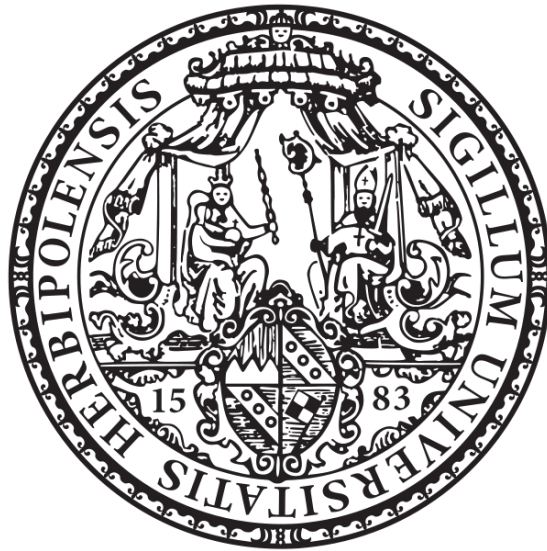


Post-Truth Epistemic Beliefs
Rooted in the Dark Factor of Personality
Predict Irrational Cognition and Behavior

Inaugural-Dissertation
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*[...] it is a deceptively simple step, down a slippery slope,
from the belief that everyone has a right to their opinion
to the belief that all opinions are equally right.*

Deanna Kuhn

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Abstract

Conspiracy theories and fake news are receiving wide media coverage and their proliferation has motivated academic research on the driving factors irrational cognition and behavior. This dissertation focuses on individuals' beliefs about knowledge and knowing, which are commonly referred to as *epistemic beliefs*. The term *post-truth epistemic beliefs* is proposed and defined as a strong trust in one's intuition, a low need to align opinions with evidence, and the strong conviction that truth is a matter of power. Across six online studies, a mediation model is proposed and tested. It includes the core of all dark traits, the *Dark Factor of Personality* (D), as an antecedent of post-truth epistemic beliefs, and irrational cognition and behavior as consequences. Manuscript #1 comprises four studies showing that post-truth epistemic beliefs are rooted in D and predict increased endorsement of COVID-19 conspiracy theories as well as less engagement in health-protective behavior against COVID-19.

Manuscript #2 includes a US nationally representative study suggesting that post-truth epistemic beliefs and D predict a lower probability of having been vaccinated against COVID-19.

Manuscript #3 presents a repeated measures experiment indicating that the nexus of D and post-truth epistemic beliefs also predicts less discernment between fake and accurate news. These findings highlight a major insight and a serious challenge for rational communication: Some individuals deliberately disregard (scientific) evidence and rational decision-making. Against this background, the need to foster the epistemological development of students and educators is emphasized.

Zusammenfassung

Verschwörungstheorien und Fake News werden in den Medien lebhaft diskutiert und haben zu einem verstärkten Interesse wissenschaftlicher Forschung an den Risikofaktoren für irrationale Überzeugungen und irrationales Verhalten beigetragen. Die vorliegende Dissertation konzentriert sich in diesem Zusammenhang auf individuelle Überzeugungen darüber, was Wissen ist und wie es entsteht, welche als *epistemische Überzeugungen* bezeichnet werden. In dieser Arbeit wird der Begriff der *postfaktischen epistemischen Überzeugungen* verwendet – für ein starkes Vertrauen in die eigene Intuition, ein geringes Bedürfnis, Meinungen mit Beweisen abzugleichen und die Überzeugung, dass Wahrheit eine Frage von Macht ist. Ein Mediationsmodell wird über sechs Online-Studien hinweg vorgeschlagen und getestet. Es enthält den Kern aller dunklen Persönlichkeitsmerkmale, den *Dunklen Faktor der Persönlichkeit (D)*, als Prädiktor von postfaktischen epistemischen Überzeugungen und irrationale Überzeugungen und irrationales Verhalten als deren Folgen. Manuskript 1 umfasst vier Studien, die zeigen, dass postfaktische epistemische Überzeugungen mit D verbunden sind und eine verstärkte Befürwortung von COVID-19-Verschwörungstheorien sowie ein verringertes Schutzverhalten bezüglich COVID-19 vorhersagen. Manuskript 2 enthält eine für die USA repräsentative Studie, die zeigt, dass postfaktische epistemische Überzeugungen und D vorhersagen, dass mit geringerer Wahrscheinlichkeit eine COVID-19-Schutzimpfung in Anspruch genommen wurde. Manuskript 3 enthält ein Experiment mit Messwiederholung, das zeigt, dass der Nexus aus D und postfaktischen epistemischen Überzeugungen vorhersagt, dass Menschen weniger zwischen falschen und wahren Nachrichten unterscheiden. Diese Ergebnisse liefern eine wichtige Erkenntnis, die eine ernsthafte Herausforderung für rationale Kommunikation aufzeigt: Einige Menschen lehnen bewusst (wissenschaftliche) Beweise und rationale Entscheidungen ab. Vor diesem Hintergrund wird die Notwendigkeit verdeutlicht, die epistemologische Entwicklung von Lernenden und Lehrenden verstärkt zu fördern.

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1. Introduction

Individuals gain a large part of their knowledge about the world through the media (Bandura, 2001; Früh, 1994; Sanborn & Harris, 2019). In times of social media and rapidly developing powerful technologies it is easier than ever before to produce and share media content. Journalistic standards that are typically imposed by editorial teams no longer have to be adhered to (Lazer et al., 2018) and publishing houses and television stations have lost their dominance as gatekeepers as they are no longer needed for the mass dissemination of information. Fake news and conspiracy theories are being vividly discussed in the media and have fueled academic research. They have been referred to as *post-truth* phenomena as they contain factually inaccurate or misleading claims, obfuscate facts, or do not oblige to evidential standards in their reasoning (Compton et al., 2021; Lewandowsky et al., 2017; McIntyre, 2018). Both fake news and conspiracy theories undermine a rational decision-making process and can lead to serious consequences such as the storm on the Capitol in 2021 (Cheney et al., 2022) or the attacks on government buildings in Brasília two years later (Camarotto, 2022). They are also an essential part of Russian propaganda, especially during the ongoing war against Ukraine (Melkozerova, 2023). Further, in the context of the COVID-19 pandemic, endorsing conspiracy theories and fake news has been linked to refusal to get vaccinated against the virus with stagnating vaccination rates at the expense of human lives (Pierri et al., 2022; Sallam et al., 2021). Ultimately, fake news and conspiracy theories are a threat to democracy because they undermine trust in democratic institutions (Bennett & Livingston, 2018; Chambers, 2021).

The development of effective countermeasures requires knowledge as to which individuals are particularly vulnerable for fake news, conspiratorial ideas and prone to engage in irrational behavior that is not based on evidence. Surprisingly, personal beliefs about what constitutes knowledge and how it is generated have received little attention in empirical psychological research in this context. Thus, the central aim of my dissertation project is to investigate the antecedents and consequences of individual differences with regard to ideas about

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the nature and generation of knowledge. More specifically, the studies described in the following empirically test whether these so-called *epistemic* or *epistemological beliefs* predict increased vulnerability for fake news and COVID-19-related conspiracy theories as well as less health-protective behavior against the virus, including COVID-19 vaccination refusal. In total, six online studies were conducted that are embedded in three manuscripts, which have been published or accepted for publication in peer-reviewed journals. All manuscripts are included in this dissertation and remain unchanged. **Manuscript #1** has been published in the *Journal of Personality* and investigated the link between epistemic beliefs and endorsing COVID-19 conspiracy theories as well as neglecting protective behavior against the virus. Manuscript #1 comprises a total of four studies that have been conducted in the USA and Germany over the course of the pandemic. **Manuscript #2** has been accepted for publication in *Scientific Reports* and investigated whether epistemic beliefs predicted the probability of having been vaccinated against COVID-19. **Manuscript #3** has been published in the *Journal of Applied Research in Memory and Cognition*. It contains a repeated measures experiment, which was conducted to test whether epistemic beliefs predict distinguishing correctly between factually accurate and inaccurate news. Additionally, all studies include the *Dark Factor of Personality* as an antecedent of epistemic beliefs. It is considered to be the core of all dark traits and is defined as “the general tendency to maximize one's individual utility — disregarding, accepting, or malevolently provoking disutility for others —, accompanied by beliefs that serve as justifications” (Moshagen et al., 2018, p. 657). Discussing post-truth phenomena requires a mutual understanding of what actually constitutes knowledge and truth. Thus, I will begin with a brief introduction on different perspectives on truth and knowledge. I will then continue by discussing epistemic beliefs and the Dark Factor of Personality. Then I will address COVID-19 conspiracy theories, health-protective behavior against COVID-19, and fake news in more detail and with respect to epistemic beliefs and the Dark Factor of Personality. Afterwards, I will describe the research lacuna and outline the aims of all three manuscripts more thoroughly.

1.1 About Knowledge and Truth

Since antiquity, humans have developed different views on knowledge and truth. Broadly, one can identify two poles of a continuous spectrum of perspectives on the nature and generation of knowledge about the world: *Realism* and *Radical Constructivism* (e.g., Appel, 2005). Realist views postulate that the environment is directly perceivable, which means that one's conception of the outside world directly corresponds to that world. In that sense, human perception and information processing can be understood as bottom-up processes in which information from the outside world unilaterally affect one's conception of the world. Potential processes that mediate how individuals perceive external stimuli are of minor importance (e.g., Reed, 2008).

Radical constructivist perspectives, in turn, hold that the outside world is generally not perceivable, which means that one's construction of reality does not correspond to an external reality (von Glasersfeld, 1984). Rather than on external information they encounter, individuals construct their reality based on their internal states such as prior experiences, emotions, and pre-existing convictions.

Both realist and radical constructivist views have been shown to be too narrow in their description of how humans perceive or construct reality and combining realist and constructivist elements allows for a more adequate description. *Cognitive Constructivism* holds that the construction of reality can be understood as the result of an interaction between external stimuli and temporally preceding internal states of the recipient (e.g., Appel, 2005; Barkin, 2003; Früh, 1994; Piaget, 1954; Powell & Kalina, 2009). More precisely, external stimuli are perceived by recipients and interact with their prior experiences, emotions, and pre-existing convictions resulting in a perceptual outcome and construction of reality. Yet at the same time, external stimuli constantly affect and shape one's internal states (Appel, 2005).

However, humans construct their own knowledge and reality not solely based on information of the outside world that interact with their internal states, but also based on their interaction with others, for example via language (Powell & Kalina, 2009; in detail in Vygotsky,

1962). Hence, the perspective of *Social Constructivism* complements Cognitive Constructivism by a social dimension: Individuals compare their worldview with peers and adjust it if necessary. It follows that assertions are considered to be true if they align with the worldview shared by the majority of a social group at a given time and untrue or false if they contradict it (Adams, 2005; Appel, 2005). Thus, knowledge acquisition is always embedded in a socio-historical context and what is considered to be true may shift over time and vary between different cultures (Holtz, 2020). Truth may be expressed for example in scientific findings of the Western world in the early 21st century (e.g., Appel, 2005; Lewandowsky, 2021; Waisbord, 2018). This well-founded consensual definition of truth will be the basis for this dissertation.

Such a complex understanding of truth and reality may easily be misunderstood as a disregard for truth in general (Holtz, 2020). As a consequence, radical constructivist perspectives have emerged challenging the very idea that facts, or more broadly speaking, truth matter at all (e.g., see Lewandowsky et al., 2020; Lewandowsky, 2021). A very prominent example is the phrase *alternative facts* uttered by Kellyanne Conway, the former U.S. Counselor to the President, when journalists confronted her with having lied about the attendance numbers at Trump's inauguration as president (Jaffe, 2017). Radical constructivist perspectives are not a new phenomenon, in fact, they have been around for thousands of years. In Greek antiquity, sophistic movements claimed that in debates it is not the better, but the rhetorically more convincing argument that will prevail (cf. Boghossian, 2006). In that sense, they considered truth to be a matter of power. Thus, different perspectives on truth and knowledge should be crucial to the interpretation of information. These so-called epistemic beliefs will be introduced in the following chapter.

1.2 Epistemic Beliefs

Epistemic beliefs are defined as beliefs about the nature of knowledge and knowing (Muis, 2007; Richter & Schmid, 2010). The concept has emerged in educational psychology to describe how individuals believe that knowledge is acquired, their views as to what constitutes knowledge, and to study how these beliefs shape their thinking and reasoning (see, e.g., Hofer & Pintrich, 1997; Kuhn et al., 2000; Schommer, 1990). Typically, they are either conceptualized as metacognitions (e.g., Hofer, 2004; Richter & Schmid, 2010) or as being closely related to but distinct from metacognitions (e.g., Bromme et al., 2010) that fuel or inhibit the propensity to engage in a rational thought process (Hofer, 2004; Richter & Schmidt, 2010; Stanovic, 2011). In concrete terms, epistemic beliefs influence how individuals evaluate the veracity of information, how certain they are about their own knowledge, and how much effort they put in decision-making processes and knowledge acquisition (Hofer, 2004). Thus, they are closely connected to the accuracy of an individual's opinions (Garrett & Weeks, 2017; Muis, 2007)

Building upon the framework of epistemic beliefs by Garrett and Weeks (2017), three aspects are distinguished: *Faith in Intuition for Facts*, *Need for Evidence* and *Truth is Political*. First, *Faith in Intuition for Facts* captures how strongly individuals trust their intuition when judging the accuracy of information. It has been shown that intuition is a valuable resource in decision-making, especially if it is followed by a rational thought process (e.g., Kahneman, 2011; Swami et al., 2014). Solely relying on one's intuition, however, can result in uninformed decisions and drastic misperceptions. Second, *Need for Evidence*, refers to the degree to which one desires to align one's opinions with the known facts, for example scientific evidence. Those who put little emphasis on evidence are inclined to let pre-existing beliefs guide their decision-making and opinion formation process. This may result in decisions and opinions that are in stark contrast to the scientific consensus (e.g., Garrett et al., 2016; Hindman, 2009). Third, *Truth is Political* captures how strongly individuals believe that what counts as truth is ultimately decided by those in power, for example politicians, journalists, and scientists. As outlined before, there is

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a wide consensus in the social sciences that the generation of knowledge is always embedded in a socio-historical context (Hacking, 1999; Holtz, 2020). Still, some arguments are considered to be more valid than others because they are backed by more (scientific) evidence. However, the scientific consensus may shift over time and those who are strongly convinced that Truth is Political misinterpret this observation as entailing a general disregard for truth (Holtz, 2020; Lewandowsky, 2021). In sum, individuals with a strong Faith in their Intuition for Facts, a low Need for Evidence, and the strong conviction that Truth is Political tend to think that all opinions are equally valid and, thus, they deliberately choose to believe what they want to be true. In the following, whenever the term *post-truth epistemic beliefs* is used, it refers to this specific combination of epistemic beliefs. It is important to note that post-truth epistemic beliefs are conceptualized as varying along a continuum (Garret & Weeks, 2017). In line with most conceptualizations, they do not rest on a dichotomous understanding between naïve and sophisticated epistemic beliefs (Bråten et al., 2015; Chinn et al., 2015; Greene et al., 2008; Hofer & Pintrich, 1997; Muis et al., 2006).

1.2.1 Related Constructs and Correlates

Epistemic beliefs are one aspect of the broader concept of *epistemic cognition* (Hofer & Bendixen, 2012; Greene & Yu, 2016). The concept includes which sources of knowledge individuals consider valid, how certain and complex they consider knowledge to be, the processes involved in comparing and evaluating multiple opposing claims, and how individuals justify what they themselves know (Hofer & Bendixen, 2012; Greene & Yu, 2016). Epistemic cognition subsumes epistemic motives, for example the *Need for Cognition*, which is an individual's desire to engage in demanding cognitive activities (Cacioppo & Perry, 1982) or the *Need for Closure*, which describes how comfortable individuals are with ambiguity and uncertainty (Kruglanski, 1990). Prior empirical research has shown that post-truth epistemic beliefs are associated with a lower Need for Cognition (Nussbaum & Bendixen, 2003) and a higher Need for Closure

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(DeBacker & Crowson, 2006). Further, they are linked to lower education (Garret & Weeks, 2017).

Epistemic beliefs differ from *motivated reasoning* in that they refer to one's general views on the concept of knowledge itself whereas motivated reasoning is defined as steering one's thought process towards a desired outcome based on one's wishes, desires or preferences (Kruglanski, 1996; Kunda, 1990). Thus, epistemic beliefs can be considered as antecedents that can lead to more or less motivated reasoning driven by directional goals (Klaczynski, 2000; Sinatra et al., 2014). Further, epistemic beliefs complement alternative perspectives that focus on *analytic thinking* as a predictor of accurate judgment (e.g., Bronstein et al., 2019; Pennycook & Rand, 2020), as they temporally precede the engagement in analytic thinking or lack thereof (Klaczynski & Robinson, 2000).

1.2.2 Development

Typically, it is assumed that epistemic beliefs develop from naïve to sophisticated beliefs through socialization (see, e.g., Bromme et al., 2010; Kuhn et al, 2000). Although they are thought to be relatively stable over time, they may be subject to change (Garret & Weeks, 2017; Schommer, 1990). I argue that there are at least two potential causes for developing pronounced post-truth epistemic beliefs. First, individuals fail to develop a sophisticated understanding of knowledge as it is outlined in the previous chapter. By that I do not refer to an extant understanding of different epistemological perspectives on the subject in philosophical terms, but rather the acknowledgment that arguments differ in their validity depending on the amount and more importantly, quality of evidence in favor of them. According to Kuhn et al. (2000), there are at least three different levels of complexity in the development of a mature epistemological understanding. At first, individuals view knowledge as an objective entity located in the outside world, which can be perceived with absolute certainty. Kuhn et al. (2000) refer to this stage as the *absolutist level* (cf. to *Realism* as described in the previous chapter). Later individuals realize that others may perceive and interpret the same event, object, construct or statement in different ways

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and, thus, develop different opinions. This stage is referred to as the *multiplist level*, in which all opinions are considered to be equally valid (cf. to *Radical Constructivism* as described in the previous chapter or Carpendale & Chandler, 1996; Pillow & Henrichon, 1996). In the last stage, the *evaluativist level*, both the objective and subjective elements of knowing are reintegrated and individuals share a complex understanding of truth. They acknowledge that in some domains such as *personal taste* or *aesthetic judgment*, different opinions may be equally valid, whereas in other domains like *truth*, some opinions can be backed by better evidence and are, thus, superior to other opinions. According to Kuhn et al. (2000), many individuals never develop an evaluativist epistemological understanding and remain at an absolutist or multiplist level. Note that post-truth epistemic beliefs, namely a strong Faith in Intuition for Facts, a low Need for Evidence, and the strong conviction that Truth is Political can be considered the equivalent of Kuhn et al.'s notion of the multiplist level.

Second, post-truth epistemic beliefs could be developed and deliberately entertained because they are deemed advantageous. Positively framed, not being bound by evidence and rational arguments allows one to act as one pleases (Jin et al., 2021; Hilbig et al., 2022; Zelenski & Desrochers, 2021). This leads to a broader personality disposition, the *Dark Factor of Personality*, which will be introduced in the following chapter.

1.3 From Dark Traits to the Dark Factor of Personality

The umbrella term *dark traits* refers to subclinical personality traits that are associated with ethically, morally and socially questionable behavior such as lying, deceiving or exploiting others (Moshagen et al. 2018). Psychological research on dark traits has long been focusing on individual traits or combinations of traits such as the *Dark Triad* (see, e.g., Furnham et al., 2013) or the *Dark Tetrad* (see, e.g., Međedović & Petrović, 2015; Paulhus et al., 2018) to account for aversive behavior. Whereas the Dark Triad subsumes narcissism, Machiavellianism, and psychopathy, the Dark Tetrad also includes sadism. According to theory (Marcus & Zeigler-Hill, 2015; Paulhus, 2014), there is a substantial overlap between dark traits, which is also supported by empirical research (Jones & Figueredo, 2013; O’Boyle et al., 2012). Moshagen et al. (2020) argue that dark traits represent specific manifestations of a general disposition, which is the *Dark Factor of Personality* (D; e.g., Bader et al., 2021; Hartung et al., 2021; Moshagen et al., 2018). They further postulate that D is driven by a prioritization of one’s “individual utility — disregarding, accepting, or malevolently provoking disutility for others —, accompanied by beliefs that serve as justifications” (Moshagen et al., 2018, p. 657). Individual utility comprises any form of material success, but also comprises hedonistic feelings, for example pleasure or power. Importantly, instead of only referring to *actual* mid- to long-term benefits (e.g., economic prospering or well-being), the term also includes *perceived* benefits such as feeling superior to others as a result of ethically questionable behavior.

1.3.1 The Dark Factor of Personality and Post-Truth Epistemic Beliefs

Despite engaging in a variety of malevolent behaviors, individuals with a pronounced Dark Factor of Personality hold and maintain a positive self-image. They do so by relying on beliefs and rationalizations that help to justify their actions (Hilbig et al, 2022). For example, embracing a radical constructivist and cynical worldview facilitates bending morals and norms to their liking so that ethically questionable behavior can be justified (e.g., Jonason et al., 2015; Moshagen et al., 2020; Mussel & Hewig, 2016; Zeigler-Hill et al., 2020). In more concrete terms,

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Hilbig et al. (2022) postulate that basic behavioral tendencies to engage in ethically questionable behavior (e.g., “I want to avoid taxes”) can be justified by endorsing specific beliefs that allow for a belief-based justification of the desired behavior, for example by believing that everyone cheats on their taxes. In this regard, post-truth epistemic beliefs could be particularly useful for individuals with a pronounced Dark Factor of Personality. Note that the practical implications of facts and scientific evidence can be experienced as inconvenient and restrictive. For example, climate change seems to necessitate reducing one’s individual carbon dioxide emissions, which is associated with restricting one’s personal freedom for the sake of the environment (Zelenski & Desrochers, 2021). Another example is the COVID-19 pandemic: primarily in the beginning, reducing the dissemination of the virus relied on engagement in social distancing, wearing hygienic face masks etc. (Jin et al., 2021; for more details see the next chapter). Thus, deliberately disregarding rational arguments and scientific evidence allows one to act as one pleases. There are at least three ways in which post-truth epistemic beliefs could be considered advantageous for individuals high in D. First, post-truth epistemic beliefs could serve as powerful tools to disregard scientific evidence and rational arguments based upon it, which could then allow for a variety of antagonistic, malevolent or socially aversive behaviors. Second, individuals high in D could deploy post-truth epistemic beliefs to discredit information contradicting their general worldview independently from any specific behavior associated with it, for example cynicism and relativism (Moshagen et al., 2020; Zeigler-Hill et al., 2020). Third, post-truth epistemic beliefs could be used to protect their positive, but fragile self-concepts (Doerfler et al., 2021), for example feelings of superiority (Horsten et al., 2021) against critical, self-threatening information. To sum up, a pronounced Dark Factor of Personality should be linked to the endorsement of post-truth epistemic beliefs (see Figure 1). A general disregard for rational arguments should lead to an increased susceptibility for conspiratorial ideas and associated behavior, which will be introduced in the following chapter.

1.4 COVID-19 Conspiracy Theories and Health-Protective Behavior

Conspiracy theories explain events or circumstances as the result of a collusion of several powerful actors who are working to their own benefit and for the detriment of large sections of the population (Swami & Furnham, 2014). Prior research has shown that during crises, conspiratorial thinking increases considerably (e.g., van Prooijen & Douglas, 2017). Thus, the COVID-19 pandemic can be considered an ideal breeding ground for conspiracy theories: its origin is difficult to understand, and it is a global event with massive effects on people's lives that leads to a lot of uncertainty (Van Bavel et al., 2020). Conspiracy theories about COVID-19 may deny or downplay its danger while suspecting that governments use the pandemic as an excuse to restrict civil liberties to install an authoritarian regime or that COVID-19 was created as a bioweapon (e.g., Imhoff & Lamberty, 2020). Indeed, these ideas were supported by a substantial amount of people: 17% of the German population supported the idea that the government used COVID-19 as an excuse to establish a permanent restriction of civil liberties (Infratest dimap, 2020). Further, 25% of U.S. citizens believed that there was some truth to the notion that the coronavirus outbreak was planned (Schaeffer, 2020).

In the following, I will argue that post-truth epistemic and D beliefs should predict the endorsement of COVID-19 conspiracy theories. I will then address the issue of health-protective behavior against the virus and will outline why post-truth epistemic beliefs and D should be linked to less engagement in such behavior.

1.4.1 COVID-19 Conspiracy Theories, Post-Truth Epistemic Beliefs, and D

It is important to note that it is not a defining criterion of conspiracy theories to be factually wrong (Imhoff & Lamberty, 2018; Oettingen et al., 2022). There have been instances, in which conspiracy theories have been proven to be true, for example the global surveillance disclosures by Edward Snowden (Wick, 2017) or the Watergate scandal, which led to the resignation of the former U.S. President Richard Nixon (Seitz, 2022). However, conspiracy theories usually lack any serious evidence, for example in the sense of scientific data. In fact, those endorsing

conspiratorial ideas often reinterpret a *lack* of evidence or even evidence *against* conspiracy theories as evidence *in favor* of them. They do so by arguing that conspirators actively try to cover up their actions. Hence, both the nonexistence of evidence *in favor* of as well as the existence of evidence *against* conspiracy theories may be construed as proof for their veracity (Keeley, 1999). Thus, deliberately disregarding rational communication based on arguments and scientific evidence should lead to an increased vulnerability for conspiratorial ideas. It follows that post-truth epistemic beliefs should be linked to conspiratorial thinking. With regard to the three aspects of post-truth epistemic beliefs separately, it is likely that individuals with a strong need to align their opinions with externally validated data (Need for Evidence) disapprove of conspiratorial ideas. Prioritizing their intuition (Faith in Intuition for Facts) could result in preferring simple solutions or explanations over complex ones (Epstein et al., 1996) and could, therefore, lead to endorsing conspiracy theories, for example about the outbreak of COVID-19 (Zajenkowski et al., 2022). Compared to the other two aspects, Truth is Political is conceptually the closest to the central idea underlying conspiracy theories. The notion that truth is a matter of power fits well with conspiratorial thinking, where a small group of people is assumed to exercise power over society, for example by controlling the flow of public information, covering up their actions and ultimately deciding what is considered to be true (Keeley, 1999). Empirically, all three post-truth epistemic beliefs have been associated with general conspiracist ideation, but the results were mixed when individual issues like safety of vaccinations or anthropogenic climate change were analyzed separately (for a detailed report see Garret & Weeks, 2017).

