed with continuous daily work to finish the study in time and publish the results as soon as possible. This work was possible thanks to the collaborative effort of everyone who was involved in the project and understood the importance of supporting science during the pandemic. CS contributed in work coordination, conceptualization, methodology, and writing. PI contributed in conceptualization, methodology, and writing. AC contributed in conceptualization, methodology, data curation, and writing. MM contributed in conceptualization, methodology, data analysis, data interpretation, and writing. SR contributed with creating and translating the questionnaires, data cleaning, formatting, and bibliography. JD and AA contributed in supervision, writing, reviewing, and final editing.

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## SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fcomm.2020.562588/full#supplementary-material>

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

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