As established in the previous chapter, individuals high in D could hold post-truth epistemic beliefs because they consider them to be advantageous as they facilitate not adhering to the better argument. Consequently, those high in D should be prone to irrational cognition and, thus, be susceptible to conspiracy theories. Hence, embracing conspiracy theories could partly be explained as a *result* of endorsing post-truth epistemic beliefs. This is in line with prior research: Machiavellianism, narcissism, and psychopathy have been associated with endorsing both generic

(Kay, 2021) as well as COVID-19-related conspiracy theories (Ahadzadeh et al., 2021).

Moreover, there are at least two additional reasons to assume a link between D and conspiratorial thinking. These hypothesized mechanisms explaining the link between D and conspiratorial thinking will be described in the following. Post-truth epistemic beliefs might fuel and accompany these mechanisms, but not – as outlined before - in a *causal* sense.

First, the idea of a powerful collusion secretly working towards their goals against the interest of the majority of the people, aligns with the self-serving worldview held by those high in D (Hilbig et al., 2022; Moshagen et al., 2018). As their highest priority is ruthlessly maximizing their individual utility, they could well suspect others to think and behave similarly. This is in line with the finding that Machiavellianism has been linked to both the endorsement of conspiracy theories and increased willingness to conspire (Douglas & Sutton, 2011).

Second, a link between D and conspiratorial thinking is plausible due to the individual utility one can extract from endorsing conspiracy theories. Conspiracy theories that downplay or deny the severity of COVID-19 can be used as a justification for not adhering to the rules set in place to counteract the spread of the virus, for example social distancing or wearing hygienic face masks. These rules and guidelines serve to protect the public, especially the most vulnerable at the expense of those with arguably minor risk (apart from serious long-term consequences such as *long COVID*; Castanares-Zapatero et al., 2022; Jin et al., 2021). Individuals high in D should only be willing to adhere to these guidelines if they assume that it increases their individual utility, for example if they belong to a risk group. This has several implications for the processing of information containing conspiratorial ideas. Information processing should be accompanied by post-truth epistemic beliefs in a sense that post-truth epistemic beliefs might facilitate the endorsement of conspiracy theories. Taken together, I propose two parallel processes that include post-truth epistemic beliefs. First, the endorsement of COVID-19 conspiracy theories could *result* from holding post-truth epistemic beliefs. Second, post-truth epistemic beliefs could *facilitate* the

endorsement of COVID-19 conspiracy theories, because the latter are deemed advantageous or plausible for the reasons outlined above.

The popularity of conspiracy theories is particularly worrisome as these ideas have been linked to a variety of behaviors that put the safety of both those endorsing them as well as their fellow human beings at risk, for example through an increased willingness to engage in political violence (Imhoff et al., 2021; Jolley & Paterson, 2020). This work's focus will be laid upon on the engagement in health-protective behavior against COVID-19 or lack thereof.

1.4.2 COVID-19 Health-Protective Behavior

Over the course of the pandemic, many governments have put out guidelines to counteract the dissemination of the virus and, thus, protect the safety of their citizens. In this work, I will concentrate on behaviors that were deemed effective by scientific standards during the time of assessment. These include social distancing, wearing hygienic face masks in public as well as getting vaccinated against COVID-19 (see, e.g., Feng et al., 2020; Ghasemiyeh et al., 2021; Lewnard & Lo, 2020). Prior research has shown that individuals who doubt or downplay the severity of COVID-19 engaged in less health protective behavior and, thus, put both their individual health and public health at risk (Allington et al., 2021; Imhoff & Lamberty, 2020).

By now, vaccines such as the Moderna or the Pfizer-BioNTech COVID-19 vaccines have been proven to be a particularly safe and effective measure against COVID-19 (e.g., Ghasemiyeh et al., 2021; Huang et al., 2022; Wu et al., 2021). The success of vaccination programs is based on direct protection for vaccinated individuals as well as indirect protection for communities through herd immunity, which requires a high uptake level (Betsch et al., 2013; Dubé et al., 2013). Despite the fact, that the majority of the mass media routinely reported on the safety and effectiveness of the COVID-19 vaccines (Christensen et al., 2022), some people seemed to ignore all available evidence and refused to get vaccinated. In the following, I will elaborate on why post-truth epistemic beliefs and D could explain why some individuals refuse to engage in health-protective behavior against the virus.

1.4.3 COVID-19 Health-Protective Behavior, Post-Truth Epistemic Beliefs, and D

The engagement in health-protective behavior relies on adherence to recommendations by health organizations and the government that are based on rational communication (Malecki et al., 2021). Thus, pronounced post-truth epistemic beliefs should be linked to less health-protective behavior as they should lead to deliberately disregarding science-based arguments advocating social distancing, wearing hygienic face masks or vaccine uptake. If as hypothesized, post-truth epistemic beliefs are associated with a pronounced Dark Factor of Personality, those high in D should engage in less health-protective behavior, for example getting vaccinated. Additionally, a link seems likely because many of the countermeasures rely on willingness to engage in prosocial behavior as they decrease the individual utility (at least for healthy individuals) for the benefit of others, most prominently risk groups (Anderson et al., 2020; Han et al., 2020). It is highly unlikely for individuals high in D to engage in such behavior as it is in stark contrast to the very definition of D (Kajonius & Björkman, 2020; Moshagen et al., 2018; Ścigała et al., 2021). Furthermore, prior research has shown that dark traits are linked to risky behavior (Tiwari et al., 2021), a tendency to oppose laws and authorities (Bader et al., 2022; Moshagen et al., 2020), and to less engagement in protective behavior against COVID-19 (Blagov, 2021; Nowak et al., 2020; Ścigała et al., 2021; Zettler et al., 2021). In line with Hilbig et al. (2022). These basic behavioral tendencies could be fueled and accompanied by post-truth epistemic beliefs, in a sense that they facilitate the decision to engage in ethically questionable behavior. More precisely, post-truth epistemic beliefs could help individuals high in D to justify disregarding scientific evidence that speaks to the importance of countermeasures. They could do so by assuming that scientific recommendations in favor of countermeasures correspond to only one of many different equivalent scientific viewpoints.

Conspiracy theories and fake news are often discussed together, sometimes even mistakenly used synonymously. In fact, they are conceptually distinct phenomena, which emphasizes the need to investigate them separately. In the following chapter, I will begin by

discussing their differences and similarities and then outline why I assume that post-truth epistemic beliefs rooted in D should predict an increased susceptibility for fake news.

1.5 Fake News

Despite the fact that some fake news transport conspiratorial ideas, it is not a defining criterion for fake news to deal with alleged collusions. Conversely, conspiracy theories may be disseminated in the form of a news report, but this does not define conspiracy theories. Further, as outlined in the previous chapter, conspiracy theories are not necessarily factually inaccurate.

Against this background, fake news are defined here as fabricated and factually wrong information in the guise of journalistic contributions (e.g., Lazer et al., 2018). It is a common misconception that fake news are a new phenomenon. In fact, fake news have been around since the beginning of journalistic reporting (see, e.g., “The Great Moon Hoax”; Stürmer, 2009). Still, the advent of social media like Facebook, Twitter, Instagram, and Tiktok combined with easy access to new types of technology have enabled almost anyone to produce and disseminate a variety of different forms of fake news (Basch et al., 2021; Lewandowsky et al., 2012). Further, journalistic standards such as fact-checking that are usually imposed by editorial offices no longer have to be followed (Lazer et al., 2018). At the same time, social media increasingly serve as a news source for many people: in the USA, almost 50% of the population use social media for this purpose (Walker & Matsa, 2021, Jenkins & Graves, 2022) whereas it is about a third in Germany (Hölig et al., 2022). Certainly, these numbers have to be interpreted with caution, as one could also follow the social media accounts of the mainstream media.

In general, individuals are interested in forming an image of reality that is as accurate as possible (Kunda, 1990). Thus, there is a basic motivation to distinguish between factually accurate news and fake news. However, people are also keen on consolidating their existing worldviews and are reluctant to give up their opinions (Kahan, 2013). Consequently, human information processing is also directed toward outcomes that align with pre-existing attitudes and beliefs. Individuals tend to readily accept information that is consistent with their worldview,

whereas they critically analyze and, thus, invalidate inconsistent information. As mentioned earlier, this process is called motivated information processing or motivated reasoning (see, e.g., Huttmacher et al., 2022; Kunda, 1990; Kruglanski, 1996). Thus, human cognition and behavior is not always rational and often affected by cognitive biases (Tversky & Kahneman, 1974).

Psychological research often focuses on these cognitive biases to explain susceptibility for fake news. One example is *confirmation bias*, which is seeking information that is consistent with one's opinions while avoiding information contradicting them (Levine et al., 2001, Lazer et al., 2018). Another example is the *illusory truth effect*, which describes individuals' tendency to overestimate the accuracy of information that they have encountered before (Fazio et al., 2015; Pennycook et al., 2018). Another important line of research emphasizes the role of analytic thinking: The more people tend to engage in a deeper and more rational thought process, the better they are at discerning fake from accurate news (Bronstein et al., 2019; Pennycook & Rand, 2019) or to identify *Deepfakes* (Appel & Prietzel, 2022). Although individuals have a certain general disposition to (not) think analytically, situational and motivational aspects can also influence whether they rely on their intuition or think about information more thoroughly (Pennycook et al., 2020). This is where metacognitions come into play that either accelerate or inhibit the propensity to engage in a deep and rational thought process (Stanovic, 2011), which then increases the probability of identifying factually inaccurate information. In the following, I will emphasize that people differ in their general willingness to adhere to the "unforced force of the better argument" (Habermas, 1996, p. 305).

1.5.1 Fake News, Post-Truth Epistemic Beliefs, and D

As outlined before, the more individuals endorse post-truth epistemic beliefs, the lower should be their willingness to base their opinions on evidence and/or argument quality. A general disregard for (indicators of) truth should be associated with less willingness to discern factually inaccurate from accurate information (Scheufele & Krause, 2019). In a similar vein, it is likely that individuals with post-truth epistemic beliefs are less skilled at processing evidence and/or

argument quality as they rarely practice the evaluation of arguments in terms of epistemic merit. Lower willingness and ability go hand in hand and should result in negative associations between post-truth epistemic beliefs and correctly distinguishing between fake and accurate news. As outlined before, individuals high in D are expected to endorse post-truth epistemic beliefs because they are deemed advantageous and should, thus, be susceptible for fake news. Additionally, the fact that they hold beliefs that they deem advantageous further suggests a link between D and belief in fake news. Those high in D should not judge the veracity of information based on indicators of truthfulness, but rather on the individual utility they can extract from it. More precisely, they should base their judgment on the suitability of the news to either justify (a) malevolent behavior, (b) their general worldview or (c) protect their self-concepts (cf. chapter 1.4.1). This process should be facilitated by post-truth epistemic beliefs as they guide and accompany information processing.

1.6 Study Overview and Summary of the Research Questions

Psychological research on irrational cognition and behavior such as belief in misinformation, conspiracy theories or vaccination hesitancy often focuses on cognitive biases (e.g., Hutmacher et al., 2022; Lazer et al., 2018; Meppelink et al., 2019; Zhou & Shen, 2022) or thinking styles (e.g., Bronstein et al., 2019; Pennycook & Rand, 2019). Thus, informed decision-making is often understood as a function of one's access to the right information and one's ability to process it rationally. We complement this perspective by arguing that one's willingness to adhere to the better argument could be an additional and crucial factor. Some people may deliberately ignore the lack of substantial evidence for conspiracy theories or the lack of indicators of truthfulness in fake news. More broadly speaking, individuals with pronounced post-truth epistemic beliefs could generally and deliberately disregard the quality of arguments and may, thus, not be receptive to rational communication.

Against this background, **Manuscript #1** comprises four online studies that were conducted in the USA and Germany, which investigated the links between D and post-truth-

STUDY OVERVIEW AND RESEARCH QUESTIONS

epistemic beliefs and their potential effects on individuals' approval of COVID-19 conspiracy theories and engagement in health-protective behavior over the course of the pandemic. Study 1 ($N = 321$) tested whether the Dark Factor of Personality was linked to post-truth epistemic beliefs. Study 2 ($N = 453$) aimed to replicate the results from Study 1 and proposed a mediation model that consisted of D as an antecedent of post-truth epistemic beliefs, and increased endorsement of COVID-19 conspiracy theories and less engagement in health-protective behavior as consequences of D and post-truth epistemic beliefs. The items assessing COVID-19 conspiracy theories were based on popular conspiratorial ideas about COVID-19 circulating at the time of assessment and conspiracy theories about the Zika virus (Piltch-Loeb et al., 2019). The items assessing the engagement in health-protective behavior were based on guidelines by the World Health Organization (2020) at the time of assessment. The goal of Study 3 ($N = 923$) was to replicate the results from Study 2 in a larger sample and at a later stage of the pandemic. Study 1, 2, and 3 were conducted in the USA. Thus, Study 4 ($N = 513$) intended to replicate the findings from Study 1, 2, and 3 in a German sample to test their robustness and cross-cultural validity.

Manuscript #2 comprises a US nationally representative study ($N = 1268$) investigating the effect of D and post-truth epistemic beliefs on COVID-19 vaccination refusal at a time where the primary immunization phase in the USA could be considered complete, which means that almost everyone willing to get immunized has had the chance for vaccine uptake (U.S. Department of Health & Human Services, 2022). Previous studies that reported associations between dark traits and vaccination hesitancy (Howard, 2022; Konc et al., 2022; Li & Cao, 2022) have at least three shortcomings. First, they are typically based on convenience samples. Second, psychological research on vaccine uptake almost exclusively relies on self-report measures of vaccination *intention* instead of the actual vaccination *status* (see, e.g., Dubé et al., 2013; Troiano & Nardi, 2021). Third, these studies did not examine the Dark Factor of Personality as an underlying tendency that could drive post-truth epistemic beliefs. The study reported in

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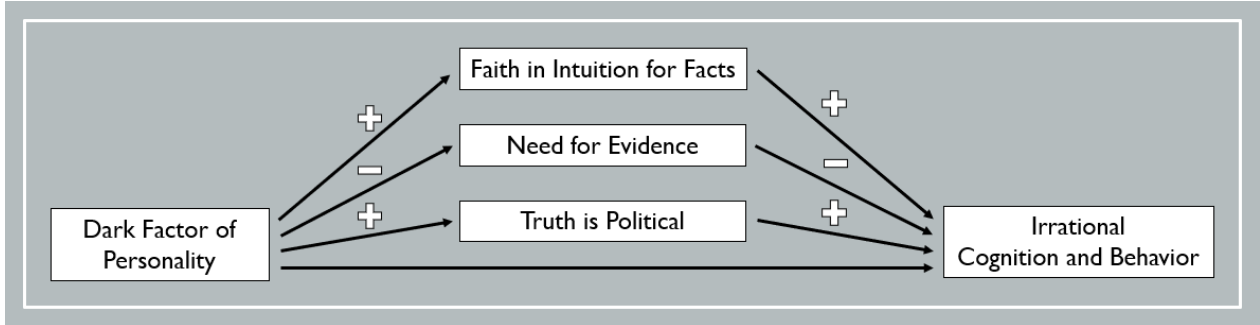
Manuscript #2 was designed to tackle these shortcomings. It complements Manuscript #1 in that instead of using self-report measures of general protective behavior against COVID-19 it assessed individuals' *vaccination status*. Note that COVID-19 vaccines were not yet available when the studies comprised in Manuscript #2 were conducted in 2020. Moreover, the large US nationally representative sample ensures both the robustness of the potential findings as well as their generalizability for the US American public.

Manuscript #3 pursued two goals: First, to investigate whether the associations examined in Manuscript #1 could be transferred to the related, but distinct post-truth phenomenon of fake news. Second, in contrast to Manuscript #1, the subject of COVID-19 was intentionally not covered by the stimuli to extend the scope of the research beyond the context of COVID-19. Manuscript #3 was based on an online repeated measures experiment ($N = 668$) investigating the effect of post-truth epistemic beliefs and their antecedent D on participants' ability and/or willingness to distinguish factually accurate from inaccurate news posts. Participants rated the perceived accuracy of six factually accurate and six factually inaccurate news posts that were presented in the format of Facebook posts. All factually accurate news posts were retrieved from US news sources and their veracity was carefully double-checked. All factually inaccurate news posts were retrieved from third-party fact-checking websites that had flagged them as fake news. The stimuli were thoroughly selected based on a pilot study ($N = 55$).

Across all manuscripts, a mediation model was proposed and tested that includes the Dark Factor of Personality as an antecedent of post-truth epistemic beliefs, and the endorsement of COVID-19 conspiracy theories and less health-protective behavior (Manuscript #1), reduced fake news discernment (Manuscript #2), and a lower probability of having been vaccinated against COVID-19 (Manuscript #3) as consequences. For a graphical depiction of the proposed mediation model, please consider Figure 1.

Figure 1

The Proposed Mediation Model Including the Dark Factor of Personality as an Antecedent of Post-Truth Epistemic Beliefs, and Irrational Cognition and Behavior as Consequences



2. Peer-Reviewed Studies

2.1 Manuscript #1

Rudloff, J. P., Hutmacher, F., & Appel, M. (2022). Beliefs about the nature of knowledge shape responses to the pandemic: Epistemic beliefs, the dark factor of personality, and COVID-19-related conspiracy ideation and behavior. *Journal of Personality, 90*, 937–955.

<https://doi.org/10.1111/jopy.12706>

**Beliefs About the Nature of Knowledge Shape Responses to the Pandemic:
Epistemic Beliefs, the Dark Factor of Personality, and COVID-19-related
Conspiracy Ideation and Behavior**

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Data availability statement: All data, analysis code, and research materials are available at https://osf.io/g3xkw/?view_only=4a7137cce68a4f3e964b3c746e347226. All studies were preregistered (Study 1: <https://aspredicted.org/blind.php?x=bp5b3x>; Study 2: <https://aspredicted.org/blind.php?x=9mq4xn>; Study 3: <https://aspredicted.org/blind.php?x=962tn4>; Study 4: <https://aspredicted.org/blind.php?x=4262j3>).

Funding statement: We received no funding for this research.

Conflict of interest disclosure: We have no known conflicts of interest to disclose.

Ethics approval statement: Based on the regulations for conducting psychological research in Germany, no formal IRB approval was required. The studies followed the ethical guidelines of the APA and the German Psychological Society (DGPs).

Permission to reproduce material from other sources: Not applicable

Abstract

Objective: Global challenges such as climate change or the COVID-19 pandemic have drawn the attention of researchers and the public to conspiracy theories and citizens' non-compliance to science-based behavioral guidelines. We focus on individuals' worldviews about how one can and should construct reality (epistemic beliefs) to explain the endorsement of conspiracy theories and behavior during the COVID-19 pandemic and propose the Dark Factor of Personality (D) as an antecedent of post-truth epistemic beliefs.

Method and Results: This model is tested in four studies. In Study 1 ($N = 321$), we found first evidence for a positive association between D and post-truth epistemic beliefs (Faith in Intuition for Facts, Need for Evidence, Truth is Political). In Study 2 ($N = 453$), we tested the whole model proper by linking epistemic beliefs to D and showing that post-truth epistemic beliefs predict the endorsement of COVID-19 related conspiracy theories and disregarding COVID-19 behavioral guidelines. In Study 3 ($N = 923$), we largely replicated the results of Study 2 at a later stage of the pandemic. Finally, in Study 4 ($N = 513$), we replicated the results found in the USA (Studies 1-3) in a German sample corroborating their cross-cultural validity. Interactions with political orientation were observed.

Conclusion: Our research highlights that epistemic beliefs need to be taken into account when addressing major challenges to humankind.

Keywords: Post-Truth, Epistemic Beliefs, Dark Factor of Personality, Conspiracy Theories, COVID-19

**Beliefs About the Nature of Knowledge Shape Responses to the Pandemic:
Epistemic Beliefs, the Dark Factor of Personality, and COVID-19-related Conspiracy
Ideation and Behavior**

It is crucial for democratic societies that their members act upon evidence, not least when faced with global challenges such as climate change or the COVID-19 pandemic (Lewandowsky et al., 2020). The popularity of conspiracy theories and the widespread failure to follow behavioral guidelines informed by science has fueled academic research investigating the antecedents of such thinking and behavior (e.g., Boot et al., 2021; Pennycook et al., 2020). Individuals' convictions or worldviews about how one can and should develop a sense of what is true could be a key to understanding post-truth phenomena (Hyman & Jalbert, 2017; Lewandowsky et al., 2017; Scheufele & Krause, 2019). Our focus here is on individual differences in epistemic beliefs, that is, people's concepts about knowledge and evidence (Schommer, 1990). Among other aspects, epistemic beliefs refer to the validity of *truthiness* (Colbert, 2005) — the belief that truth rightfully derives from one's gut feeling rather than facts. Building upon a three-dimensional framework of epistemic beliefs (Garret & Weeks, 2017), we examined the Dark Factor of Personality as an antecedent to the endorsement of epistemic beliefs and COVID-19 conspiratorial thinking and the (non-)adherence to WHO health behavioral guidelines during the pandemic as consequences of epistemic beliefs. We start with a brief introduction on epistemic beliefs.

Epistemic Beliefs

Imagine reading the abstract of a recently published study on COVID-19. Further, imagine that you find the authors' results and conclusions intuitively plausible. Do you believe that you can trust your gut feeling – or do you rather find it necessary to take a closer look at the study before drawing any conclusions? Also, do you think that science provides objective facts or do you rather hold that scientific conclusions are influenced by those in power? These questions refer to your *epistemic beliefs*. Epistemic beliefs can be defined as beliefs about the nature and

generation of knowledge (Muis, 2007). The concept of epistemic beliefs emerged in educational psychology (see, e.g., Hofer & Pintrich, 1997; Kuhn et al., 2000; Schommer, 1990), but has since also been adapted to study the general public. In contrast to the concept of motivated reasoning (Kruglanski, 1996; Kunda, 1990), which is the process of producing justifications or decisions based on individual motives, goals, and attitudes instead of evidence, epistemic beliefs refer to one's general attitude toward the concept and generation of knowledge itself (Hornsey et al., 2020). It has been demonstrated that epistemic beliefs are related to the accuracy of peoples' opinions (Garrett & Weeks, 2017). What does that mean?

To capture the impact of epistemic beliefs on cognition and behavior, three different aspects need to be distinguished (see Garrett & Weeks, 2017). First, the degree to which people have *Faith in Intuition for Facts*, that is, the degree to which people believe that they can trust their gut feeling when evaluating information. Intuition can be an important source of knowledge (see, e.g., Damasio, 2005; Kahneman, 2011), especially when taken as a starting point for further careful and thorough consideration. If faith in one's intuition is not accompanied by analytic thinking however, people tend to ignore and disregard existing evidence, which can lead to severe misperceptions (e.g., Swami et al., 2014).

Second, the degree to which people have a *Need for Evidence*, that is, the degree to which people believe that their opinions need to be based on externally validated data. People with a high Need for Evidence will try to ensure that their opinions align with the known facts. On the contrary, people with a low Need for Evidence hold opinions that are driven by their ideological convictions, even if they know that these convictions conflict with the current scientific consensus (e.g., Garrett et al., 2016; Hindman, 2009).

Third, the degree to which people believe that "facts" are shaped by those in power, that is, the degree to which people believe that *Truth is Political*. In the social sciences, it has been emphasized that the generation of knowledge is always embedded in historical and societal circumstances (e.g., Hacking, 1999). Such a social constructionist perspective can easily be

misunderstood as entailing a disregard for the truth (Holtz, 2020). People who believe that facts do not exist independently from the political context tend towards this misunderstanding (Garrett & Weeks, 2017). Based on the observation that there are different interpretations of reality and that the scientific consensus shifts over time, it is concluded that “truth” is nothing but a matter of power.

To sum up, there is a distinct set of epistemic beliefs that we call *post-truth epistemic beliefs* because they shield individuals from questioning their opinions and from engaging in a rational discourse. In other words, people with a strong Faith in their Intuition for Facts, a low Need for Evidence and a strong conviction that Truth is Political will show little inclination to commit to “the unforced force of the better argument” (Habermas, 1996, p. 305). Instead, they will deliberately choose to believe what they want to be true. In the following, we argue that epistemic beliefs are closely connected to and an expression of a broader personality disposition, the Dark Factor of Personality.

The Dark Factor of Personality (D) and Epistemic Beliefs

The Dark Factor of Personality (D) is defined as “the general tendency to maximize one's individual utility — disregarding, accepting, or malevolently provoking disutility for others —, accompanied by beliefs that serve as justifications” (Moshagen et al., 2018, p.657). Utility refers to any form of material success or hedonistic feelings such as power or pleasure. The concept of D can be understood as an equivalent to G, the core factor of intelligence, explaining common variance between dark traits such as egoism, Machiavellianism, and psychopathy (Moshagen et al., 2018). Individuals high in D embrace a relativist and cynical worldview, which enables them to bend moral values and to refrain from injunctive norms, whenever it suits their agenda (e.g., Ajzen, 1991; Jonason et al., 2015; Moshagen et al, 2018; Moshagen et al., 2020; Zeigler-Hill et al., 2020).

Thus, it is to be expected that the stronger D, the stronger is the tendency to approve external information that justifies an individual's antagonistic, malevolent or socially aversive behavior while disregarding information criticizing it. We argue that epistemic beliefs serve as

tools to construct and maintain convictions that serve as justifications for this behavior. Further, we assume that individuals high in D use epistemic beliefs to fend off information contradicting their worldviews even if these worldviews are not directly linked to justifying antagonistic, malevolent or socially aversive behavior, as threats to any worldview may cause disutility. In addition, as individuals high in D are likely to hold positive, but fragile (e.g., Doerfler et al., 2021) self-concepts, epistemic beliefs serve as a means to shield these self-concepts from critical, self-threatening information.

In terms of the three aspects of epistemic beliefs, individuals with high levels in D are expected to trust their intuition when evaluating the accuracy of any information, implying a strong Faith in Intuition for Facts. As evidence bears the risk of contradicting one's worldview, we expect a negative association between D and Need for Evidence. The disregard of evidence can be supported by endorsing the idea that facts, including scientific evidence, are partially or completely constructed by society which allows for multiple perspectives on what is to be regarded as true (Kata, 2012). Accordingly, we expect that individuals with high levels in D tend to hold the belief that Truth is Political. To sum up, we argue that a pronounced Dark Factor of Personality should be linked to post-truth epistemic beliefs.

COVID-19 Conspiracy Theories and Protective Behavior

We assume that D and post-truth epistemic beliefs are associated with specific cognitions and behavior in response to societal and political phenomena such as the handling of the COVID-19 pandemic. Conspiracy theories attribute the actual cause of an event to the intrigues of several powerful actors who are working towards a common goal that is contrary to the interests of large sections of the population (Swami & Furnham, 2014). Conspiracy theories about COVID-19 range from downplaying its danger while suspecting others to profit from exaggerating the severity of the disease, to explicitly assuming that malevolent forces spread COVID-19 as a bioweapon (e.g., Imhoff & Lamberty, 2020). The central idea of conspiracy theories, namely powerful actors secretly working towards a common goal against the will of the majority of the

people, fits within the self-serving worldview of individuals high in D (Moshagen et al., 2018). Ruthlessly prioritizing one's individual utility as the core motif of individuals with high levels in D, could well lead to the assumption that others think and behave similarly. Accordingly, Machiavellianism has been linked to a tendency to believe in conspiracy theories and increased willingness to conspire (Douglas & Sutton, 2011). More recently, Machiavellianism, narcissism, and psychopathy were found to be associated with the endorsement of generic (Kay, 2021) and COVID-19 specific conspiracy theories (Ahadzadeh et al., 2021). Following our line of argument, individuals high in D should trust their intuition when confronted with conspiratorial ideas and refrain from relying on evidence. The idea that what is regarded as "true" is dependent on politics and society, could further enhance conspiratorial thinking (Garret & Weeks, 2017).

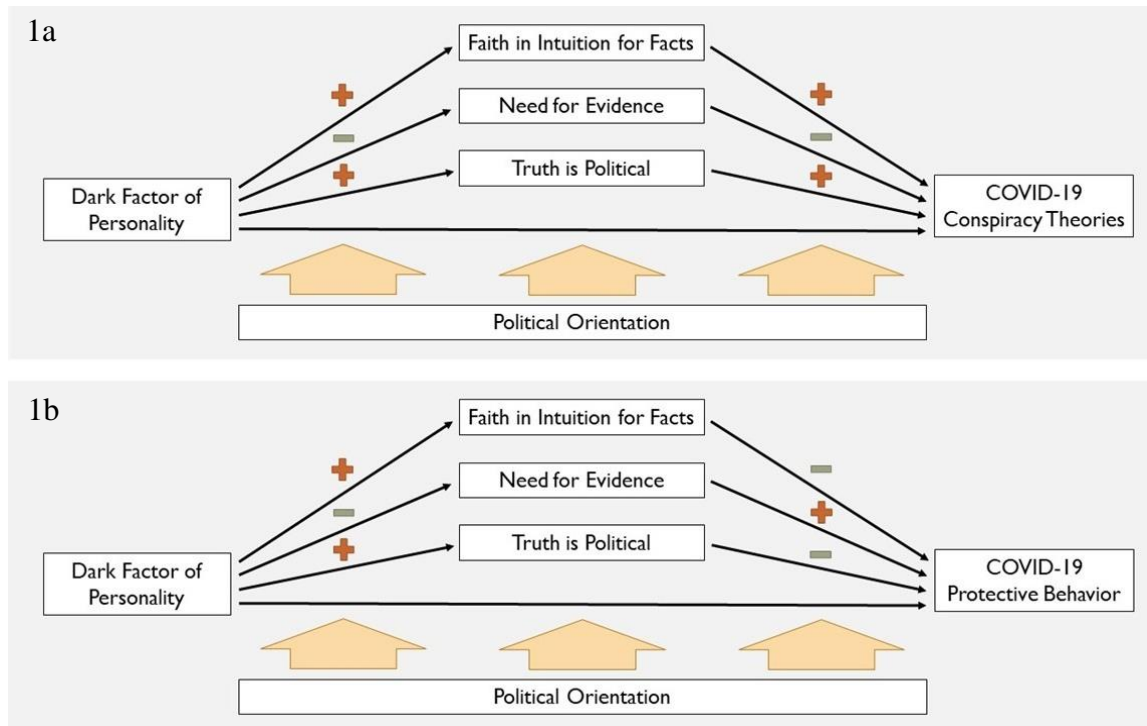
Compliance with countermeasures against COVID-19, including handwashing, wearing hygienic face masks and social distancing, is highly dependent on trust in government and science (Plohl & Musil, 2021). As described above, individuals high in D should only rely on evidence and hence trust scientific recommendations, if it suits their agenda. In the context of COVID-19, however, this seems highly unlikely, as countermeasures rely on the engagement in prosocial behavior (Anderson et al., 2020; Han et al., 2020), which is in stark contrast to the very definition of D (Moshagen et al., 2018). Research has linked D as well as individual dark traits such as Machiavellianism, narcissism and psychopathy to less protective behavior against COVID-19 (Blagov, 2021; Nowak et al., 2020; Ścigała et al., in press; Zettler et al., 2021). Again, following our line of argument, individuals high in D should rely on post-truth epistemic beliefs to neglect scientific evidence regarding COVID-19 and devalue it, for example by trusting their intuition about its accuracy. They could also assume that recommendations aiming at the implementation of countermeasures are merely the result of one of multiple (scientific) points of view.

Much of the available research has demonstrated that dark traits are more common in the right-wing political spectrum (Duspara & Greitemeyer, 2017; Jonason, 2015) and were linked to

traditionally conservative stands on major societal topics (Arvan, 2013). Not all studies, however, corroborated these relationships. It appears that these associations depend on various factors, such as the particular traits considered and the measures applied (see, e.g., Vize et al., 2018; Zeigler-Hill et al., 2020). In terms of epistemic beliefs, both Faith in Intuition for Facts and Truth is Political were linked to conservatism (Garret & Weeks, 2017). Additionally, conservatism has been shown to be associated with the endorsement of COVID-19 conspiracy theories as well as less protective behavior (e.g., de Bruin et al., 2020; Freeman et al., 2020). In addition to these associations, political orientation could moderate the paths between D, epistemic beliefs, and both COVID-19 variables. More specifically, the joint occurrence of high scores on D and a right-wing political orientation could provide particularly fertile ground for strong inclinations to endorse post-truth epistemic beliefs, conspiracy ideation, and harmful behavior. For left-leaning individuals high in D, such inclinations could be weaker, as their social environment is likely more critical towards these stands, thereby reducing their utility. Moreover, post-truth epistemic beliefs could relate to the outcome variables in different ways, with stronger links for individuals with a more right-leaning political orientation.

Figure 1

The Proposed Mediator Models with Endorsement of COVID-19 Conspiracy Theories (1a) and COVID-19 Protective Behavior (1b) as the Dependent Variables.



The Present Research

Despite its theoretical plausibility, the connection between dark traits and epistemic beliefs has not been investigated yet and empirical evidence for the link between epistemic beliefs and the endorsement of conspiracy theories rests on one study (Garret & Weeks, 2017). The latter authors showed that all three epistemic beliefs were associated with the score on a conspiracist ideation scale, but the results were somewhat mixed when relationships to conspiracy-related assertions about specific topics were examined (e.g., “Vaccines cause autism”). Although Machiavellianism and psychopathy have been linked to endorsing COVID-19 conspiracy theories (Hughes & Machan, 2021) and engaging in less protective behavior (Triberti et al., 2021), research on the characteristic handling of evidence associated with dark traits is still missing. Additionally, we intend to corroborate as well as to extend prior research using a

measure of the core of dark traits. Our studies are not only the first to investigate the link between dark traits and epistemic beliefs, but also to propose a model taking into account the complex interactions between dark traits, epistemic beliefs and political orientation as well as their collective effect on COVID-19-related cognitions and behavior (for an overview, see Figure 1). Four studies are presented: In Study 1, we investigated the relationship between D and epistemic beliefs, while in Studies 2-4 we included links to the endorsement of COVID-19 conspiracy theories and engagement in COVID-19 protective behavior, both inside and outside the United States over the course of the pandemic.

We expected D to be positively associated with Faith in Intuition for Facts and Truth is Political and negatively associated with Need for Evidence (Studies 1-4). We further expected D to be positively associated with the endorsement of COVID-19 conspiracy theories and negatively associated with COVID-19 protective behavior (Studies 2-4). We hypothesized that these associations would be mediated by Faith in Intuition for Facts, Need for Evidence and Truth is Political, with Faith in Intuition for Facts and Truth is Political being positively and Need for Evidence being negatively associated with the endorsement of COVID-19 conspiracy theories. For COVID-19 protective behavior, we expected the reverse pattern of correlations (Studies 2-4).

In Studies 2-4, we also investigated the potential moderating role of political orientation on the associations described above. Following preliminary results (Study 2), we expected that the associations between D and the endorsement of COVID-19 conspiracy theories and engagement in COVID-19 protective behavior would increase with a more conservative political orientation. We expected the same pattern for the association between D and Truth is Political. Additionally, we expected both the association between D and Need for Evidence and the association between Need for Evidence and the endorsement of COVID-19 conspiracy theories to increase with a more liberal political orientation (Studies 3 and 4).

For all studies presented in this article, we report how we determined our sample size, all data exclusions, and all measures in the study, and we follow the Journal Article Reporting

Standards (JARS; Kazak, 2018). All data, analysis code, research materials are available at https://osf.io/g3xkw/?view_only=4a7137cce68a4f3e964b3c746e347226. All studies were preregistered (Study 1: <https://aspredicted.org/blind.php?x=bp5b3x>; Study 2: <https://aspredicted.org/blind.php?x=9mq4xn>; Study 3: <https://aspredicted.org/blind.php?x=962tn4>; Study 4: <https://aspredicted.org/blind.php?x=4262j3>).

Study 1

In the first study, we explored the relationship between D and the epistemic beliefs subscales Faith in Intuition for Facts, Need for Evidence, and Truth is Political. A more detailed report of a confirmatory factor analysis can be found in the online supplement (S1).

Method

Participants

Our required sample size was based on a study by Wolf et al. (2013) who systematically varied major model properties to evaluate sample size requirements for commonly used structural equation models using Monte Carlo data simulation techniques. Note that, despite being an ancillary analysis in our case, confirmatory factor analysis demands greater sample sizes than the zero-order correlations presented below. Based on their results for similar models, we aimed for a final minimum sample size of 300 participants, and we recruited 407 participants via Mechanical Turk to account for exclusions and paid 1 USD. We excluded 55 participants because they failed to respond to our control question appropriately (“This is a control question. Please do not select any of the 7 options below.”; for details on the exclusion criteria and wordings of the control questions in all four studies see S5.3). Further, 30 participants were excluded because they showed unreasonably low response times of less than 90 seconds and one participant because of an unreasonably high response time of more than 2700 seconds, indicating careless responding. The final sample consisted of 321 participants ($M = 37.12$, $SD = 10.73$, 20-78 years, 38% female). In terms of educational attainment, 38.3% had graduated from high school, 48.3% had a bachelor’s degree, 9.0 % had a master’s degree and 1.6 % had a Ph.D. or higher. The remaining

2.8 % completed some high school or trade school. Regarding ethnicity, 75.7% stated they were White, 10.3% Black, 6.2 % Hispanic, 5.3% Asian or Asian American, and 0.6% Native American.

Measures

Epistemic beliefs were assessed with a 12-item questionnaire by Garret and Weeks (2017) capturing the three subscales Faith in Intuition for Facts (e.g., “I trust my gut to tell what’s true and what’s not”, $\alpha = .92$), Need for Evidence (e.g., “Evidence is more important than whether something feels true”, $\alpha = .84$) and Truth is Political (e.g., “Facts depend on their political context”, $\alpha = .92$) with four items per subscale. Items are answered on a 7-point scale, ranging from *strongly disagree* (1) to *strongly agree* (7).

The Dark Factor of Personality was assessed with the D16 short version (Moshagen et al., 2020). It consists of 16 items with a 7-point scale, ranging from *strongly disagree* (1) to *strongly agree* (7, e.g., “My own pleasure is all that matters”, $\alpha = .90$).

Table 1

Study 1: Means, Standard Deviations, and Zero-Order Correlations of the Continuous Variables

	<i>M (SD)</i>	(1)	(2)	(3)
(1) Dark Factor of Personality	2.43 (0.95)	-		
(2) Faith in Intuition for Facts	4.61 (1.36)	.27**	-	
(3) Need for Evidence	5.84 (0.93)	-.20**	-.34**	-
(4) Truth is Political	3.41 (1.57)	.50**	.35**	-.22**

Note. $N = 321$. ** $p < .001$.

Results and Discussion

Table 1 shows all zero-order correlations between the epistemic beliefs subscales and D as well as their means and standard deviations. As expected, Faith in Intuition for Facts and Truth is Political correlated positively with D, $r = .27, p < .001$ and $r = .50, p < .001$, respectively, and

Need for Evidence was negatively correlated with D, $r = -.20$, $p < .001$. Study 1 provides first evidence for the link between D and the epistemic beliefs subscales. Indeed, the higher the participants' tendency to maximize their individual utility, the less they were inclined to commit to "the unforced force of the better argument" in Habermas' terms (Habermas, 1996, p. 305). These results build the foundation for Studies 2-4 that investigated the effects of D and epistemic beliefs on the endorsement of COVID-19 conspiracy theories and the engagement in COVID-19 protective behavior.

Study 2

The study was conducted on March 21, 2020, 10 days after the World Health Organization declared the COVID-19 outbreak a pandemic (WHO, 2020a). At this time, there had been around 15,000 reported cases of COVID-19 infections in the United States and 201 registered COVID-19-related deaths (WHO, 2020b). The pandemic had started to dominate the public debate (McKinley, 2020).

Method

Participants

Based on an analysis with G*Power (Faul et al., 2009), the required sample size for identifying an association of $r = .15$, with $\alpha = .05$ and power = .90 is 462. Accordingly, we aimed for 550 participants to account for potential exclusions. Participants were recruited via Mechanical Turk and were paid 1.50 USD. In total, 550 participants completed the questionnaire. As we relied on U.S. participants, 56 participants were excluded because they either used a VPN/VPS or a proxy to mask their country and/or failed to provide an adequate description of the study in English implying they are not native speakers or bots or careless responders. Additionally, we excluded 26 participants because they failed to respond to at least one of our control questions appropriately (see Table S5.3). Further, 13 participants were excluded because they showed unreasonably low response times of less than 120 seconds and two participants because of unreasonably high response times of more than 2700 seconds, indicating careless

responding.¹ The final sample amounted to 453 participants ($M = 40.37$ years, $SD = 12.23$ years, 19-78 years, 42.4% female).² In terms of educational attainment, 29.6 % had graduated from high school, 53.2 % had a bachelor's degree, 13.7 % had a master's degree and 1.1 % had a Ph.D. or higher. The remaining 2.4 % completed some high school or trade school. Regarding ethnicity, 79.5 % stated they were White, 7.5 % Black, 7.5 % Asian or Asian American, 4.6 % Hispanic, and 0.5 % Native American.

Measures

In Study 2, we relied on the same measures for the epistemic beliefs and D that were used in Study 1. Again, reliabilities were excellent or good (Table S5.2). Further, we assessed participants' endorsement of COVID-19 conspiracy theories. The items were based on popular COVID-19 conspiracy theories circulating at the time of assessment and a prior instrument for assessing the endorsement of conspiracy theories regarding the Zika virus (Piltch-Loeb et al., 2019). On a 7-point scale, participants indicated the likelihood of six statements (e.g., "COVID-19 is a biological weapon originally developed by the Chinese government."). Options ranged from *not at all likely* (1) to *extremely likely* (7), $\alpha = .92$.

The items for COVID-19 protective behavior were based on the COVID-19 pandemic behavior guidelines provided by the WHO (2020a). Participants indicated how much they complied with six statements referring to behaviors to slow the distribution of the coronavirus in the last three days (e.g., "In the last three days I have stayed home, unless required for my job, to buy groceries, or to help those in need."). A 7-point scale was provided, options ranged from *strongly disagree* (1) to *strongly agree* (7), $\alpha = .78$.

¹ Note that we adjusted our low response time exclusion criterion from 90 seconds (Study 1) to 120 seconds (Studies 2, 3, and 4), because the number of items was substantially larger in the latter three studies. Some scholars (e.g., Paas & Morren, 2018; Read et al., 2021) recommend the exclusion of particularly long response times and we followed this advice. In addition to the analyses reported in the main text, we performed the analyses without applying the upper exclusion criterion. All major results remain virtually the same (see Supplement S5).

² The final sample size was a bit smaller than planned. Given $\alpha = .05$, power = .90, and a sample size of 453, we were able to detect an association of $r = .151$, not $r = .150$ as originally planned (Faul et al., 2009).

Two additional items were used to measure the interference of social life during the past four weeks due to physical health or emotional problems (Hays et al., 1993). We used the mean of both items as a control variable for additional analyses that involved the behavioral dependent variable (Supplement S2). Political orientation was assessed with a 7-point scale ($M = 3.58$, $SD = 1.84$). Options ranged from *extremely left* (1) to *extremely right* (7). Please note that our sample's distribution of political orientation was somewhat right-skewed. In Studies 2-4, we further assessed the percentages of participants tested (positive) for SARS-CoV-2 (see Table S5.1). We included participants irrespective of their test results. The means, standard deviations, and zero order correlations of all focal variables are displayed in Table S2.1.

Results and Discussion

We used PROCESS version 3.4.1 (Hayes, 2018) for our main analyses. While D served as the independent variable, endorsement of COVID-19 conspiracy theories and COVID-19 protective behavior served as dependent variables, respectively. The epistemic belief scales were entered as simultaneous mediators. The data for D and epistemic beliefs were standardized prior to all mediation and moderation analyses. In this parallel multiple mediator model, antecedent variable D was modeled as influencing one dependent variable (endorsement of COVID-19 conspiracy theories or COVID-19 protective behavior) directly as well as indirectly through the three mediators, with the condition that no mediator causally influences another (Hayes, 2018).

The path coefficients, standard errors, and p -values are shown in Figure 2a. The first analysis yielded a total effect of D on the endorsement of COVID-19 conspiracy theories, $B = .79$, $SEB = .06$, 95% CI [.68; .90], $p < .001$, indicating that individuals high in D tend to endorse COVID-19 conspiracy theories. D was associated with all three epistemic beliefs in the expected directions. Also, in accordance with our predictions, Faith in Intuition for Facts and Truth is Political were associated with the endorsement of COVID-19 conspiracy theories. Need for Evidence was unrelated to the endorsement of COVID-19 conspiracy theories. We found a significant indirect effect for Faith in Intuition for Facts, $B = .09$, $SEB = .02$, 95% CI [.05; .13] as

a mediator, as well as for Truth is Political, $B = .20$, $SEB = .03$, 95%CI [.14; .27]. Need for Evidence did not serve as a mediator, $B = .03$, $SEB = .02$, 95%CI [-.02; .08]. These results show that the association between D and the endorsement of COVID-19 conspiracy theories can be partly explained by the epistemic beliefs held by individuals high in D.

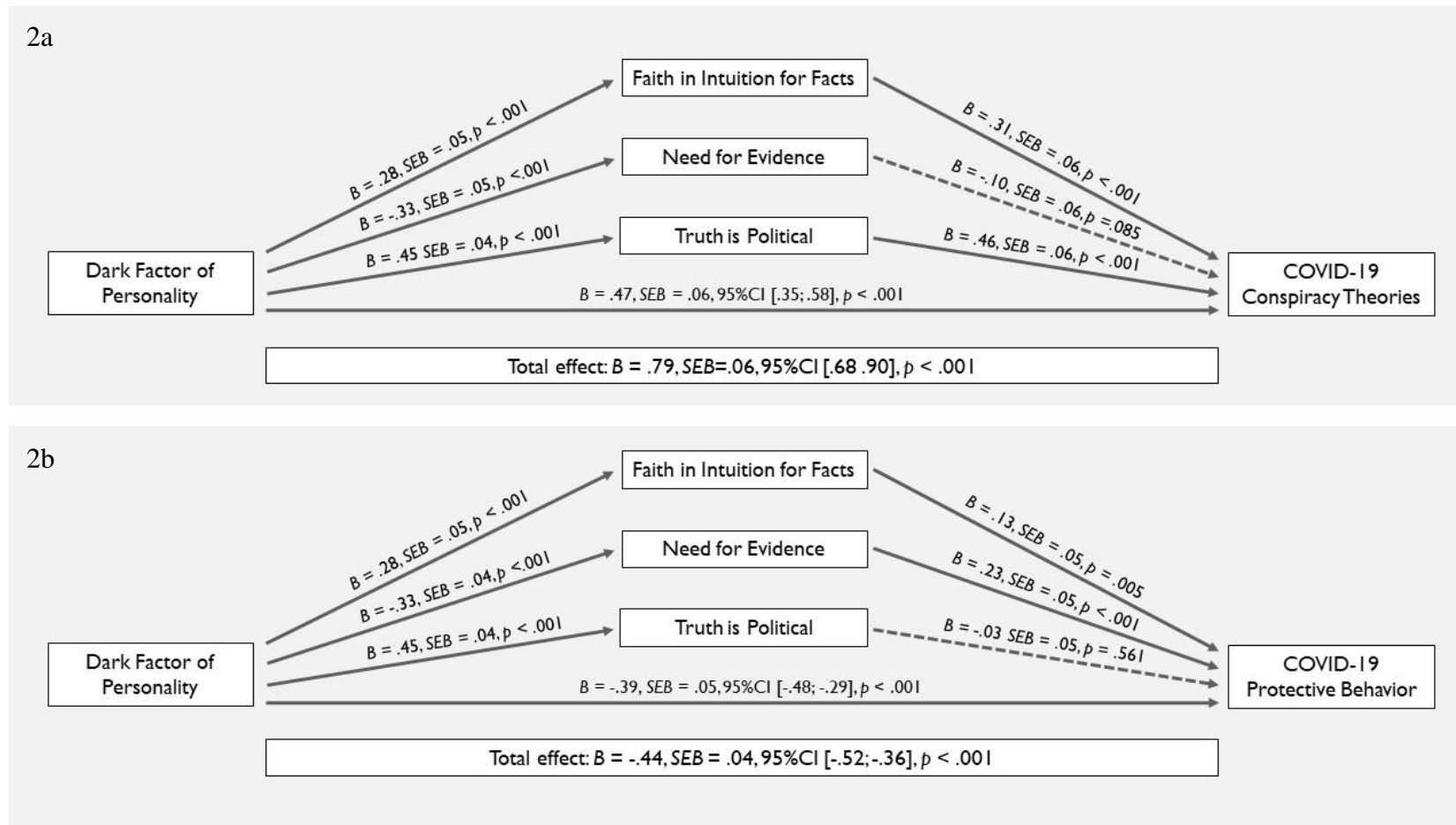
The second parallel mediation analysis yielded a significant total effect of D on COVID-19 protective behavior, $B = -.44$, $SEB = .04$, 95%CI [-.52; -.36], $p < .001$, indicating that individuals with high levels in D showed less COVID-19 protective behavior. Further, Faith in Intuition for Facts and Need for Evidence predicted COVID-19 protective behavior (Figure 2b). Note that although we expected a negative association between Faith in Intuition for Facts and COVID-19 protective behavior, the association was positive. Truth is Political was unrelated to the dependent variable in the joint model. As expected, we found a significant indirect effect of D on COVID-19 protective behavior, mediated by Faith in Intuition for Facts, $B = .04$, $SEB = .01$, 95%CI [.01; .06] and Need for Evidence, $B = -.08$, $SEB = .02$, 95%CI [-.11; -.04]. Truth is Political, $B = -.01$, $SEB = .02$, 95%CI [-.06; .03], did not serve as a mediator. These results show that the association between D and COVID-19 protective behavior can be partly explained by epistemic beliefs shown by individuals high in D.

Additionally, we performed two moderation analyses that included political orientation as a moderator variable of the mediation paths outlined above. Endorsement of COVID-19 conspiracy theories or COVID-19 protective behavior served as dependent variables. Political orientation was significantly associated with both endorsing COVID-19 conspiracy theories, $B = .33$, $SEB = .05$, 95%CI [.23; .44], $p < .001$, and COVID-19 protective behavior, $B = -.12$, $SEB = .05$, 95%CI [-.21; -.03], $p = .010$, indicating that a more right-wing political orientation was associated with a stronger endorsement of COVID-19 conspiracy theories and less engagement in COVID-19 protective behavior. In these models, D was positively associated with the endorsement of COVID-19 conspiracy theories, $B = .39$, $SEB = .06$, 95%CI [.28; .50], $p < .001$, and negatively

associated with the engagement in COVID-19 protective behavior, $B = -.36$, $SEB = .05$, 95% $CI [-$
 $.45; -.27]$, $p < .001$.

Figure 2

Study 2: Main Results of the Parallel Mediator Models with Endorsement of COVID-19 Conspiracy Theories (2a) and COVID-19 Protective Behavior (2b) as the Dependent Variables

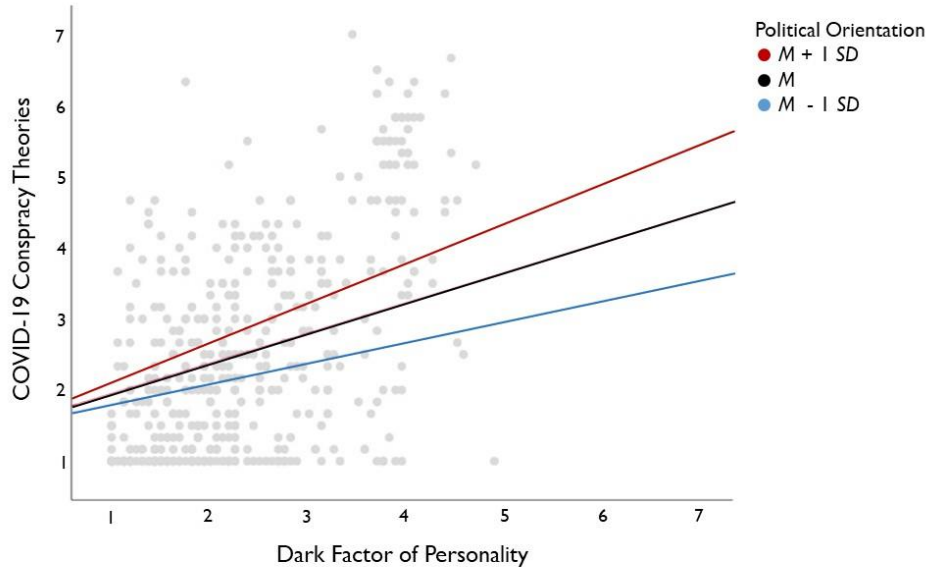


Note. Solid paths indicate significant associations ($p < .05$), dashed paths are non-significant.

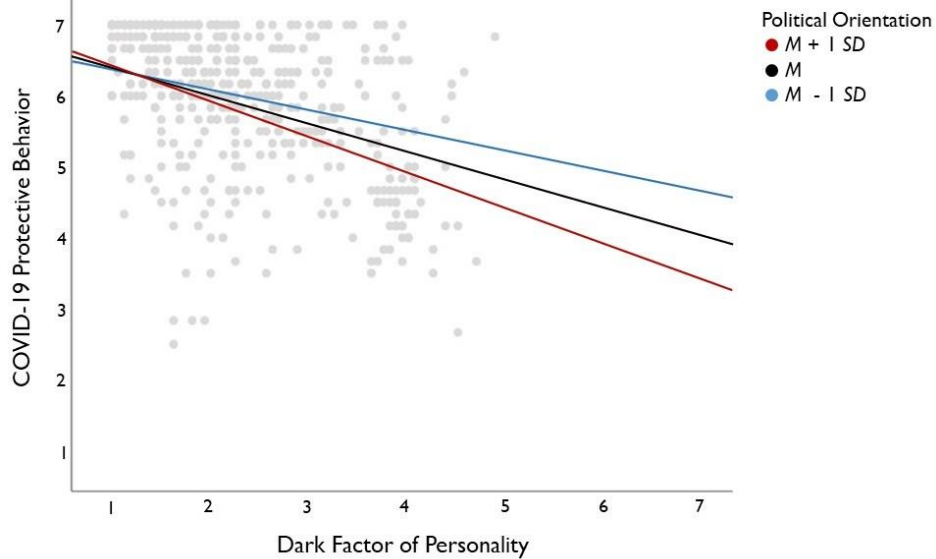
Figure 3

Graphical Representation of the Interaction Between D and Political Orientation with COVID-19 Conspiracy Theories (3a) and COVID-19 Protective Behavior (3b) as Criteria (Study 2).

3a



3b



Note. Higher scores in political orientation indicate a more right-leaning orientation. Semi-transparent scatterplots represent single data points.

Importantly, we found a significant overall interaction effect of political orientation: The positive association between D and the endorsement of COVID-19 conspiracy theories increased with a more right-wing political orientation, $B = .12$; $SEB = .05$, 95%CI [.02; .23], $p = .024$ (see Figure 3a). For individuals scoring more to the right of the political spectrum ($M + 1 SD$), the positive association between D and the endorsement of COVID-19 conspiracy theories was the strongest, $B = .52$; $SEB = .07$, 95%CI [.37; .66], $p < .001$, but it remained significant for individuals scoring more to the left of the political spectrum ($M - 1 SD$), $B = .27$; $SEB = .08$, 95%CI [.11; .43], $p = .001$.

We also found a moderating effect of political orientation on the effect of D on COVID-19 protective behavior, $B = -.10$, $SEB = .05$, 95%CI [-.19; -.01], $p = .033$ (Figure 3b). For individuals scoring more to the right of the political spectrum ($M + 1 SD$), the negative association between D and COVID-19 protective behavior was the strongest, $B = -.46$; $SEB = .06$, 95%CI [-.59; -.34], $p < .001$, but it remained significant for individuals scoring more to the left of the political spectrum ($M - 1 SD$), $B = -.26$; $SEB = .07$, 95%CI [-.40; -.13], $p < .001$.

Political orientation also moderated several additional paths of our mediation models, which will be outlined in the following (see Figure S2 for graphical depictions, and Tables S2.2-S2.4 for the complete regression results). There was a significant moderating effect on the association between D and Need for Evidence, $B = .11$, $SEB = .04$, 95%CI [.02; .20], $p = .017$. For individuals scoring more to the left of the political spectrum ($M - 1 SD$), the negative association between D and Need for Evidence was the strongest, $B = -.40$; $SEB = .07$, 95%CI [-.53; -.27], $p < .001$, but it remained significant for individuals scoring more to the right of the political spectrum ($M + 1 SD$), $B = -.19$; $SEB = .06$, 95%CI [-.30; -.07], $p = .001$. Political orientation further moderated the association between D and Truth is Political, $B = .10$, $SEB = .04$, 95%CI [.02; .19], $p = .012$. For individuals scoring more to the right of the political spectrum ($M + 1 SD$), the positive association between D and Truth is Political was the strongest, $B = .48$; $SEB = .06$, 95%CI [.37; .59], $p < .001$, but it remained significant for individuals scoring more to

the left of the political spectrum ($M - 1 SD$), $B = .27$; $SEB = .06$, 95%CI [.15; .40], $p < .001$.

Political orientation also moderated the association between Need for Evidence and the endorsement of COVID-19 conspiracy theories, $B = .14$, $SEB = .05$, 95%CI [.03; .24], $p = .010$.

For individuals scoring more to the left of the political spectrum ($M - 1 SD$), the negative association between Need for Evidence and the endorsement of COVID-19 conspiracy theories was the strongest, $B = -.27$; $SEB = .09$, 95%CI [-.44; -.10], $p = .002$, and it did not remain significant for individuals scoring more to the right of the political spectrum ($M + 1 SD$), $B = .01$; $SEB = .07$, 95%CI [-.12; .14], $p = .911$.

In sum, Study 2 supports our proposed model taking into account D, epistemic beliefs and political orientation as well as their interactive effect on COVID-19-related beliefs and behavior. We present evidence for the link between epistemic beliefs and COVID-19 related beliefs and behaviors. Our results build upon existing empirical evidence for the connection between dark traits and the endorsement of COVID-19 conspiracy theories and protective behavior. We find a tendency of individuals with high levels in D to endorse COVID-19 conspiracies as well as to neglect COVID-19 protective behavior. Our results show that the effect of D on the endorsement of COVID-19 conspiracy theories and the engagement in COVID-19 protective behavior can be explained by post-truth epistemic beliefs held by individuals high in D and that the strength of the associations increases with a more conservative political orientation.

Study 3

Due to constantly and rapidly changing circumstances during the COVID-19 pandemic, the need to replicate initial findings appeared to be of extraordinary importance. Thus, in Study 3 we aimed for a replication of Study 2 using a larger sample size to corroborate the results at a later stage of the pandemic. Study 3 was conducted six months after Study 2, on October 14 and 15, 2020. At the time, there were almost eight million reported cases of COVID-19 infections in the USA and around 214,000 registered COVID-19-related deaths (WHO, 2020b).

Before and during Trump's presidency, political polarization in the USA had increased (Abramowitz, 2018) and COVID-19 had become a partisan issue when Study 3 was conducted (Makridis & Rothwell, 2020; Druckman et al., 2021; Gollwitzer et al., 2020). The politicization of COVID-19 led to the crucial question whether individual differences in epistemic beliefs could still contribute to explaining the endorsement of COVID-19 conspiracy theories and engagement in protective behavior and whether the interactions with political orientation found in Study 2 could still be observed. Apart from minor adjustments to the scales used to assess COVID-19 protective behavior (see Measures), our hypotheses and methods remained identical to those in Study 2.

Method

Participants

We aimed for a substantially larger sample size than for our previous studies based on extant recommendations for powering replications and interaction effects (Giner-Sorolla, 2018; Simonsohn, 2015). A sample of 1156 Mechanical Turk participants was invited, and 1113 participants completed the questionnaire and were paid 1.10 USD. We excluded 164 participants that either used a VPN/VPS or a proxy to mask their country of access and/or failed to provide an adequate description of the study in English implying they were not native speakers or bots or careless responders (Kennedy et al., 2020). We excluded another 14 participants because they failed to answer at least one of our control questions correctly (see Table S5.3). Further, one additional participant was excluded because of an unreasonably low response time of less than 120 seconds and eight participants because of unreasonably high response times of more than 2700 seconds. Participants were asked to state both their current age as well as their year of birth. Three participants were excluded because there was a mismatch between the two pieces of information, which was another indicator of careless responding (Kennedy, et al., 2020). The final sample amounted to 923 participants ($M = 39.43$ years, $SD = 11.64$ years, 19-78 years, 44.9 % female). In terms of educational attainment, 29.6 % had graduated from high school, 51.1 %

had a bachelor's degree, 14.0 % a master's degree, and 2.0 % had a Ph.D or higher. The remaining 3.3 % completed some high school or trade school. Regarding ethnicity, 79.2 % stated they were White, 7.4 % Black, 7.3 % Asian or Asian American, 3.9 % Hispanic, and 0.1 % Native American.

Measures

In Study 3, we relied on the same measures for D, epistemic beliefs, the endorsement of COVID-19 conspiracy theories and political orientation that were used in Studies 1 and 2. Again, reliabilities were excellent or good (see Table S5.2 and Table S3.1 for the descriptive statistics and zero-order correlations) and political orientation scores were somewhat right-skewed ($M = 3.57$; $SD = 1.76$). As the WHO advice for the public had been updated since Study 2 (WHO, 2020a), we changed our items for COVID-19 protective behavior slightly in accordance with the WHO advice. The means, standard deviations, and zero order correlations of the focal variables are reported in Table S3.1.

Results and Discussion

We performed the same analyses as in Study 2. Path coefficients, standard errors, and p -values are shown in Figure 4. The first analysis yielded a total effect of D on the endorsement of COVID-19 conspiracy theories, $B = .50$, $SEB = .04$, 95%CI [.42; .57], $p < .001$, corroborating the result from Study 2. D was associated with Need for Evidence and Truth is Political in the expected directions, but D was not significantly correlated with Faith in Intuition for Facts. Further, the epistemic beliefs were associated with the endorsement of COVID-19 conspiracy theories in the expected directions. We found a significant indirect effect of D on the endorsement of COVID-19 conspiracy theories, mediated by Need for Evidence, $B = .04$, $SEB = .01$, 95%CI [.02; .07], and an indirect effect, mediated by Truth is Political, $B = .12$; $SEB = .02$; 95%CI [.09; .16]. Faith in Intuition for Facts did not serve as a mediator, $B = .01$; $SEB = .01$; 95%CI [-.01; .03]. These results, obtained at a later stage of the pandemic, corroborate the

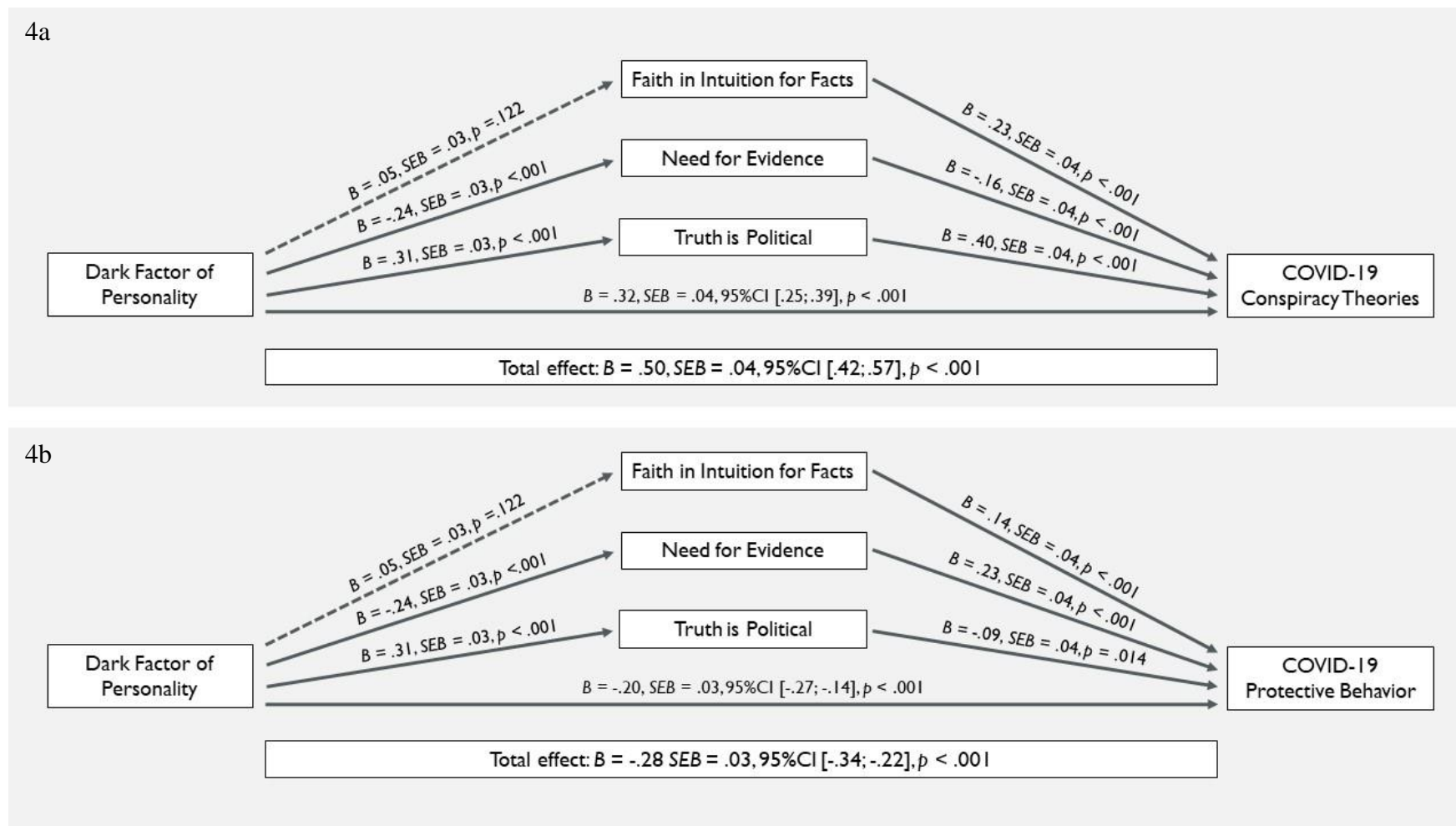
assumption that the association between D and the endorsement of COVID-19 conspiracy theories can be explained by the epistemic beliefs held by individuals high in D.

The second parallel mediation analysis yielded a significant total effect of D on COVID-19 protective behavior, $B = -.28$, $SEB = .03$, 95%CI [-.34; -.22], $p < .001$, replicating the finding that individuals with high levels in D tend to show less COVID-19 protective behavior. As expected, Need for Evidence and Truth is Political predicted COVID-19 protective behavior (Figure 4b). Faith in Intuition for Facts also predicted COVID-19 protective behavior, but not in the expected direction. In line with our hypotheses, we found a significant indirect effect of D on COVID-19 protective behavior, mediated by Need for Evidence, $B = -.06$; $SEB = .01$; 95%CI [-.08; -.03] and Truth is Political, $B = -.03$; $SEB = .01$; 95%CI [-.05; -.01]. Faith in Intuition for Facts, $B = .01$; $SEB = .01$; 95%CI [-.003; .02], did not serve as a mediator. These results further support the assumption that the association between D and COVID-19 protective behavior can be explained by the epistemic beliefs held by individuals high in D.

As in Study 2, we performed two moderation analyses including political orientation as a moderator variable and the endorsement of COVID-19 conspiracy theories and COVID-19 protective behavior as dependent variables respectively. Political orientation predicted both the endorsement of COVID-19 conspiracy theories, $B = .35$, $SEB = .04$, 95%CI [.28; .42], $p < .001$ and COVID-19 protective behavior, $B = -.27$, $SEB = .03$, 95%CI [-.33; -.20], $p < .001$. In these models, D was positively associated with the endorsement of COVID-19 conspiracy theories, $B = .30$, $SEB = .04$, 95%CI [.23; .37], $p < .001$, and negatively associated with the engagement in COVID-19 protective behavior, $B = -.20$, $SEB = .03$, 95%CI [-.26; -.13], $p < .001$. Deviating from the results of Study 2, political orientation did neither moderate the effects of D on the endorsement of COVID-19 conspiracy theories, $B = .05$, $SEB = .03$, 95%CI [-.02; .12], $p = .148$, nor on COVID-19 protective behavior, $B = .01$, $SEB = .03$, 95%CI [-.05; .07], $p = .759$.

Figure 4

Study 3: Main Results of the Parallel Mediator Models with Endorsement of COVID-19 Conspiracy Theories (4a) and COVID-19 Protective Behavior (4b) as the Dependent Variables



Note. Solid paths indicate significant associations ($p < .05$), dashed paths are non-significant.

However, we did find a moderating effect of political orientation on the association between D and Need for Evidence, $B = .11$, $SEB = .03$, 95%CI [.05; .17], $p < .001$ (Figure S3a). For individuals scoring more to the left of the political spectrum ($M - 1 SD$), the negative association between D and Need for Evidence was the strongest, $B = -.33$, $SEB = .05$, 95%CI [-.42; -.24], $p < .001$, but it remained significant for individuals scoring more to the right of the political spectrum ($M + 1 SD$), $B = -.11$, $SEB = .04$, 95%CI [-.20; -.03], $p = .006$. We also found a moderating effect of political orientation on the association between Faith in Intuition for Facts and COVID-19 protective behavior, $B = .07$, $SEB = .03$, 95%CI [.01; .13], $p = .028$ (Figure S3b). For individuals scoring more to the right of the political spectrum ($M + 1 SD$), the positive association between Faith in Intuition for Facts and COVID-19 protective behavior was the strongest, $B = .24$, $SEB = .05$, 95%CI [.15; .33], $p < .001$, but it remained significant for individuals scoring more to the left of the political spectrum ($M - 1 SD$), $B = .10$, $SEB = .05$, 95%CI [.01; .19], $p = .039$.

Study 3 largely corroborated our proposed model at a later stage of the pandemic at times of increased political polarization. We found support for the role of post-truth epistemic beliefs and respective links to D, to the endorsement of COVID-19 conspiracy theories, and to the engagement in COVID-19 protective behavior. Study 3 yielded an additional significant indirect effect of D on the endorsement of COVID-19 conspiracy theories, mediated by Need for Evidence that was not found in Study 2. We also found an additional significant indirect effect of D on COVID-19 protective behavior, mediated by Truth is Political. We did not replicate the indirect effect of D on the endorsement of COVID-19 conspiracy theories, mediated by Faith in Intuition for Facts (which involved an association that was reversed to what we had expected) as well as most of the moderating effects of political orientation. Nevertheless, the substantial main effects of political orientation on the dependent variables do speak for the pivotal role of political orientation as a

contributing factor to the endorsement of COVID-19 conspiracy theories and neglect of COVID-19 protective behavior.

Study 4

After having found largely consistent support for our proposed model focusing on the antecedents and consequences of post-truth epistemic beliefs over the course of the pandemic, we aimed to corroborate our results outside of the United States to provide support for their cross-cultural validity. Study 4 was conducted in Germany on December 22, 2020. At this time, around 1,500,000 people or 1.9% of the German population had reportedly been infected with SARS-CoV-2 and around 27,000 COVID-19-related deaths were registered for this country (WHO, 2020b).³ There are certain differences between the US and Germany with regard to public trust in science and political polarization. In a study that was conducted in the years 2019 and 2020, 13% of the German population stated that they had little or no trust in science, whereas it was 21% in the USA (Funk et al., 2020). In addition, in the USA the degree of polarization regarding trust in science between people self-identifying as politically left or right was far more pronounced (Funk et al., 2020). In both countries, COVID-19 conspiracy theories are endorsed by a substantial part of the public (although the popularity of specific theories varies). In Germany, 17% of the population agreed to the notion that the government used COVID-19 as an excuse to restrict civil liberties (Infratest dimap, 2020), whereas 25% of U.S. citizens thought that the outbreak and dissemination of COVID-19 was planned (Schaeffer, 2020). In contrast to the inconsistent and multi-faceted assessment of COVID-19 by the US government and members of the Republican party, there was a major consensus among German parties (including the then ruling conservative party, Christlich

³ The infection rate is comparable to the infection rate of 2.4% of the U.S. population at the time of assessment of Study 3 (WHO, 2020b). However, there were only half as many reported COVID-19 related fatalities per 100,000 inhabitants in Germany (33 per 100,000 on December 22, 2020) than in the USA at the time of assessment of Study 3 (65 per 100,000 on October 15, 2020).

Demokratische Union, CDU) in favor of science-based protective measures against COVID-19, such as wearing face masks, lockdowns, and social distancing (e.g., Dean et al., 2020; Deutsche Welle, 2020). Apart from minor adjustments to the scales used to assess the endorsement of COVID-19 conspiracy theories (see Measures), our hypotheses and methods remained unchanged.

Method

Participants

We used G*Power and point biserial correlations as our basis for determining our sample size a priori. Given $r = .20$, $\alpha = .05$ and power = .80, a sample size of 191 is required.⁴ To add power for the interaction analyses, the required sample size was doubled, yielding 383 participants (Giner-Sorolla, 2018; Simonsohn, 2017). We aimed for 550 participants to account for potential exclusions. Participants were recruited online from the crowdworking site clickworker.de and paid 1.30 €. In total, 550 participants were invited to participate in our study and 539 participants completed it. We excluded 11 participants because they failed to respond to at least one of our control questions appropriately (see Table S5.3). Further, three participants were excluded because of unreasonably low response times of less than 120 seconds and seven participants because of unreasonably high response times of more than 2700 seconds. Another four participants were excluded because they were under the age of 18. One participant did not indicate their political orientation and therefore had to be excluded. The final sample amounted to 513 participants ($M = 37.54$ years, $SD = 12.23$ years, 18-73 years, 40.7 % female). In terms of educational attainment, 32.4% had graduated from high school, 43.5 % had a bachelor's degree or master's degree. Another 24.0 % completed some high school and one participant had no degree.

⁴ Note that in Study 2 we aimed for 90% power, as it was the first study in which we applied our newly developed model, 80% power appeared adequate for the subsequent studies. Furthermore, in Study 4 we relied on point biserial correlations as a basis for our sample size calculation because we also assessed a dichotomous dependent variable (the usage of a contact tracing app) but decided to move these analyses to the Online Supplement. Based on a Pearson correlation of $r = .20$, $\alpha = .05$, and power = .80, the required sample size would have amounted to 193 participants.

Measures

In Study 4, we relied on the same measures for D, the epistemic beliefs, COVID-19 protective behavior, and political orientation that were used in Studies 1-3. Reliabilities were good, close to excellent (Table S5.2), the distribution of political orientation was somewhat right-skewed ($M = 3.62$, $SD = 0.99$). Prior research showed that content of popular conspiracy theories in Germany differed somewhat from those in the USA. Thus, a set of items based on COVID-19 conspiracy theories circulating in Germany during the time of assessment was used (Imhoff & Lamberty, 2020). For the assessment of D, we used the German version of the scale we had used in the previous studies (Bader et al., 2021). All other scales were translated to German using the committee method.⁵ Please refer to Table S4.1 for descriptive statistics (including zero order correlations) of all focal variables.

Results and Discussion

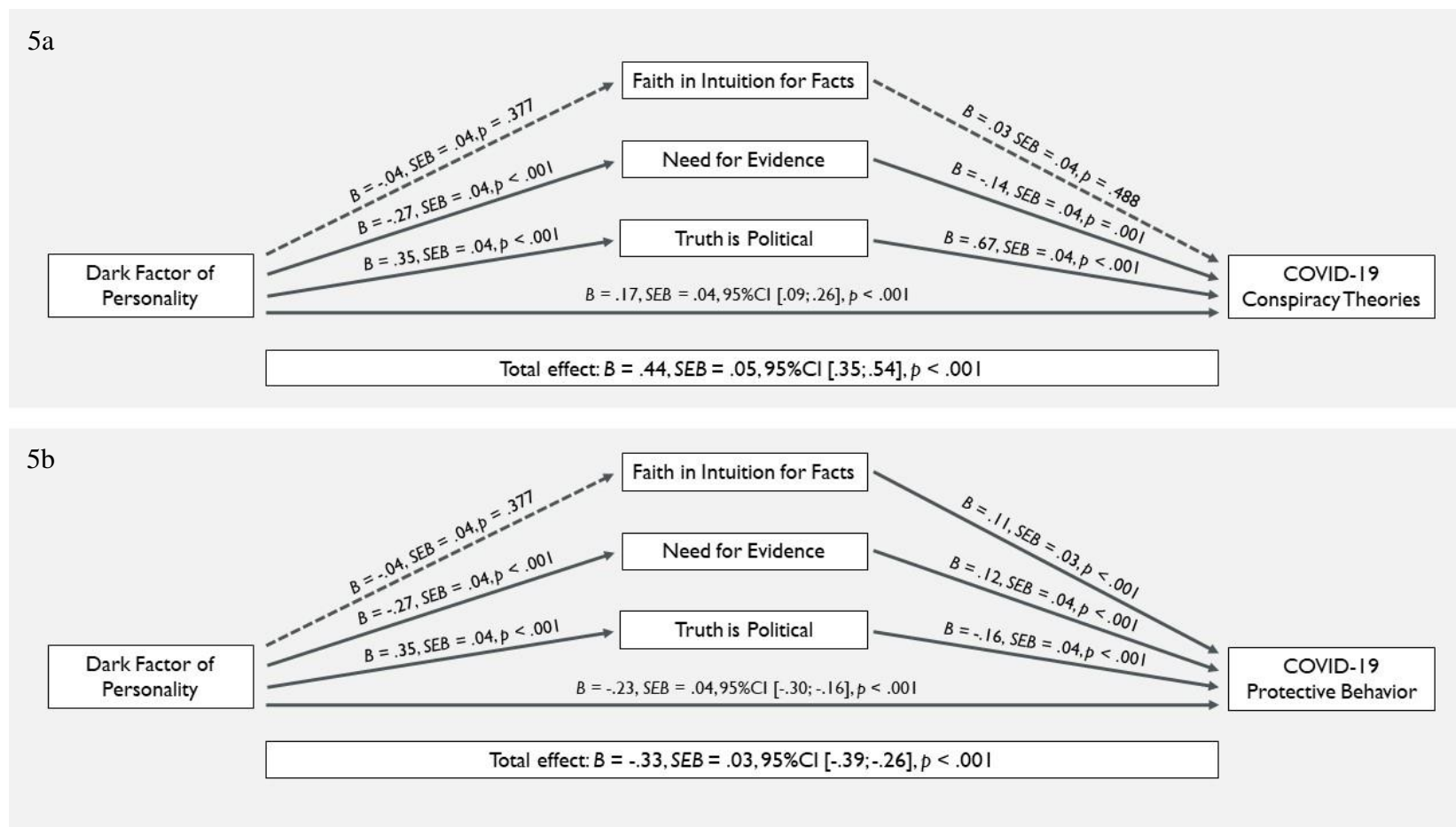
We performed the same analyses as in Studies 2 and 3. Path coefficients, standard errors, and p -values are shown in Figure 5. The first analysis yielded a total effect of D on the endorsement of COVID-19 conspiracy theories, $B = .44$, $SEB = .05$, 95% CI [.35; .54], $p < .001$, corroborating the results of Studies 2 and 3. D was associated with Need for Evidence and Truth is Political in the expected directions, but not significantly linked to Faith in Intuition for Facts. Further, Need for Evidence and Truth is Political were associated with the endorsement of COVID-19 conspiracy theories in the expected directions, while Faith in Intuition for Facts was not significantly associated with endorsing COVID-19 conspiracy theories. As expected, we found a significant indirect effect of D on the endorsement of COVID-19 conspiracy theories, mediated by Need for Evidence, $B = .04$;

⁵ Additionally, we expanded our research towards possible effects of D and epistemic beliefs on the use of contact tracing apps, more precisely the *Corona-Warn-App*. Given that at the time the study was conducted the utility of this app was questioned by government officials and many people who were following other behavioral advice (Kreder, 2020; Spiegel, 2020), we are cautious to interpret the data. A detailed report of the results pertaining to the use of the *Corona-Warn-App* as the dependent variable can be found in the Online Supplement S4.

$SEB = .02$; 95% CI [.01; .07], as well as a significant indirect effect of D on the endorsement of COVID-19 conspiracy theories, mediated by Truth is Political, $B = .24$; $SEB = .04$; 95% CI [.17; .31]. Faith in Intuition for Facts did not serve as a mediator, $B = -.001$; $SEB = .003$; 95% CI [-.01; .004]. These results extend our empirical insights to Germany, corroborating the assumption that the association between D and the endorsement of COVID-19 conspiracy theories can be partly explained by post-truth epistemic beliefs held by individuals high in D.

Figure 5

Study 4: Main Results of the Parallel Mediator Models with Endorsement of COVID-19 Conspiracy Theories (5a) and COVID-19 Protective Behavior (5b) as the Dependent Variables



Note. Solid paths indicate significant associations ($p < .05$), dashed paths are non-significant.

The second parallel mediation analysis yielded a significant total effect of D on COVID-19 protective behavior, $B = -.33$, $SEB = .03$, 95%CI [-.39; -.26], $p < .001$, replicating the findings from Studies 2 and 3 that individuals with high levels in D tend to show less COVID-19 protective behavior. Further, Need for Evidence and Truth is Political predicted COVID-19 protective behavior in the expected directions (Figure 5b). As in Studies 2 and 3, Faith in Intuition for Facts was positively associated with COVID-19 protective behavior whereas we had expected an effect in the opposite direction. As expected, we found significant indirect effects of D on COVID-19 protective behavior, mediated by Need for Evidence, $B = -.03$, $SEB = .02$; 95%CI [-.07; -.01], and Truth is Political, $B = -.06$; $SEB = .02$; 95%CI [-.10; -.03]. Faith in Intuition for Facts did not serve as a mediator, $B = -.004$; $SEB = .01$; 95%CI [-.02; .01].

These results further support the assumption that the association between D and COVID-19 protective behavior can be partly explained by epistemic beliefs held by individuals high in D.

As in Studies 2 and 3, we performed two moderation analyses, in which we additionally included political orientation as a moderator variable. The endorsement of COVID-19 conspiracy theories and COVID-19 protective behavior served as dependent variables. Political orientation significantly predicted the endorsement of COVID-19 conspiracy theories, $B = .14$, $SEB = .04$, 95%CI [.06; .22], $p < .001$, but not COVID-19 protective behavior, $B = -.05$, $SEB = .03$, 95%CI [-.12; .02], $p = .127$. D was positively associated with the endorsement of COVID-19 conspiracy theories, $B = .13$, $SEB = .04$, 95%CI [.04; .21], $p = .004$, and negatively associated with the engagement in COVID-19 protective behavior, $B = -.22$, $SEB = .04$, 95%CI [-.29; -.15], $p < .001$. As in Study 3, we did not find any significant moderating effect of political orientation on the links between D and the endorsement of COVID-19 conspiracy theories, $B = .02$, $SEB = .03$, 95%CI [-.05; .09], $p = .550$, nor between D and COVID-19 protective behavior, $B = .01$, $SEB = .03$, 95%CI [-.04; .07], $p = .625$.

Political orientation moderated the association between D and Need for Evidence, $B = .10$, $SEB = .03$, 95%CI [.03; .17], $p = .006$ (Figure S4a). For individuals scoring more to the left of the political spectrum ($M - 1 SD$), the negative association between D and Need for Evidence was the strongest, $B = -.37$, $SEB = .06$, 95%CI [-.49; -.26], $p < .001$, but it remained significant for individuals scoring more to the right of the political spectrum ($M + 1 SD$), $B = -.18$, $SEB = .05$, 95%CI [-.29; -.08], $p < .001$. In addition, political orientation moderated the association between Need for Evidence and COVID-19 protective behavior, $B = -.09$, $SEB = .03$, 95%CI [-.15; -.03], $p = .002$ (Figure S4b). For individuals scoring more to the left of the political spectrum ($M - 1 SD$), the positive association between Need for Evidence and COVID-19 protective behavior was the strongest, $B = .21$, $SEB = .05$, 95%CI [.12; .30], $p < .001$. There was no such relationship for individuals scoring more to the right of the political spectrum ($M + 1 SD$), $B = .02$, $SEB = .05$, 95%CI [-.07; .11], $p = .639$.

We also found a moderating effect of political orientation on the association between Truth is Political and COVID-19 protective behavior, $B = -.10$, $SEB = .03$, 95%CI [-.17; -.04], $p = .002$ (Figure S4c). For individuals scoring more to the right of the political spectrum ($M + 1 SD$), the negative association between Truth is Political and COVID-19 protective behavior was the strongest, $B = -.25$, $SEB = .05$, 95%CI [-.34; -.16], $p < .001$. There was no significant association for individuals scoring more to the left of the political spectrum ($M - 1 SD$), $B = -.05$, $SEB = .05$, 95%CI [-.15; .06], $p = .383$.

In sum, Study 4 largely corroborated the results found in the USA in a German sample. This speaks to the cross-cultural role of post-truth epistemic beliefs in shaping conspiracy ideation and behavior.

General Discussion

The complex challenges that our globalized, postmodern world faces, require evidence-based decision-making on a societal level, but also the individual willingness to follow “the unforced force of the better argument” (Habermas, 1996, p. 305) and to adjust

one's behavior accordingly. However, not everyone shows this willingness: At least some people may deliberately choose to believe what they want to believe and to shield their opinions from the rational discourse. Our studies, which were conducted in the context of the COVID-19 pandemic, are the first to investigate both the antecedents and the consequences of these kinds of epistemic beliefs (Garret & Weeks, 2017). In brief, our four studies demonstrate that individuals high in D, that is, individuals who show a general tendency to maximize their personal utility, are more likely to hold a set of epistemic beliefs that views truth as being shaped by those in power while having a comparably low Need for Evidence and a high Faith in one's Intuition for Facts (a set we labelled post-truth epistemic beliefs). In turn, these epistemic beliefs predict the endorsement of COVID-19 conspiracy theories and protective behavior.

The Dark Factor, Epistemic Beliefs, and COVID-19

In Study 1, we demonstrated that individuals high in D tend to hold a set of post-truth epistemic beliefs, that is, are less inclined to commit to reasoning and argument based on evidence. These preliminary results were supported and extended in Studies 2-4. In addition to the association between D and epistemic beliefs already identified in Study 1, we found that epistemic beliefs predict the endorsement of COVID-19 conspiracy theories as well as protective behavior. While Studies 2 and 3 were conducted at two different points of the pandemic and, thus, demonstrate the stability of the results over time, Study 4 provided support for the cross-cultural validity of our results. Apart from these general findings, several aspects need to be emphasized. First, although we consistently found indirect effects of D mediated by epistemic beliefs on both dependent variables, the link between D and endorsing COVID-19 conspiracy theories was somewhat stronger than between D and COVID-19 protective behavior across all studies. This could be a result of regulations set in place that mandated social distancing, wearing masks in public transportation, and so on. Thus, even if

post-truth epistemic beliefs led to an opposition of the rules set in place, the link to overt behavior could have been somewhat weakened by these policies.

Second, although the core idea of the proposed model was supported across all studies, there were some differences in terms of indirect effects between Study 2 on the one hand and Studies 3 and 4 on the other. The association between D and the endorsement of conspiracy theories was consistently mediated by Truth is Political. Whereas Faith in the Intuition for Facts served as a mediator in Study 2, indirect effects of mediator Need for Evidence were observed in both other studies. The association between D and engaging in COVID-19 protective behavior was consistently mediated by Need for Evidence. Whereas Faith in the Intuition for Facts served as a mediator in Study 2, indirect effects of mediator Truth is Political were observed in both other studies. In sum, the indirect effect pattern results of Study 3 are remarkably similar to the results of Study 4, which was conducted in a different country, but at a comparable point of the pandemic.

Third, deviating from our hypotheses, higher Faith in Intuition for Facts was associated with *more* protective behavior across all studies when considered in the joint model. When looking at the zero-order correlations, Faith in Intuition for Facts was not significantly correlated with protective behavior in Studies 2 and 3, and positively correlated in Study 4. This heterogeneity suggests that the way Faith in Intuition for Facts translates into protective behavior depends on various contextual factors. Possibly, the dissemination of scientific knowledge over the course of the pandemic has, on average, aligned judgments based on scientific evidence and individuals' intuitions, both speaking to protecting oneself against the virus.

Political Orientation

As our studies demonstrate, political orientation plays a role in explaining the endorsement of COVID-19 conspiracy theories and the neglect of protective behavior beyond epistemic beliefs and D. Both the endorsement of COVID-19 conspiracy theories and reduced

protective behavior were related to a more right-wing political orientation, which is in line with prior research (Kim & Kim, 2021; Miller, 2020). Especially in the case of the US samples (Studies 2 and 3), this finding likely reflects that the Trump administration and the Republican party downplayed the danger of COVID-19 and the efficacy of countermeasures while focusing on economic issues (Haberman & Cooper, 2020; Smith, 2020). Interestingly, the main effect of political orientation on COVID-19 conspiracy theories was weaker and the effect on protective behavior not significant in the German sample. It seems plausible to assume that this finding mirrors the fact that political polarization is less pronounced in Germany compared to the US (Boxell et al., 2020).

Note also that the influence of political orientation changed between Studies 2 and 3. While we found a main effect of political orientation on endorsing COVID-19 conspiracy theories and protective behavior in both studies, we found clear moderating effects of political orientation in Study 2, but not in Study 3. In other words, political orientation did no longer interact with individual differences in Study 3. We hypothesize that the difference is an effect of an increased politicization of COVID-19 over the course of the pandemic (Kuchler, 2020; Marsh, 2020): While holding certain beliefs and showing certain behavior with respect to COVID-19 was more of an individual matter in the beginning of the pandemic, it more and more became a matter of one's political affiliation over the course of time. This hypothesis is supported by the stronger main effect of political orientation on COVID-19 protective behavior in Study 3 compared to Study 2.

Limitations and Future Directions

Although the present set of studies provides evidence for our model on the antecedents and consequences of post-truth epistemic beliefs, there are several important limitations to be considered. First, the present studies are cross-sectional and non-experimental, which makes it difficult to conclude causality. Although it seems theoretically far more plausible to assume that stable personality characteristics (i.e., the Dark Factor of Personality) influence epistemic

beliefs, which in turn influence conspiratorial thinking and protective behavior than vice versa, more research is needed to establish clear causal links.

Second, our focus here was exclusively on post-truth epistemic beliefs as predictors of conspiratorial thinking and the willingness to engage in protective behavior in the context of COVID-19. This does not rule out, but rather complements alternative perspectives, such as work that has highlighted the role of individual differences in analytic thinking (e.g., Pennycook et al., 2021) or numeracy (Hutmacher et al., 2022).

Third, it remains to be examined how epistemic beliefs shape the processing and dissemination of information pertinent to challenging societal topics. We assume that individual differences in epistemic beliefs can explain how individuals deal with misinformation, including the processing of misinformation indicators and the spreading of misinformation.

Fourth, the present studies were conducted in a very specific context: the COVID-19 pandemic. We assume that our basic model, the nexus between D, post-truth epistemic beliefs, and conspiratorial thinking and behavior holds for other key challenges our society faces. More specifically, we hypothesize that the current model will replicate in the field of climate change: Post-truth epistemic beliefs, fueled by D, nourish conspiracy ideation and behavior that stands in contrast to science-based recommendations.

Conclusion

Post-truth phenomena such as conspiracy theories and related behavior are widely considered to be a major threat to individual and societal prospering. We present consistent and cross-cultural evidence for the pivotal role of post-truth epistemic beliefs rooted in the Dark Factor of Personality in explaining the endorsement of COVID-19 conspiracy theories and non-adherence to behavioral recommendations throughout the pandemic. Our research highlights that individuals' worldviews about how one can and should construct reality need to be taken into account when addressing major challenges to humankind.

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Online Supplement for the Manuscript

***Beliefs About the Nature of Knowledge Shape Responses to the Pandemic:
Epistemic Beliefs, the Dark Factor of Personality, and COVID-19-related Conspiracy
Ideation and Behavior***

Supplement S1: Confirmatory Factor Analysis, Study 1	Page 81
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Supplement S1: Confirmatory Factor Analysis, Study 1

We performed a confirmatory factor analysis⁶ to test the factorial structure of the epistemic beliefs subscales using AMOS 25.0, a plug-in for SPSS (Arbuckle, 2019). Note that Garret and Weeks (2017) assumed that the covariance between Need for Evidence and Truth is Political equals zero. However, this is not founded in theory as doubt in the existence of political or scientific certainties (Truth is Political) should be linked to a lower need to base one's opinions on evidence (Need for Evidence). Therefore, we estimated the covariance rather than setting it to zero a priori.

According to Curran (1997, as cited by Kline, 2011), skewness absolute values greater than 3 and kurtosis absolute values greater than 8 indicate substantial deviation from normal distribution. All variables showed skewness absolute values below 1.5 and kurtosis absolute values below 3 indicating normal distribution. Accordingly, we chose maximum likelihood estimation.

Confirmatory factor analysis showed that our model suited the data better than the factorial structure proposed by Garret and Weeks (2017). Goodness of fit statistics were good or acceptable: CFI = .96; NFI = .94; RMSEA = .08, 90% CI [.07; .10]; IFI = .96; SRMR = .05 ($\chi^2(51, N = 321) = 3.27, p < .001$). We achieved a power of .93 to detect an RMSEA \geq .050 (Jobst et al., 2021). Note that our model surpasses the alternative model postulated by Garret and Weeks (2017) in most goodness of fit statistics⁷. Factor loadings varied between .74 and .92, indicating good fit (see Figure S1). Faith in Intuition for Facts and Need for Evidence ($cov = -.38, SE = .07, p < .001$) as well as Need for Evidence and Truth is Political ($cov = -.32, SE = .09, p < .001$) showed negative covariances. Faith in Intuition for Facts and Truth is

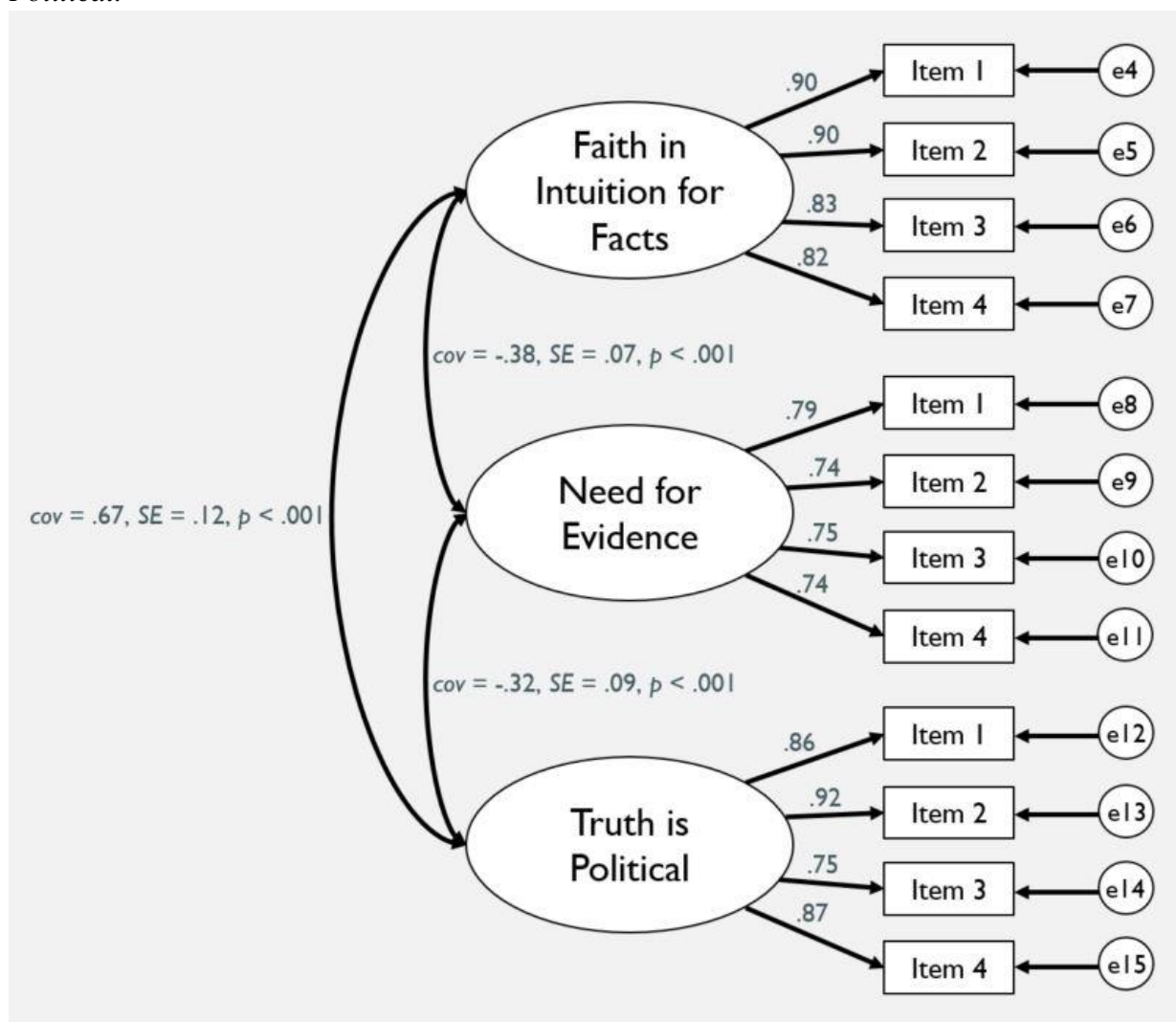
⁶ Note that, although preregistered, we did not perform structural equation modeling to explore the link between the Dark Factor of Personality and epistemic beliefs and instead relied on bivariate correlations as reported in the manuscript (Study 1).

⁷ Conventional goodness of fit statistics for the factorial structure model proposed by Garret and Weeks (2017): CFI = .95; NFI = .93; RMSEA = .09, 90% CI [.08; .10]; IFI = .95, SRMR = .10. The achieved power to detect an RMSEA \geq .050 was .94.

Political ($cov = .67, SE = .12, p < .001$) covaried positively. Residual analysis did not indicate any major issues apart from the standardized residual covariance between two items (Need for Evidence: “I trust the facts, not my instincts, to tell me what is true” and Truth is Political: “What counts as truth is defined by power”, $z_{cov} = -2.83$). According to Jöreskog and Sörbom (1993), standardized residual covariance values greater than 2.58 or less than -2.58 are deemed problematic. As this residual covariance presents the only problematic value and both items are of major importance for the hypothesized model, we did not exclude them.

Figure S1

Confirmatory Factor Analysis Showing Factor Loadings and Correlations Between the Epistemic Belief Subscales Faith in Intuition for Facts, Need for Evidence and Truth Is Political.



Supplement S2: Additional Results Pertaining to Study 2**Table S2.1***Study 2: Means, Standard Deviations, and Zero-Order Correlations of the Continuous Variables*

	<i>M (SD)</i>	(1)	(2)	(3)	(4)	(5)	(6)
(1) Dark Factor of Personality	2.36 (0.92)	-					
(2) Faith in Intuition for Facts	4.35 (1.33)	.28**	-				
(3) Need for Evidence	5.98 (0.92)	-.33**	-.36**	-			
(4) Truth is Political	3.41 (1.56)	.45**	.31**	-.34**	-		
(5) COVID-19 conspiracy theories	2.56 (1.45)	.54**	.43**	-.36**	.55**	-	
(6) COVID-19 protective behavior	5.90 (0.99)	-.44**	-.07	.32**	-.24**	-.37**	-
(7) Political Orientation	3.58 (1.84)	.26**	.33**	-.26**	.30**	.46**	-.21**

Note. $N = 453$. * $p < .05$, ** $p < .001$.

Summary of the Results Controlled for Emotional and Physical Health

In order to account for effects of emotional and physical health on COVID-19 protective behavior, we performed the same mediation analysis including the standardized mean of both health-related items. All indirect effects reported in the main article remained significant.

Results of the Moderation Analyses Between D and Political Orientation, With Epistemic Belief Scales as the Criterion (Study 2)

Table S2.2

Study 2: Results of the Moderation Analysis Between D and Political Orientation. Faith in Intuition for Facts as the Criterion.

	Coefficient	SE	95%CI LL	95%CI UL	p
Constant					
Main Effect of D	.208	.046	.119	.298	< .001
Main Effect of Political Orientation	.279	.045	.191	.368	< .001
Interaction	.008	.044	-.079	.094	.858

Table S2.3

Study 2: Results of the Moderation Analysis Between D and Political Orientation. Need for Evidence as the Criterion.

	Coefficient	SE	95%CI LL	95%CI UL	p
Constant					
Main Effect of D	-.295	.046	-.384	-.205	< .001
Main Effect of Political Orientation	-.180	.045	-.269	-.091	< .001
Interaction	.106	.044	.019	.192	.017

Table S2.4

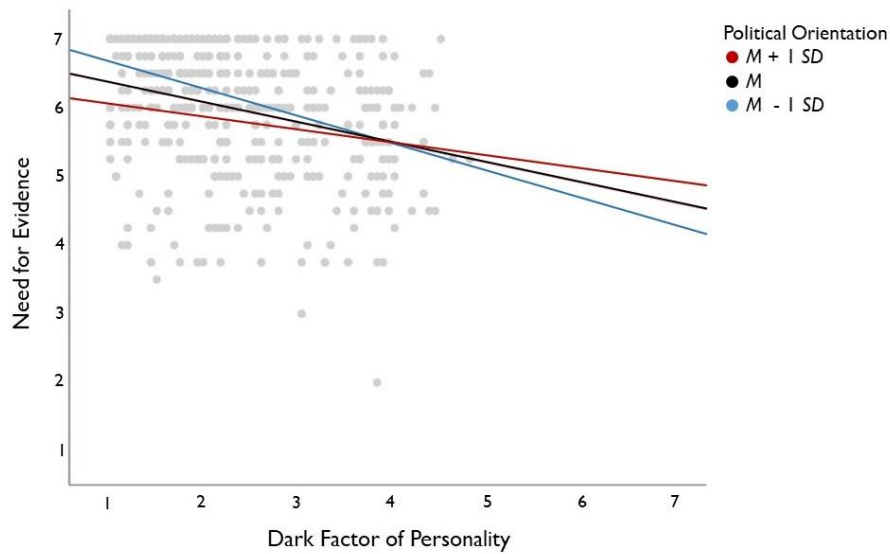
Study 2: Results of the Moderation Analysis Between D and Political Orientation. Truth Is Political as the Criterion.

	Coefficient	SE	95%CI LL	95%CI UL	p
Constant					
Main Effect of D	.378	.043	.294	.462	< .001
Main Effect of Political Orientation	.209	.043	.126	.293	< .001
Interaction	.105	.042	.023	.186	.012

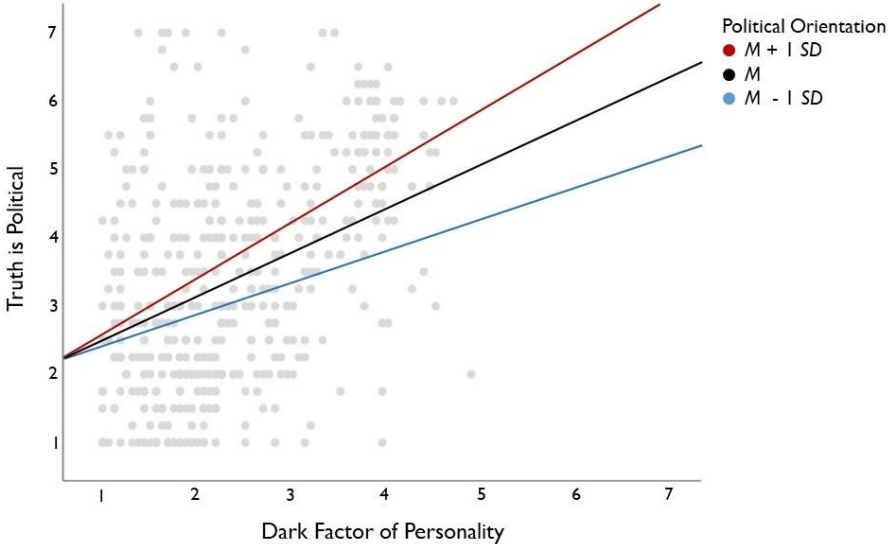
Figure S2

Study 2: Graphical Representation of Interactions Involving the Epistemic Belief Scales and Political Orientation

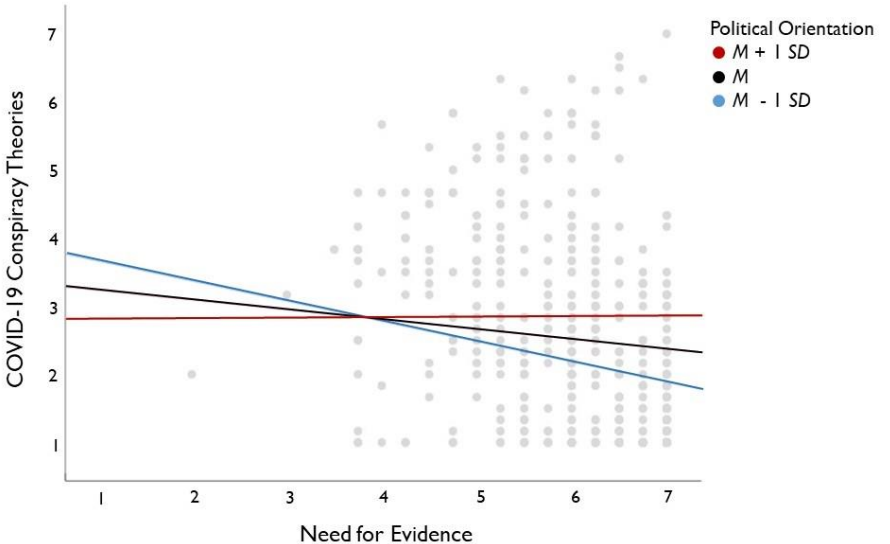
S2a



S2b



S2c



Note. Higher scores in political orientation indicate a more right-leaning orientation. Semi-transparent scatterplots represent single data points.

Supplement S3: Additional Results Pertaining to Study 3**Table S3.1***Study 3: Means, Standard Deviations, and Zero-Order Correlations of the Continuous**Variables*

	<i>M (SD)</i>	(1)	(2)	(3)	(4)	(5)	(6)
(1) Dark Factor of Personality	2.34 (0.91)	-					
(2) Faith in Intuition for Facts	4.56 (1.24)	.05	-				
(3) Need for Evidence	5.90 (0.98)	-.24**	-.39**	-			
(4) Truth is Political	3.28 (1.50)	.31**	.25**	-.28**	-		
(5) COVID-19 conspiracy theories	2.39 (1.30)	.38**	.32**	-.34**	.46**	-	
(6) COVID-19 protective behavior	6.08 (1.04)	-.27**	.01	.25**	-.18**	-.16**	-
(7) Political orientation	3.57 (1.76)	.14**	.22**	-.23**	.26**	.43**	-.30**

Note. $N = 923$. ** $p < .001$.

Results of the Moderation Analyses Between D and Political Orientation, With Epistemic Belief Scales as the Criterion (Study 3)

Table S3.2

Study 3: Results of the Moderation Analysis Between D and Political Orientation. Faith in Intuition for Facts as the Criterion.

	Coefficient	SE	95%CI LL	95%CI UL	p
Constant					
Main Effect of D	.019	.033	-.045	.083	.561
Main Effect of Political Orientation	.217	.033	.153	.281	< .001
Interaction	.017	.032	-.045	.079	.588

Table S3.3

Study 3: Results of the Moderation Analysis Between D and Political Orientation. Need for Evidence as the Criterion.

	Coefficient	SE	95%CI LL	95%CI UL	p
Constant					
Main Effect of D	-.222	.032	-.284	-.160	< .001
Main Effect of Political Orientation	-.193	.032	-.255	-.132	< .001
Interaction	.107	.031	.047	.167	< .001

Table S3.4

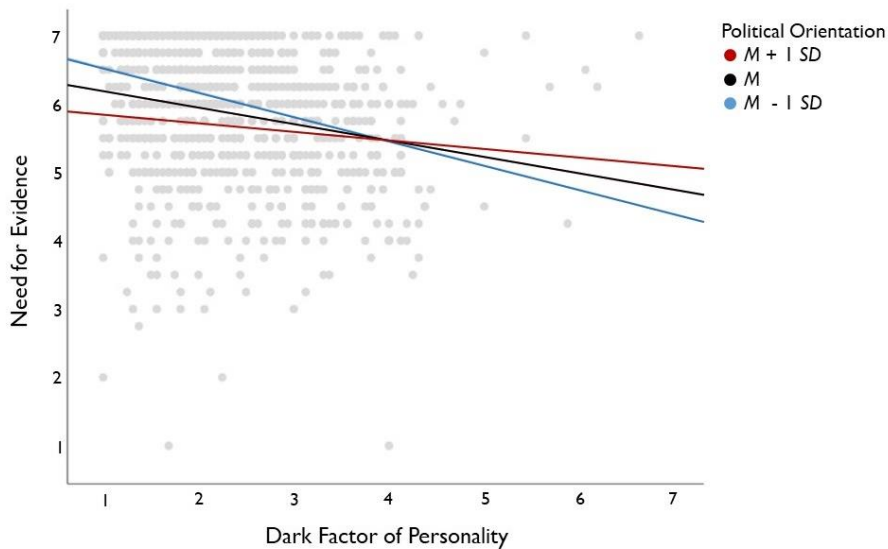
Study 3: Results of the Moderation Analysis Between D and Political Orientation. Truth Is Political as the Criterion.

	Coefficient	SE	95%CI LL	95%CI UL	<i>p</i>
Constant					
Main Effect of D	.279	.031	.219	.340	< .001
Main Effect of Political Orientation	.225	.031	.164	.285	< .001
Interaction	-.005	.030	-.063	.054	.875

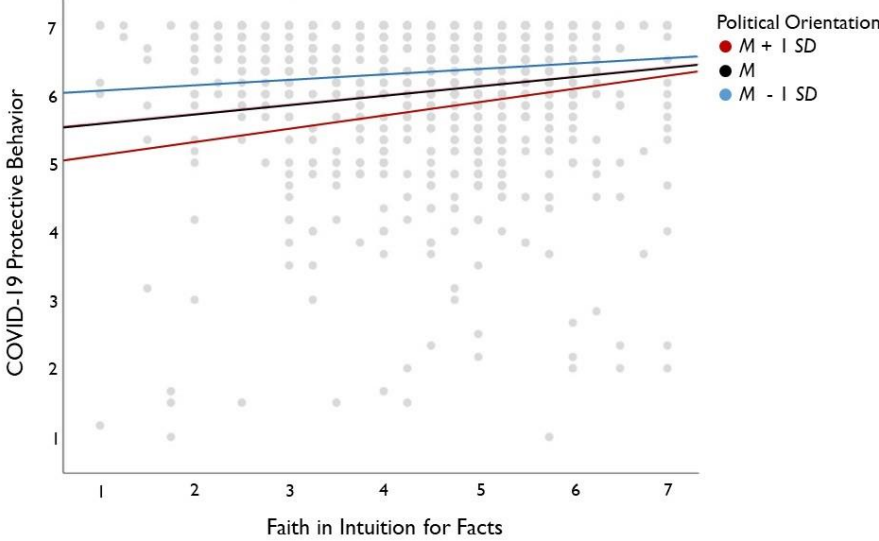
Figure S3

Study 3: Graphical Representation of Interactions Involving the Epistemic Beliefs Scales and Political Orientation

S3a



S3b



Note. Higher scores in political orientation indicate a more right-leaning orientation. Semi-transparent scatterplots represent single data points.

Supplement S4: Additional Results Pertaining to Study 4**Table S4.1**

Study 4: Means, Standard Deviations, and Zero-Order Correlations of the Continuous Variables

	<i>M (SD)</i>	(1)	(2)	(3)	(4)	(5)	(6)
(1) Dark Factor of Personality	2.59 (.78)	-					
(2) Faith in Intuition for Facts	4.64 (.99)	-.04	-				
(3) Need for Evidence	5.74 (.87)	-.27**	-.19**	-			
(4) Truth is Political	3.40 (1.44)	.35**	.13**	-.32**	-		
(5) COVID-19 conspiracy theories	2.23 (1.19)	.37**	.11*	-.34**	.66**	-	
(6) COVID-19 protective behavior	6.22 (.83)	-.39**	.09*	.26**	-.33**	-.40**	-
(7) Political orientation	3.62 (.99)	.31**	.06	-.10*	.16**	.26**	-.18**

Note. $N = 513$. * $p < .05$, ** $p < .001$.

Results of the Moderation Analyses Between D and Political Orientation, With Epistemic Belief Scales as the Criterion (Study 4)

Table S4.2

Study 4: Results of the Moderation Analysis Between D and Political Orientation. Faith in Intuition for Facts as the Criterion.

	Coefficient	SE	95%CI LL	95%CI UL	p
Constant					
Main Effect of D	-.065	.047	-.157	.028	.169
Main Effect of Political Orientation	.073	.047	-.020	.165	.123
Interaction	.013	.036	-.059	.084	.732

Table S4.3

Study 4: Results of the Moderation Analysis Between D and Political Orientation. Need for Evidence as the Criterion.

	Coefficient	SE	95%CI LL	95%CI UL	p
Constant					
Main Effect of D	-.277	.045	-.365	-.189	< .001
Main Effect of Political Orientation	-.032	.045	-.121	.057	.481
Interaction	.097	.035	.028	.165	.006

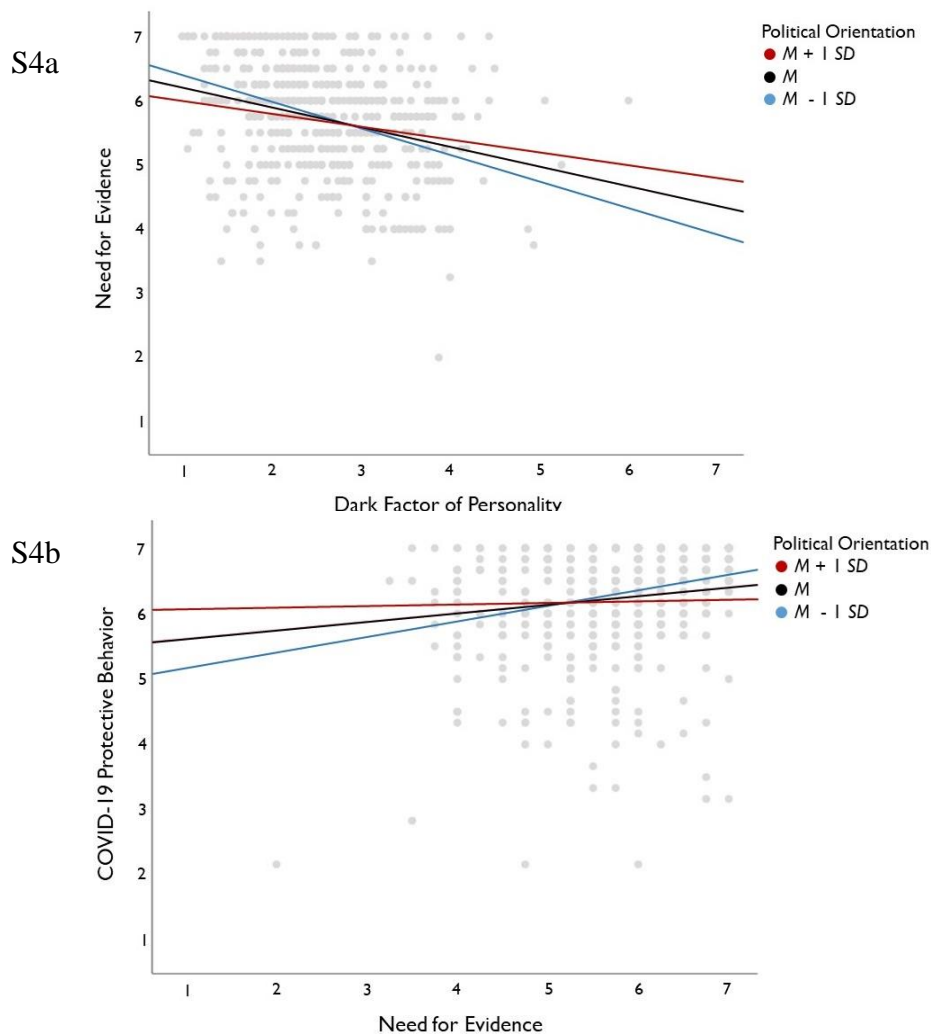
Table S4.4

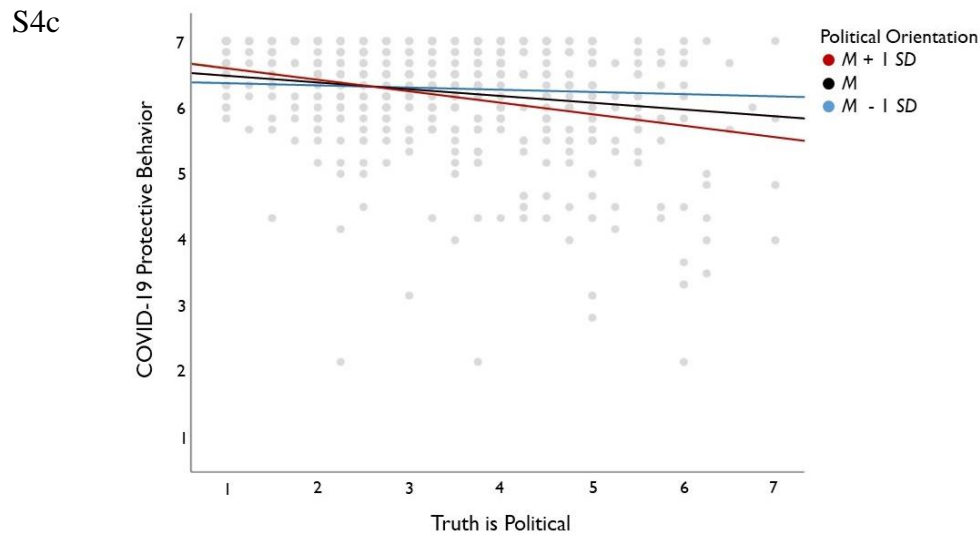
Study 4: Results of the Moderation Analysis Between D and Political Orientation. Truth Is Political as the Criterion.

	Coefficient	SE	95%CI LL	95%CI UL	p
Constant					
Main Effect of D	.340	.044	.254	.426	< .001
Main Effect of Political Orientation	.072	.044	-.014	.158	.102
Interaction	-.062	.034	-.129	.005	.069

Figure S4.1

Study 4: Graphical Representation of Interactions Involving the Epistemic Beliefs Scales and Political Orientation





Notes. Higher scores in political orientation indicate a more right-leaning orientation. Semi-transparent scatterplots represent single data points.

Additional Results on Corona-Warn-App Usage

In the months leading to Study 4, contact tracing apps were strongly promoted in Europe as they seemed like an effective means for tracking infection chains (European Commission, 2020). Their effectiveness depends on peoples' willingness to engage in prosocial behavior, which led us to include the use of the *Corona-Warn-App* in our study. However, by the time of assessment it was already foreseeable that the app would not reach its potential as user numbers were stagnating far below the necessary threshold (Kreder, 2020; FAZ, 2020; Spiegel, 2020). At the time the utility of the app was questioned by government officials and many people who were following other behavioral advice, so we are cautious to interpret the data.

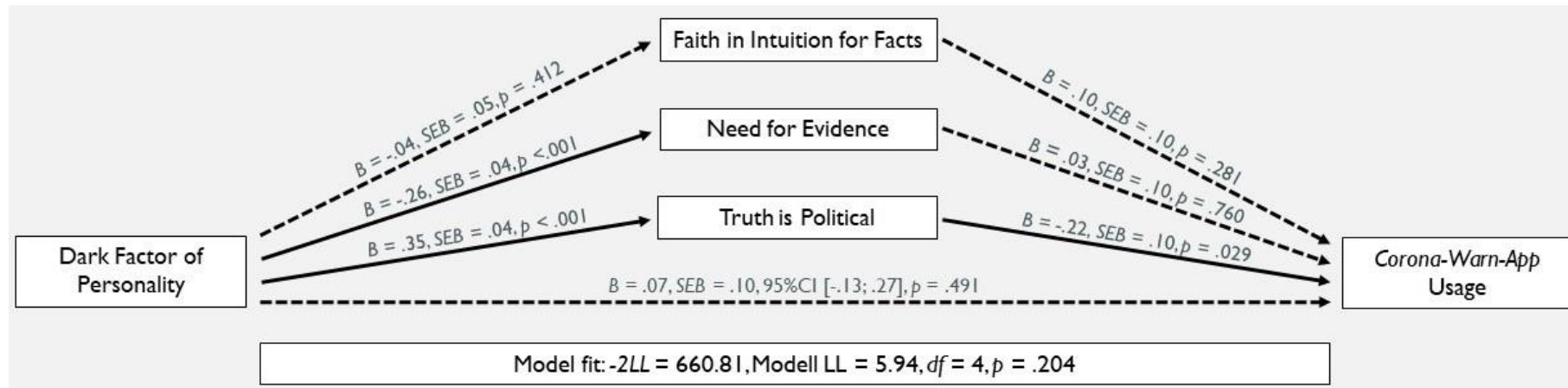
We excluded 32 participants who did not have a smartphone compatible with the requirements of the *Corona-Warn-App* or did not indicate whether they used the app (final $N = 481$). We first ran a logistic regression analysis to identify the association between D (the sole predictor in the model) and the use of the *Corona-Warn-App* (the criterion). D did not significantly predict whether (1) or not (0) participants made use of the app, $B = -.02$; $SEB = .09$; $Wald(1) = .05$, $p = .820$, $OR = .979$. Next, we tested the mediation model and performed a

parallel mediation analysis including D as a predictor variable, Faith in Intuition for Facts, Need for Evidence and Truth is Political as mediator variables and the use of the *Corona-Warn-App* as a binary dependent variable. The likelihood-ratio test was not significant, $-2LL = 660.81$, Model LL = 5.94, $df = 4$, $p = .204$ (McFadden's $R^2 = .01$, Cox & Snell's $R^2 = .01$, Nagelkerke's $R^2 = .02$), indicating that the model as a whole did not significantly predict the usage of the *Corona-Warn-App*. Path coefficients, standard errors, and p -values are shown in Figure S4.2. D was associated with Need for Evidence and Truth is Political in the expected directions, but not significantly linked to Faith in Intuition for Facts. Further, Truth is Political was associated negatively with the usage of the *Corona-Warn-App*, while Faith in Intuition for Facts and Need for Evidence were not significantly associated with the usage of the *Corona-Warn-App*. We found a significant indirect effect of D on the usage of the *Corona-Warn-App*, mediated by Truth is Political, $B = -.08$; $SEB = .04$; 95%CI [-.16; -.01], but no significant indirect effects of D on the usage of the *Corona-Warn-App*, mediated by Faith in Intuition for Facts, $B = -.004$; $SEB = .01$; 95%CI [-.03; .01] and Need for Evidence, $B = -.01$; $SEB = .03$; 95%CI [-.07; .04].

In sum, the findings were mixed: Truth is Political was the only variable that predicted the use of the *Corona-Warn-App* in a sense that the endorsement of this post-truth epistemic belief aspect predicted a lower likelihood of using the *Corona-Warn-App*.

Figure S4.2

Main Results of the Parallel Mediator Model With Corona-Warn-App Usage as the Binary Dependent Variable.



Note. Solid paths indicate significant associations ($p < .05$), dashed paths are non-significant.

We also performed a moderation analysis including political orientation as a moderator variable for all paths of the parallel mediator model. The likelihood-ratio test was not significant, $-2LL = 654.91$, Model LL = 11.85, $df = 9$, $p = .222$ (McFadden's $R^2 = .02$, Cox & Snell's $R^2 = .02$, Nagelkerke's $R^2 = .03$), indicating that the model did not significantly predict the usage of the *Corona-Warn-App*. In this model, political orientation was no significant predictor of the usage of the *Corona-Warn-App*, $B = -.17$, $SEB = .10$, 95%CI [-.36; .03], $p = .101$.

We did not find a significant moderating effect of political orientation on the effect of D on the usage of the *Corona-Warn-App*, $B = -.02$, $SEB = .08$, 95%CI [-.19; .15], $p = .812$. Political orientation did not moderate any of the paths with *Corona-Warn-App* use as the criterion. In this model we found that political orientation moderated the association between D and Need for Evidence, $B = .12$, $SEB = .04$, $p = .001$, which means that the negative association between D and Need for Evidence increased with a more left-wing political orientation. For individuals scoring more to the left of the political spectrum ($M - 1 SD$) the negative association between D and Need for Evidence was the strongest, $B = -.39$, $SEB = .06$, 95%CI [-.51; -.27], $p < .001$, but it remained significant for individuals scoring more to the right of the political spectrum ($M + 1 SD$), $B = -.15$, $SEB = .06$, 95%CI [-.26; -.04], $p = .008$.

Also, political orientation moderated the association between D and Truth is Political, $B = -.07$, $SEB = .04$, $p = .046$, which means that the positive association between D and Truth is Political increased with a more right-wing political orientation. For individuals scoring more to the right of the political spectrum ($M + 1 SD$), the positive association between D and Truth is Political was the strongest, $B = .41$, $SEB = .06$, 95%CI [.29; .52], $p < .001$, but it remained significant for individuals scoring more to the left of the political spectrum ($M - 1 SD$), $B = .26$, $SEB = .05$, 95%CI [.16; .37], $p < .001$.

Supplement S5: Self-Reported SARS-CoV-2 Test Results, Scale Reliabilities, Additional Details on the Exclusion Criteria, and a Summary of Results When the Upper Exclusion Criterion Regarding Response Time Was Suspended

Table S5.1

Percentages of Participants Tested (Positive) For SARS-CoV-2 in Studies 2-4

	Study 2	Study 3	Study 4
Not tested	92.3%	80.8%	75.6%
Tested	7.7%	19.2%	24.4%
Negative result	5.3%	17.8%	23.2%
Positive result	2.4%	1.4%	1.2%

Table S5.2

Reliabilities (Cronbach's α) Of All Scales Used in Studies 1-4

	Study 1	Study 2	Study 3	Study 4
(1) Dark Factor of Personality	.897	.904	.907	.871
(2) Faith in Intuition for Facts	.921	.901	.903	.810
(3) Need for Evidence	.841	.843	.866	.829
(4) Truth is Political	.915	.906	.898	.896
(5) COVID-19 conspiracy theories	-	.918	.894	.851
(6) COVID-19 protective behavior	-	.777	.888	.858

Additional Information on the Exclusion Criteria for Studies 1-4***Study 1***

In total, 407 participants completed the questionnaire. We excluded 55 participants because they failed to respond to our control question appropriately, which means they did not follow the instructions and did not select the requested option or no option at all depending on the wording of the control questions (see Table S5.3). Further, 30 participants were excluded because they showed unreasonably low response times of less than 90 seconds and one participant because of an unreasonably high response time of more than 2700 seconds. Both extremely low and high response times are indicative of careless responding (e.g., Paas & Morren, 2018; Read et al., 2021). The final sample consisted of 321 participants ($M = 37.12$, $SD = 10.73$, 20-78 years, 38% female).

Study 2

In total, 550 participants completed the questionnaire. As we relied on U.S. participants, 56 participants were excluded because they either used a VPN/VPS or a proxy to mask their country and/or failed to provide an adequate description of the study in English implying they are not native speakers or bots or careless responders. This procedure is recommended by Kennedy et al. (2020) as a countermeasure against declining data quality due to the use of virtual private servers to fraudulently gain access to studies conducted via MTurk. Additionally, we excluded 26 participants because they failed to respond appropriately to at least one of our attention check questions (see Table S5.3). Further, 13 participants were excluded because they showed unreasonably low response times of less than 120 seconds and two participants because of unreasonably high response times of more than 2700 seconds. The final sample amounted to 453 participants ($M = 40.37$ years, $SD = 12.23$ years, 19-78 years, 42.4% female).

Study 3

For Study 3, we implemented a screening procedure in accordance with recommendations by Kennedy et al. (2020). As we relied on U.S. participants, individuals who used a VPN/VPS or a proxy to mask their country of access or who failed to provide the English name of an *eggplant* after having been presented a picture of the latter or who failed to pass a CAPTCHA test, were automatically prevented from completing the study. In total, 1113 participants completed the questionnaire. We excluded 164 participants (that were not detected by the screening procedure) that either used a VPN/VPS or a proxy to mask their country of access and/or failed to provide an adequate description of the study in English and/or failed to provide the English name of an *eggplant* after having been shown a picture of it implying they are not native speakers or bots or careless responders. We excluded 14 participants because they failed to answer at least one of our control questions correctly (see Table S5.3). Further, one participant was excluded because of an unreasonably low response time of less than 120 seconds and eight participants because of unreasonably high response times of more than 2700 seconds. Participants were also asked to indicate both their year of birth and current age. Three participants were excluded because there was a mismatch between the two pieces of information, which was another indicator of careless responding (Kennedy, et al., 2020). Another three participants were excluded because they failed to do so, which implies careless responding. The final sample amounted to 923 participants ($M = 39.43$ years, $SD = 11.64$ years, 19-78 years, 44.9 % female).

Study 4

Participants who failed to pass a CAPTCHA test, were automatically prevented from completing the questionnaire. In total, 539 participants completed the questionnaire. We relied on German participants, one control question was to describe the study in full sentences in German (Kennedy et al., 2020). All participants provided an adequate description of the study, so no one was excluded based on this criterion of careless responding or lack of language proficiency. We excluded 11 participants because they failed to respond appropriately to at least one of our

control questions (see Table S5.3). Further, three participants were excluded because of unreasonably low response times of less than 120 seconds and seven participants because of unreasonably high response times of more than 2700 seconds. Another four participants were excluded because they were under the age of 18. One participant did not indicate their political orientation and therefore had to be excluded. The final sample amounted to 513 participants ($M = 37.54$ years, $SD = 12.23$ years, 18-73 years, 40.7 % female).

Table S5.3

Exact Wordings of Attention Check Items Used in Studies 1-4

Wording Attention Check Items	
Study 1	“This is a control question. Please do not select any of the 7 options below.”
Study 2	In Study 2, two attention check items were included: “This is a control item, please select “extremely likely”.” and “This is a control question. Please select that you “strongly agree”.”
Study 3	In Study 3, two attention check items were included: “This is a control item, please select "not at all likely".” and “This is a control question. Please select "strongly disagree".”
Study 4	“Dies ist eine Testfrage. Bitte wählen Sie "Starke Ablehnung" aus.“ [“This is a control question. Please select "strongly disagree".”]

Note. In Study 4 the attention check item was presented twice at two different places in the questionnaire. English-language translation of the item in parentheses (Study 4).

Table S5.4

Means and Standard Deviations for All Major Variables Without Applying the Upper Exclusion Criterion of a Response Time of More Than 2700 Seconds

	Study 1	Study 2	Study 3	Study 4
(1) Dark Factor of Personality	2.43 (0.95)	2.36 (0.92)	2.34 (0.91)	2.60 (0.79)
(2) Faith in Intuition for Facts	4.61 (1.37)	4.35 (1.33)	4.56 (1.24)	4.64 (1.00)
(3) Need for Evidence	5.84 (0.94)	5.98 (0.92)	5.90 (0.98)	5.74 (0.87)
(4) Truth is Political	3.42 (1.57)	3.41 (1.56)	3.28 (1.50)	3.41 (1.44)
(5) Political Orientation	-	3.58 (1.84)	3.57 (1.77)	3.63 (1.00)
(5) COVID-19 conspiracy theories	-	2.55 (1.45)	2.40 (1.30)	2.24 (1.19)
(6) COVID-19 protective behavior	-	5.89 (0.99)	6.08 (1.03)	6.21 (0.83)

Note. Study 1: $N = 322$; Study 2: $N = 455$; Study 3: $N = 931$; Study 4: $N = 520$.

Summary of Results When the Upper Exclusion Criterion Regarding Response Time Was Suspended

Some scholars (e.g., Paas & Morren, 2018; Read et al., 2021) recommend the exclusion of particularly long response times and we followed this advice. In addition to the analyses reported in the main text, we performed the analyses without applying the upper exclusion criterion. In the following tables, the main results are reported without excluding participants based on the upper response time limit of 2700 seconds. All major results remained virtually the same as in the analyses in the main manuscript.

Table S5.5

Study 2: Total Effects, Direct Effects of D and Indirect Effects of the Three Parallel Mediators Faith in Intuition for Facts, Need for Evidence and Truth Is Political for the Two Dependent Variables Without Applying the Upper Exclusion Criterion of a Response Time of More Than 2700 Seconds

	Effect	SEB	95%CI LL	95%CI UL
COVID-19 conspiracy theories				
Total Effect	.79	.06	.67	.90
Direct Effect of D	.46	.06	.35	.57
Faith in Intuition for Facts	.09	.02	.05	.13
Need for Evidence	.03	.02	-.02	.08
Truth is political	.21	.03	.14	.27
COVID-19 protective behavior				
Total Effect	-.44	.04	-.52	-.36
Direct Effect of D	-.39	.05	-.48	-.30
Faith in intuition for facts	-.04	.01	.01	.07
Need for evidence	-.08	.02	-.11	-.04
Truth is political	-.01	.02	-.05	.03

Note. $N = 455$, SEB = Standard Error (bootstrapped).

Table S5.6

Study 3: Total Effects, Direct Effects of D and Indirect Effects of the Three Parallel Mediators Faith in Intuition for Facts, Need for Evidence and Truth Is Political for the Two Dependent Variables Without Applying the Upper Exclusion Criterion of a Response Time of More Than 2700 Seconds

	Effect	SEB	95%CI LL	95%CI UL
COVID-19 conspiracy theories				
Total Effect	.50	.04	.42	.58
Direct Effect of D	.32	.04	.25	.40
Faith in Intuition for Facts	.01	.01	-.01	.03
Need for Evidence	.04	.01	.02	.06
Truth is political	.13	.02	.09	.17
COVID-19 protective behavior				
Total Effect	-.28	.03	-.34	-.21
Direct Effect of D	-.20	.03	-.27	-.13
Faith in intuition for facts	.01	.01	-.003	.02
Need for evidence	-.06	.01	-.08	-.03
Truth is political	-.03	.01	-.05	-.005

Note. $N = 931$, SEB = Standard Error (bootstrapped).

Table S5.7

Study 4: Total Effects, Direct Effects of D and Indirect Effects of the Three Parallel Mediators Faith in Intuition for Facts, Need for Evidence and Truth Is Political for the Two Dependent Variables Without Applying the Upper Exclusion Criterion of a Response Time of More Than 2700 seconds

	Effect	SEB	95%CI LL	95%CI UL
COVID-19 conspiracy theories				
Total Effect	.45	.05	.35	.54
Direct Effect of D	.18	.04	.09	.26
Faith in Intuition for Facts	-.001	.002	-.01	.005
Need for Evidence	.04	.01	.01	.07
Truth is political	.24	.03	.17	.31
COVID-19 protective behavior				
Total Effect	-.32	.03	-.39	-.26
Direct Effect of D	-.23	.04	-.30	-.16
Faith in intuition for facts	-.004	.01	-.02	.006
Need for evidence	-.03	.02	-.07	-.01
Truth is political	-.06	.02	-.10	-.03

Note. $N = 520$, SEB = Standard Error (bootstrapped).

Additional Moderating Effect of Political Orientation

Without applying the upper exclusion criterion of a response time of more than 2700 seconds, Study 4 yielded an additional moderating effect of political orientation on the association between Truth is Political and the endorsement of COVID-19 conspiracy theories, $B = .08$, $SEB = .04$, 95%CI [.002; .16], $p = .043$. For individuals scoring more to the right of the political spectrum ($M + 1 SD$), the positive association between Truth is Political and endorsing COVID-19 conspiracy theories was the strongest, $B = .74$, $SEB = .05$, 95%CI [.64; .85], $p < .001$, but it remained significant for individuals scoring more to the left of the political spectrum ($M - 1 SD$), $B = .58$, $SEB = .06$, 95%CI [.46; .70], $p < .001$.

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2.2 Manuscript #2

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Dark Factor of Personality are associated with higher COVID-19 vaccination refusal.

Scientific Reports. <https://doi.org/10.1038/s41598-023-31079-9>

**Post-truth epistemic beliefs rooted in the Dark Factor of Personality
are associated with higher COVID-19 vaccination refusal**

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<https://aspredicted.org/359tb.pdf>

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Abstract

A substantial number of people refused to get vaccinated against COVID-19, which prompts the question as to why. We focus on the role of individual worldviews about the nature and generation of knowledge (epistemic beliefs). We propose a model that includes epistemic beliefs, their relationship to the Dark Factor of Personality (D), and their mutual effect on the probability of having been vaccinated against COVID-19. Based on a US nationally representative sample ($N = 1268$), we show that stronger endorsement of post-truth epistemic beliefs was associated with a lower probability of having been vaccinated against COVID-19. D was also linked to a lower probability of having been vaccinated against COVID-19, which can be explained by post-truth epistemic beliefs. Our results indicate that the more individuals deliberately refrain from adhering to the better argument, the less likely they are vaccinated. More generally, post-truth epistemic beliefs pose a challenge for rational communication.

Keywords: Post-Truth, Epistemic Beliefs, Dark Factor of Personality, COVID-19 Vaccination Status

**Post-truth epistemic beliefs rooted in the Dark Factor of Personality
are associated with higher COVID-19 vaccination refusal**

For thousands of years, humans have tried to define and understand what constitutes truth and knowledge (Glanzberg, 2018). In the contemporary social sciences, there is a wide consensus that even though knowledge is always rooted in historical and societal circumstances, some allegations or opinions are more valid than others because they are backed by better evidence, for example by scientific data (e.g., Holtz, 2020; Lewandowsky, 2021; Waisbord, 2018). In contrast, there have been intellectual movements since antiquity assuming that there is no such thing as truth at all or at least claiming that it is not the better but the rhetorically more appealing argument that will prevail in debates. These movements, which have commonly been portrayed as relativistic or sophistic in nature (cf. Boghossian, 2006), seem to hold that what counts as truth is ultimately a matter of power. Consequently, they often share unbounded constructivist perspectives that challenge the very idea of any scientific consensus (e.g., see Lewandowsky et al., 2020; Lewandowsky, 2021). Individuals who doubt the possibility of truth and knowledge will ignore evidence, believe what feels true to them and will not be open to arguments challenging their worldview (e.g., Garret & Weeks, 2017; Rudloff et al., 2022). As we argue, these worldviews are crucial to the interpretation of information and ultimately to individual behavior such as getting vaccinated.

Epistemic Beliefs

In psychological research, worldviews about the concept of knowledge are referred to as *epistemic beliefs* (Muis, 2007). They are developed during childhood and adolescence through socialization and are considered to be relatively stable albeit not fixed over time (Garret & Weeks, 2017; Schommer, 1990). Typically, they are assumed to develop from so-called *naïve* to *sophisticated* beliefs (see, e.g., Bromme et al., 2010). Kuhn et al. (2000) distinguish between three different stages of epistemic beliefs. In the beginning, individuals hold an absolutist perspective, which implies that knowledge is an objective entity being located in the outside world that can be perceived with absolute certainty. Later, individuals acknowledge that others may perceive the same event, object, construct or statement differently and therefore develop different opinions (multiplist

perspective). The third and last stage is called the evaluativist level and reintegrates both the objective and subjective elements of knowing. In this stage, individuals share a sophisticated and complex understanding of truth. There is still no final consensus on the exact relation between epistemic beliefs and metacognitions: Some authors argue that epistemic beliefs are metacognitions (e.g., Hofer, 2004; Richter & Schmid, 2010), whereas others see them as closely related to but still conceptually distinct from metacognitions (e.g., Bromme et al., 2010). Either way, epistemic beliefs accelerate or inhibit a rational processing of information and are, thus, related to the accuracy of individuals' opinions (Garrett & Weeks, 2017; Stanovich, 2011).

Our work is based on the framework by Garrett and Weeks (2017) that distinguishes three aspects of epistemic beliefs. First, *Faith in Intuition for Facts* captures how much people rely on their gut feeling when evaluating the accuracy of information. Intuition can be a valuable resource in decision-making (see, e.g., Damasio, 2005; Kahneman, 2011), especially when being followed by analytic thinking. Prioritizing one's intuition, however, bears the risk of ignoring and disregarding existing evidence, which may lead to drastic misperceptions (e.g., Swami et al., 2014). Second, *Need for Evidence* refers to the degree to which people find it necessary to align their opinions with the known facts, for example externally validated data. People who put little emphasis on evidence are prone to making decisions based on ideological convictions, regardless of the current scientific consensus (e.g., Garrett et al., 2016; Hindman, 2009). Third, *Truth is Political* refers to the degree to which people are convinced that facts are dependent on the societal and political context, that is, that facts are shaped by those in power, for example, politicians, journalists, and scientists. In extreme cases, it may be concluded that what counts as "truth" is nothing but a matter of power (Holtz, 2020; Garrett & Weeks, 2017).

A strong Faith in one's Intuition for Facts, a low Need for Evidence and the strong conviction that Truth is Political, have been referred to as *post-truth epistemic beliefs* (e.g., Rudloff et al., 2022). This distinct combination of beliefs prevents people from questioning their opinions and immunizes them against any external intervention. Individuals with pronounced

post-truth epistemic beliefs will deliberately choose to disregard evidence and instead believe what they intuitively hold to be true. Note that the notion of post-truth epistemic beliefs does not imply a dichotomy of sophisticated epistemic beliefs on the one hand and problematic post-truth epistemic beliefs on the other (Bråten et al., 2015; Chinn et al., 2015; Greene et al., 2008; Hofer & Pintrich, 1997; Muis et al., 2006). Instead, epistemic beliefs are understood to be varying along a continuum (Garret & Weeks, 2017). Post-truth epistemic beliefs have been associated with lower education and lower need for cognition, which is one's desire for cognitively demanding tasks (Garrett & Weeks, 2017). They have also been linked to the endorsement of COVID-19 conspiracy theories as well as problems with discerning fake news from real news (Rudloff et al., 2022; Rudloff & Appel, 2022).

The Dark Factor of Personality

Prior research has shown that post-truth epistemic beliefs are embedded in a broader personality disposition, the *Dark Factor of Personality* (D; Rudloff et al., 2022; Rudloff & Appel, 2022). It is defined as “the general tendency to maximize one's individual utility—disregarding, accepting, or malevolently provoking disutility for others—accompanied by beliefs that serve as justifications” (Moshagen et al., 2018, p. 657). Utility refers to various forms of material success, but also includes rewarding feelings, such as power or pleasure. Moreover, utility does not necessarily refer to *actual* mid- to long-term benefits (e.g., economic prospering or well-being), but rather *perceived* benefits resulting from ethically questionable behavior (e.g., feeling superior to others). D is considered to be the core of all dark traits, for example egoism, Machiavellianism, and psychopathy and explains their common variance (Moshagen et al., 2018). Individuals high in D show a variety of ethically questionable behavior, such as lying or exploiting and manipulating others (Moshagen et al., 2018). They manage to uphold a positive self-image despite their malevolent behavior by relying on beliefs and rationalizations that help to justify it (Hilbig et al., 2022). Crucially, “the concept of D does not imply that individuals must hold any one particular belief or set of beliefs; instead, the main idea is that individuals hold some

belief(s) that they deem appropriate to justify malevolent acts” (Moshagen et al., 2020, p. 4). Thus, they may embrace a relativistic and cynical worldview, enabling them to bend morals and norms, whenever they perceive it to be beneficial (e.g., Jonason et al., 2015; Moshagen et al., 2018, Moshagen et al., 2020; Zeigler-Hill et al., 2020). Importantly, prior research has shown that individuals with high levels in D tend to endorse post-truth epistemic beliefs (Rudloff et al., 2022; Rudloff & Appel, 2022). These beliefs are deemed advantageous because they justify not adhering “to the unforced force of the better argument” (Habermas, 1996, p. 305). If, as previously shown, D was associated with post-truth epistemic beliefs, D should in turn be associated with lower adherence to recommendations that are based on rational communication. The higher D, the less likely individuals should be convinced by expert sources and strong arguments. In the case of the COVID-19 pandemic, this should result in less adherence to behavioral recommendations expressed by health organizations and the government (Rudloff et al., 2022). Moreover, evidence suggests that dark traits are linked to engaging in risky behavior (Tiwari et al, 2021), opposing laws and authorities (Bader et al., 2022; Moshagen et al., 2020), and ignoring the interests of vulnerable others (Kajonius & Björkman, 2020; Ścigała et al., 2022). Post-truth epistemic beliefs likely accompany and fuel basic behavioral tendencies as justifications at different steps of the motivational process culminating in a decision.

COVID-19 Vaccination

Vaccination programs are one of the most efficient public health measures and have contributed to reducing morbidity and mortality rates of a variety of different infectious diseases (cf. Dubé et al., 2013). To be successful, that is, to reach protection for entire communities, vaccination programs require a high uptake level, which can only be achieved if people trust those who advocate vaccination: health professionals, policymakers, the media, and scientists (Larson et al, 2011).

This general pattern also applies to the COVID-19 vaccination in particular. Even though COVID-19 vaccines such as the Moderna or the Pfizer-BioNTech COVID-19 vaccine are

considered safe and effective by now (e.g., Ghasemiyeh et al., 2021; Huang et al., 2022; Wu et al., 2021) and are typically portrayed as such in mass media (Christensen et al., 2022), some people seem to ignore the available evidence. We argue that post-truth epistemic beliefs prevent individuals from questioning their opinions and immunize them against any external intervention, such as arguments that favor vaccine uptake based on scientific evidence.

With regard to dark traits, studies have shown associations with less health-protective behavior against COVID-19 (Blagov, 2021; Nowak et al., 2020; Ścigała et al., 2021; Zettler et al., 2021), including vaccination hesitancy (Howard, 2022; Konc et al., 2022; Li & Cao, 2022). However, these studies on vaccination hesitancy have at least three shortcomings: First, they typically relied on convenience samples. Second, the vast majority of psychological research on vaccine uptake focuses on self-report measures of vaccination *intention* rather than the actual vaccination *status* (see, e.g., Dubé et al., 2013; Troiano & Nardi, 2021). Third, they did not investigate D as a potential underlying factor driving post-truth epistemic beliefs.

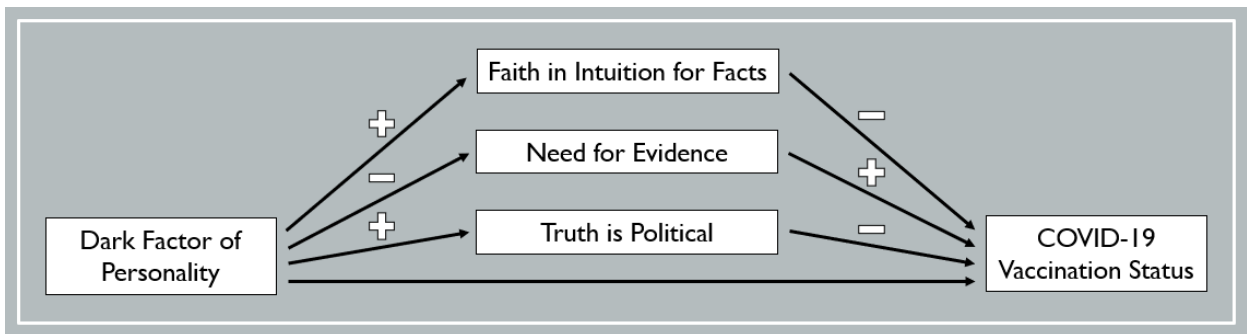
The Current Research

We conducted a study to address these shortcomings. In order to do so, we relied on a large US nationally representative sample, which enables us to ensure the robustness of our results and to draw conclusions that can be generalized for the US American public. In many Western countries such as the USA, the primary immunization phase against COVID-19 can be considered complete. That is, at the time of assessment (July 2022), almost anyone willing to get vaccinated against the original variant of the virus has received their vaccination doses (U.S. Department of Health & Human Services, 2022). Thus, it is the ideal time to assess individuals' actual vaccination *status* instead of their vaccination *intention* and to analyze the reasons behind uptake or refusal in order to gain insights for future vaccination campaigns. Moreover, we propose a model that includes the Dark Factor of Personality as an antecedent of post-truth epistemic beliefs and a lower probability of having been vaccinated against COVID-19 as a consequence.

More specifically, we propose three major hypotheses: First, post-truth epistemic beliefs, which comprise a strong Faith in Intuition for Facts, a low Need for Evidence, and the strong conviction that Truth is Political, should predict a lower probability of having been vaccinated against COVID-19. Second, the Dark Factor of Personality should predict holding post-truth epistemic beliefs. Third, these associations should result in a mediation effect as depicted in Figure 1. We will use two indicators of COVID-19 vaccination status: (1) whether individuals have been vaccinated against COVID-19 at all (i.e., received at least one vaccine dose) and (2) whether individuals have been fully vaccinated (i.e., received at least two vaccine doses). If it turned out that D and post-truth epistemic beliefs indeed drive refusal to get vaccinated, that would be a (worrying) explanation why some individuals act in contrast to the scientific consensus. In the case of at least some individuals, arguments must fail as these individuals are simply not willing to adhere to the better argument.

Figure 1

The Proposed Mediator Model with COVID-19 Vaccination Status as the Dependent Variable



Results

Main Analyses

In our sample ($N = 1368$), 239 participants (18.8%) had received no COVID-19 vaccination, 75 participants (5.9%) had been vaccinated once, 290 participants (22.9%) had been vaccinated twice, 497 participants (39.2%) had been vaccinated three times, and 167 participants (13.2%) had been vaccinated four or more times against COVID-19.

We conducted two parallel multiple logistic mediation analyses using PROCESS version 3.4.1 (Hayes, 2018). For the first analysis, Faith in Intuition for Facts, Need for Evidence and Truth is Political were included as simultaneous mediators. The Dark Factor of Personality served as the predictor variable influencing the binary dependent variable COVID-19 vaccination status (not vaccinated/vaccinated at least once) directly and indirectly through the three mediators (Hayes, 2018). Figure 2 shows all path coefficients, standard errors, and p -values. As can be seen in Table 1, all major variables were significantly correlated in the expected directions. D significantly predicted whether (1) or not (0) participants had been vaccinated at least once against COVID-19, $B = -.20$; $SEB = .07$; $Wald(1) = 8.84$, $p = .003$, $OR = .815$. The likelihood-ratio test was significant, $-2LL = 1096.39$, $Model LL = 131.08$, $df = 4$, $p < .001$ (McFadden's $R^2 = .11$, Cox & Snell's $R^2 = .10$, Nagelkerke's $R^2 = .16$), indicating that our model significantly predicted the participants' COVID-19 vaccination status. Need for Evidence and Truth is Political were significantly associated with participants' COVID-19 vaccination status in the expected directions. Faith in Intuition for Facts was no significant predictor. D was significantly associated with all epistemic belief subscales in the expected directions. Thus, we found significant indirect effects for Need for Evidence, $B = -.08$, $SEB = .02$, 95%CI [-.12; -.05], and for Truth is Political, $B = -.13$, $SEB = .03$, 95%CI [-.19; -.09], whereas Faith in Intuition for Facts was no significant mediator, $B = -.01$, $SEB = .01$, 95%CI [-.04; .01].

In order to test the robustness of our results, we examined whether our model could also predict the probability of being fully vaccinated, that is, having received at least two doses

(Centers for Disease Control and Prevention, 2022). Thus, we performed a second analysis for having been fully vaccinated (1) and not having been vaccinated or only once (0). As can be seen in Figure 3, results remained virtually identical to the previous analysis. In sum, the study provides evidence that post-truth epistemic beliefs predict whether participants have been (fully) vaccinated against COVID-19 and that they explain the link between the Dark Factor of Personality and the COVID-19 vaccination status.

Table 1

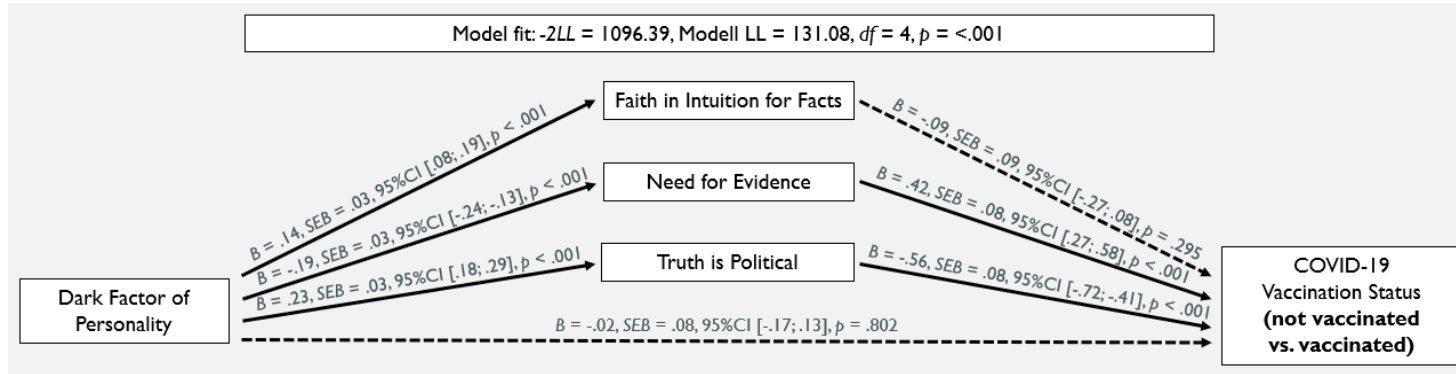
Means, Standard Deviations, and Zero-Order Correlations of the Continuous Variables

	<i>M (SD)</i>	(1)	(2)	(3)	(4)
(1) Dark Factor of Personality	2.18 (0.79)	-			
(2) Faith in Intuition for Facts	4.63 (1.18)	.14**	-		
(3) Need for Evidence	5.75 (1.02)	-.19**	-.37**	-	
(4) Truth is Political	3.31 (1.48)	.24**	.23**	-.32**	-
(5) COVID-19 Vaccination Status	-	-.08*	-.14**	.25**	-.27**

Note. $N = 1268$. ** $p < .001$, * $p < .01$. The Dark Factor of Personality and the epistemic beliefs subscales were measured on a 7-point scale that ranged from *strongly disagree* (1) to *strongly agree* (7). COVID-19 Vaccination Status was operationalized as a binary variable (0=not vaccinated; 1=vaccinated)

Figure 2

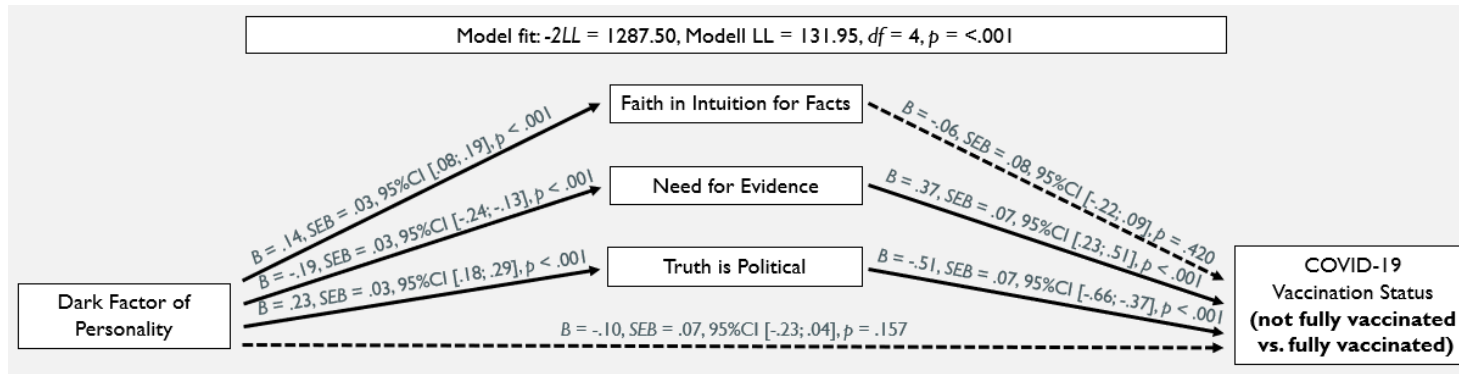
Main Results of the Parallel Mediator Model with COVID-19 Vaccination Status as the Binary Dependent Variable (0=not vaccinated; 1=vaccinated)



Note. Solid paths indicate significant associations ($p < .05$), dashed paths are non-significant.

Figure 3

Main Results of the Parallel Mediator Model with COVID-19 Vaccination Status as the Binary Dependent Variable (0=not vaccinated or partially vaccinated; 1=fully vaccinated)



Note. Solid paths indicate significant associations ($p < .05$), dashed paths are non-significant.

Discussion

The COVID-19 pandemic highlights the need to understand why a substantial number of individuals are unwilling to get vaccinated despite an enormous body of scientific evidence speaking to the effectiveness and safety of the vaccines (Ghasemiyeh et al., 2021; Huang et al., 2022; Wu et al., 2021). Our study yields three important results: First, epistemic beliefs predicted whether or not individuals were vaccinated against COVID-19. The stronger participants endorsed post-truth epistemic beliefs, the lower the probability that they had been vaccinated. This finding complements research showing that post-truth epistemic beliefs are linked to COVID-19 conspiracy beliefs (Rudloff et al., 2022). Second, the stronger individuals' Dark Factor of Personality, the lower the probability that they had been vaccinated. This is in line with prior research on individual dark traits and vaccination *hesitancy* (Howard, 2022; Konc et al., 2022; Li & Cao, 2022).

Third, post-truth epistemic beliefs explain the link between D and individuals' COVID-19 vaccination status. Importantly, all results were virtually identical for different definitions of having been vaccinated (having received at least one dose versus having received two or more doses). Thus, as expected D was associated with lower adherence to recommendations that are based on rational communication such as expert sources and strong arguments. More precisely, this implies that the decision-making process of individuals high in D is guided by post-truth epistemic beliefs, which help to fend off information advocating vaccine uptake. As a consequence of not adhering to rational arguments, they tend to remain unvaccinated.

With regard to the perceived benefits of vaccine uptake, these individuals should only be willing to get vaccinated if they perceive it to be advantageous, for example if they belong to a risk group or their employer demands them to get vaccinated. As outlined in the introduction, *perceived* individual utility does not necessarily go hand in hand with the *actual* utility. That is,

vaccination refusal could have a high *perceived* individual utility as it fuels, for instance, a feeling of superiority (“I am strong enough, I do not need the vaccine”; Chávez-Ventura et al., 2022) or the feeling of being smarter than the majority (“I understand things about this vaccine that others do not”). This does not imply, of course, that the deliberate refusal to adhere to rational arguments in favor of vaccine uptake is not an ill-advised decision that puts the individual’s health at risk. In this context also note that a habitual unwillingness to base one’s decisions on evidence and rational arguments could additionally lead to a reduced ability to do so over time due to a lack of practice (Rudloff & Appel, 2022). This should also decrease the ability to assess which behavioral option is the most beneficial.

Taken together, our study also has broader implications for understanding the deeper reasons behind problematic information processing and decision-making. Psychological research often focuses on cognitive biases (e.g., Hutmacher et al., 2022; Lazer et al., 2018; Meppelink et al., 2019; Zhou & Shen, 2022) or thinking styles (e.g., Bronstein et al., 2019; Pennycook & Rand, 2019) to explain seemingly irrational cognition and behavior such as belief in misinformation, climate change denial or vaccination hesitancy. Our research complements these perspectives by highlighting the insight that getting vaccinated against COVID-19 may not solely be a function of one’s access to the right information, nor of one’s ability to process it rationally, but of one’s willingness to adhere to the better argument. In other words, the stronger people’s post-truth epistemic beliefs the more likely they disregard the quality of arguments.

Practical Implications

A belief system in which the evaluation of arguments against criteria of truth is deliberately suspended presents a major challenge to health communication, and more broadly speaking, to rational communication in other fields. As disillusioning as this realization may be, it also bears the opportunity for two potentially fruitful countermeasures. First, preventing the

development of post-truth epistemic beliefs should be of vital interest to our society. Efforts must be increased to emphasize the difference between mere opinions and scientific evidence and the importance and challenges of rational communication. As epistemic beliefs are developed during childhood and adolescence (Garret & Weeks, 2017; Schommer, 1990), schools could be the appropriate institutions to implement these measures. Second, the results underscore the relevance of providing incentive structures for rational behavior, in a sense that behavior that is in line with scientific evidence should also be the behavioral option with the highest perceived personal benefits (Campos-Mercade et al., 2021; Salali & Uysal. 2021).

Limitations and Open Questions

There are certain limitations to our study. First, note that despite the significant zero-order correlation between Faith in Intuition for Facts and participants' COVID-19 vaccination status (Table 1), the link was not significant in the mediation model. From a theoretical perspective, the effect of Faith in Intuition for Facts on vaccine uptake might depend on the type of media individuals consumed and the intuitions formed during the pandemic. Individuals who mainly followed mainstream media were most likely most exposed to the view that the vaccines are safe and effective. Hence, they may have developed an intuition that the vaccines can be trusted. Conversely, individuals who mainly followed alternative media were likely primarily exposed to the view that vaccines cannot be trusted and might have adjusted their intuitions accordingly. Therefore, Faith in Intuition for Facts should have no consistent association with COVID-19 vaccination status. Additionally, there is also a potential statistical explanation for the non-significant link in the mediation model: Faith in Intuition for Facts showed the smallest zero-order correlation with COVID-19 vaccination status of all epistemic beliefs subscales. Thus, the non-significant path in the mediation model could be due to the common variance shared by D,

Faith in Intuition for Facts, Need for Evidence, and Truth is Political as suggested by the significant associations between all three mediators as well as D (Table 1).

Second, our design is cross-sectional, so we cannot conclude causality neither for the link between D and epistemic beliefs, nor for their associations with individuals' COVID-19 vaccination status. However, we would like to stress that it is much more likely that personality traits such as the Dark Factor of Personality influence epistemic beliefs than the other way round. The same applies to the links between D, post-truth epistemic beliefs, and individuals' COVID-19 vaccination status. We encourage future research to address the issue of causality. Third, the study focuses on post-truth epistemic beliefs as a predictor of participants' COVID-19 vaccination status. Our approach does not exclude, but rather complements alternative perspectives, for example work on a lack of scientific trust (Kata, 2012; Sturgis et al., 2021) or conspiracy beliefs (Loomba et al., 2021). Further, several studies have indicated that dark traits directly influence COVID-19 related behaviors, such as vaccination hesitancy, or non-compliance with measures and recommendations. These findings are often interpreted as a result of low caring for others (Ścigala et al., 2022) or increased risk-taking in health-related behaviors in general (Konc et al., 2022). Our study does not contradict these findings, but rather provides an additional explanation for seemingly irrational cognition and behavior, which could result from poor judgment due to deliberately disregarding evidence and rational arguments as post-truth epistemic beliefs accompany and guide decision making (Rudloff & Appel, 2022). Third, individuals high in D are prone to deceptive behavior, so we cannot rule out that they may have purposefully misreported their COVID-19 vaccination status. However, such a tendency should induce unsystematic error rather than driving the observed effects.

Conclusion

In sum, our study highlights the pivotal role of post-truth epistemic beliefs in explaining why a substantial number of people remained unvaccinated against COVID-19. People with post-truth epistemic beliefs seem to be unwilling to adhere to the overwhelming scientific evidence in favor of vaccine uptake. This finding provides the ground for potential measures to increase peoples' willingness to act in accordance with the scientific consensus. The fact that epistemic beliefs are developed during childhood and adolescence presents a window of opportunity for interventions, yet at the same time emphasizes the need to act foresightedly.

Method

In reporting our study, we follow the Journal Article Reporting Standards (JARS; Kazak, 2018). Sample size determination, all data exclusions as well as all measures used in the study are reported in the following. Data, analysis code and research materials are available at <https://doi.org/10.17605/OSF.IO/Z8UQ5>. The study was preregistered (<https://aspredicted.org/359tb.pdf>) and has been approved by the internal review board of our institution. Informed consent was obtained from all participants.

Participants

We recruited a US nationally representative sample via Prolific, which means that distributions of gender, age, and ethnicity correspond to the US census. As we expected that a substantial number of participants would not disclose their vaccination status, we aimed for 1300 participants to account for potential exclusions. In total, 1304 participants completed the questionnaire from July, 26 – 29, 2022, and were paid 0.92\$, which corresponds to an average hourly wage of 9.32\$. The following exclusion criteria were applied: First, nine participants were excluded because they did not respond correctly to a control item (e.g., “This is a control question. Please select ‘strongly disagree’”). As preregistered, we checked for extremely low

response times, but all participants exceeded the defined threshold of 120 seconds to complete the study. This threshold was based on the idea that people need at least 2-3 seconds to answer survey items diligently (Huang et al., 2012). Participants were also asked to provide a brief description of the study in English to check whether they were native speakers and responded diligently. As a consequence, four participants were excluded. Another 10 participants were excluded because they were under the age of 18 or did not indicate their age. Finally, we excluded 13 participants, because they did not disclose their COVID-19 vaccination status. Our final sample consisted of 1268 participants ($M = 45.51$ years, $SD = 16.30$ years, 18-93 years, 50.2 % female, 48.5 % male, 1.3 % unspecified or another gender identity). With regard to educational attainment, 30.2 % had a high school diploma, 45.0 % had a bachelor's degree, 17.3 % had a master's degree, and 3.2 % a Ph.D., while 4.3 % completed some high school or trade school. Regarding ethnicity, 78.1 % were White (including Hispanic/Latinx Americans), 12.5 % were Black, 5.6 % were Asian, 1.8 % were Mixed and 2.1 % indicated "Other" or did not disclose their ethnicity.

Measures

Epistemic Beliefs

We relied on a 12-item questionnaire developed by Garret and Weeks (2017) to measure participants' epistemic beliefs. It captures three subscales comprising four items each: Faith in Intuition for Facts (e.g., "I trust my gut to tell what's true and what's not", $\alpha = .90$), Need for Evidence (e.g., "Evidence is more important than whether something feels true", $\alpha = .87$), and Truth is Political (e.g., "Facts depend on their political context", $\alpha = .88$). Items were answered on a 7-point scale that ranged from *strongly disagree* (1) to *strongly agree* (7).

The Dark Factor of Personality

We measured the Dark Factor of Personality using the D16 short version by Moshagen et al., 2020. It contains 16 items that were answered on a 7-point scale that ranged from *strongly disagree* (1) to *strongly agree* (7) (e.g., “My own pleasure is all that matters”, $\alpha = .89$).

COVID-19 Vaccination Status

Further, we assessed participants’ COVID-19 vaccination status (“Please indicate how many times you have been vaccinated against COVID-19.”). Options were “0”, “1”, “2”, “3”, “4 or more”, and “I don't want to answer”. For the first analysis, we aggregated all options other than “0”, thereby differentiating solely between individuals who were willing to get vaccinated (scored 1 in the analyses) from those who were not (scored 0). For the second analysis, we aggregated the options “2”, “3” and “4 or more” to indicate full vaccination status (score 1), whereas “0” and “1” indicated no full vaccination status (score 0). We also asked participants to indicate which vaccine they had received (“Moderna COVID-19 vaccine”, “Pfizer-BioNTech COVID-19 vaccine”, “Janssen (Johnson & Johnson) COVID-19 vaccine”, “Novavax COVID-19 vaccine”, “Other”, “I can't remember”). Selecting multiple options was possible. The items concerning individuals' COVID-19 vaccination status were embedded in several additional items about participants’ travel activities in the past 2 years to disguise the purpose of the study and to avoid reactance. Participants were thoroughly debriefed at the end of the study.

Political Affiliation

Participants were asked to indicate whether they self-identified as Republicans ($n = 277$), Democrats ($n = 582$) or Independents ($n = 408$). One participant did not indicate their political affiliation.

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2.3 Manuscript #3

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When Truthiness Trumps Truth.
Epistemic Beliefs Predict the Accurate Discernment of Fake News

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Abstract

The widespread distribution of mis- and disinformation highlights the need to understand why individuals fall for fake news. Surprisingly, individuals' very understanding of knowledge and how it is created (epistemic beliefs) has received little attention in this context. We present a model focusing on the role of post-truth epistemic beliefs, their relationship to the Dark Factor of Personality (D), and their mutual association with fake news discernment. Based on a repeated measures experiment ($N = 668$), we show that individuals who endorse post-truth epistemic beliefs distinguish less between fake news and accurate news (fake news discernment). Further, D was linked to reduced fake news discernment, which is explained by a positive relationship with post-truth epistemic beliefs. Results remained virtually identical when ideology congruent and ideology incongruent news were considered separately. In conclusion, when addressing the global threat of fake news, epistemic beliefs need to be considered.

Keywords: Post-Truth, Epistemic Beliefs, Dark Factor of Personality, Fake News, Misinformation, Disinformation

General Audience Summary

The development of effective countermeasures against the distribution of mis- and disinformation, relies on knowledge as to which individuals are more likely to fall for fake news. People have different worldviews regarding facts and knowledge (*epistemic beliefs*). People differ in how much emphasis they put on evidence when evaluating the accuracy of information and how much they prioritize their intuition. Moreover, people have different views as to whether there are independent facts or whether “facts” are created by politicians. We assumed that individuals who prefer to trust their intuition, who put little emphasis on evidence and who think that facts are formed by those in power (*post-truth epistemic beliefs*) are particularly susceptible to fake news. Prior research has shown that these beliefs are connected to dark personality traits, more specifically the Dark Factor of Personality. People with a pronounced Dark Factor of Personality only act for their own benefit without caring for others and hold beliefs that justify their behavior. In an online experiment, we presented factually accurate and inaccurate news posts and asked participants to rate the accuracy of the news posts. Our results show that people with post-truth epistemic beliefs and a pronounced Dark Factor of Personality distinguished less between accurate and fake news. Based on our results, we recommend educating children and adolescents to develop sophisticated epistemic beliefs, which would help them differentiate between accurate and inaccurate news and more broadly, improve their ability to form opinions and to make decisions based on evidence.

When Truthiness Trumps Truth. Epistemic Beliefs Predict the Accurate Discernment of Fake News

Major challenges to humankind such as climate change or COVID-19 have highlighted the need for academic research on the antecedents of accepting fake news (e.g., Lazer et al., 2018; Lewandowsky et al., 2020, Pennycook et al., 2020). Fake news are conceived here as fabricated and factually inaccurate information with a similar look and feel as journalistic contributions (e.g., Lazer et al., 2018). We argue that individuals' convictions about the nature and generation of knowledge (i.e., *epistemic beliefs*, Schommer, 1990) could be pivotal to understanding the acceptance of fake news (Hyman & Jalbert, 2017; Lewandowsky et al., 2017; Scheufele & Krause, 2019). Based on a three-dimensional framework of epistemic beliefs (Garrett & Weeks, 2017), we propose a model including the Dark Factor of Personality (Moshagen et al., 2018) as a predictor of post-truth epistemic beliefs and impaired discernment between fake news and accurate news as a consequence.

Epistemic Beliefs

Beliefs about the nature and generation of knowledge are often referred to as epistemic beliefs (Muis, 2007). In the social sciences, it is widely agreed upon that knowledge is always embedded in the historical and societal context, but that not all assertions or opinions are equally valid (e.g., Holtz, 2020; Lewandowsky, 2021; Popper, 1976/1969; Waisbord, 2018). In contrast to this position, strongly relativist, unbounded constructivist perspectives have surfaced, most prominently in the political realm (e.g., the notion of “alternative facts”, see Lewandowsky, 2020; Lewandowsky, 2021). Our focus here is on epistemic beliefs as everyday people's worldviews about how one can and should construct knowledge and reality. Whereas motivated reasoning (Kruglanski, 1996; Kunda, 1990) is defined as the process of drawing conclusions based on the desired outcome, epistemic beliefs refer to one's general views on the concept of

knowledge itself. Research on epistemic beliefs complements alternative perspectives, for example work on individual differences in analytic thinking (e.g., Bronstein et al., 2019; Pennycook & Rand, 2020). While the latter focuses on individual differences in the ability and disposition to think rationally, our work emphasizes the role of higher-level cognitions and goals that fuel or inhibit rational processing of information (Stanovich, 2011). Epistemic beliefs develop through socialization and are thought to be relatively stable over time, but not fixed (Garret & Weeks, 2017; Schommer, 1990).

Following Garrett and Weeks (2017), we distinguish between three aspects of epistemic beliefs: First, *Faith in Intuition for Facts* refers to the degree to which individuals believe that they should trust their gut feeling rather than evidence when judging the accuracy of information. This aspect overlaps to a large extent with the notion of *truthiness*, popularized by comedian and talk show host Stephen Colbert (Colbert, 2005). Although intuition can be a significant source of knowledge (e.g., Damasio, 2005; Kahneman, 2011), it can lead to drastic misperceptions if it is not complemented by analytic thinking (e.g., Swami et al., 2014). Second, *Need for Evidence* refers to the degree to which people believe that their views need to align with externally validated data. A low Need for Evidence increases susceptibility towards ideological convictions contradicting the current scientific consensus (e.g., Garrett et al., 2016; Hindman, 2009). Third, *Truth is Political* captures the degree to which people assume that facts are determined by those in power, for example politicians, journalists, and scientists. In that sense, evidence is considered to be nothing but a matter of power (Holtz, 2020; Garrett & Weeks, 2017).

We consider a strong Faith in Intuition for Facts, a low Need for Evidence and a strong conviction that Truth is Political as a set of *post-truth epistemic beliefs*. Prior research (Garrett & Weeks, 2017) showed that lower education and lower need for cognition were associated with all three post-truth epistemic belief components. Moreover, political conservatism was linked to the

endorsement of post-truth epistemic beliefs. Initial evidence further suggests that post-truth epistemic beliefs are associated with the endorsement of COVID 19 conspiracy theories (Rudloff et al., 2022). Research based on a different but related belief framework (Lewandowsky, 2021) further showed that the beliefs that truth is not knowable and that knowledge sources are unreliable, as well as the prioritization of intuition were associated with higher conspiracy mentality (Imhoff & Buder, 2014), a stronger need for chaos (Arceneaux et al., 2021), and the perception that scientists are more divided on issues (e.g., vaccinations).

The Dark Factor of Personality (D) and Epistemic Beliefs

Recent theoretical and empirical work has introduced the *Dark Factor of Personality (D)* as the common core of dark traits such as Machiavellianism, psychopathy, and narcissism (e.g., Bader et al., 2021; Hartung et al., 2021; Moshagen et al., 2018). D is defined as “the general tendency to maximize one's individual utility — disregarding, accepting, or malevolently provoking disutility for others —, accompanied by beliefs that serve as justifications” (Moshagen et al., 2018, p. 657). Utility can be understood as any form of material success, but it also refers to hedonistic feelings such as power or pleasure.

Embracing a relativist and cynical worldview enables individuals with high levels in D to twist morals and to disregard norms, whenever it is beneficial to their agenda (e.g., Jonason et al., 2015; Moshagen et al., 2018; Moshagen et al., 2020; Zeigler-Hill et al., 2020). As facts may be an obstacle to maximizing one's own utility, we assume that post-truth epistemic beliefs function as a means to construct and maintain a self-serving worldview that defies arguments, injunctive norms or scientific evidence. Indeed, D was positively associated with post-truth epistemic beliefs (Rudloff et al., 2022). D as well as individual dark traits such as Machiavellianism, narcissism, and psychopathy were further related to the endorsement of conspiracy theories (Ahadzadeh et al., 2021; Douglas & Sutton, 2011; Kay, 2021; Rudloff et al., 2022). Some (but

not all) studies show that scores on dark traits increase with a more conservative, right-wing political orientation (e.g., Arvan, 2013; Jonason, 2015; Vize et al., 2018).

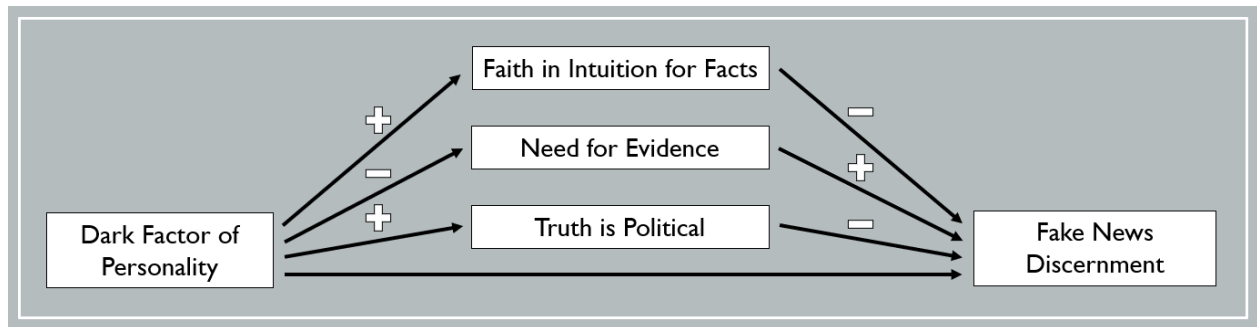
Fake News Discernment and the Current Study

The contribution of D and post-truth epistemic beliefs with respect to accepting and spreading disinformation and other incivil behavior online remains to be addressed. The focus of our study was on post-truth epistemic beliefs as a predictor of the processing of information, more specifically, of lower fake news discernment scores (e.g., Pennycook & Rand, 2019). Following from the theory and research outlined in the previous sections, we assumed that the more individuals endorse post-truth epistemic beliefs, the lower their willingness as well as their ability (given limited practice) to base their judgments on evidence. As a consequence, information that could signal that news are inaccurate are disregarded by individuals with pronounced post-truth epistemic beliefs. This should result in negative associations between post-truth epistemic beliefs and the correct distinction between fake and accurate news. We further argue that individuals with high levels in D use post-truth epistemic beliefs to approve or reject information based on their individual utility (rather than assessments of truth or truthfulness). As a consequence, the higher D, the worse participants should perform on tasks that require discerning between factually accurate and inaccurate news.

Based on these assumptions, a mediation model is proposed and tested (see Figure 1). We used a repeated measures experimental design in which the accuracy of news posts (accurate vs. fake) was manipulated within subjects. This model includes the three epistemic belief factors as mediating variables. It further includes a residual association between D and fake news discernment.

Figure 1

The Proposed Mediator Model with Fake News Discernment as the Dependent Variable.



Theory and research further suggest that individuals could be particularly susceptible to mis- and disinformation that align with pre-existing convictions, for example news in favor of their political views (e.g., Kahan, 2013). Thus, we aimed at testing whether the model holds for all news or only news that are ideology congruent or incongruent. To this end, the political stance of the posts (pro-Democrat vs. pro-Republican) served as a second factor that was manipulated within subjects (see Kim & Dennis, 2019; Pennycook et al., 2020; Pennycook & Rand, 2019, for similar approaches).

Method

We report how we determined our sample size, all data exclusions, and all measures in the study, and we follow the Journal Article Reporting Standards (JARS; Kazak, 2018). All data, analysis code and research materials are available at <https://doi.org/10.17605/OSF.IO/KQYRJ>. Our study was preregistered (<https://aspredicted.org/46fu7.pdf>) and has been approved by the internal review board of our institution.

Participants

An analysis with G*Power (Faul et al., 2009) yielded a required sample size of 193 participants for detecting an association of $r = .20$, with $\alpha = .05$ and power = .80. Given that additional analyses on political stance and ideology congruence were planned, we aimed for at least 500 participants. We intended to invite 700 MTurk participants (U.S. residents with good English proficiency) to account for potential exclusions. A total of 821⁸ participants completed the questionnaire on October, 29 – 30, 2020, and received 1.50\$ (participants required an approval rating of 97% or higher and a minimum of 1,000 previous tasks). The following exclusions were made: First, 74 participants were excluded because they deployed a VPN/VPS or a proxy to hide their country of access and/or failed to adequately describe the study in English indicating they were either not native speakers or bots or careless responders (Kennedy et al., 2020). Another 57 participants were excluded because they failed to respond appropriately to at least one of our control questions (e.g., “This is a control item. Please choose “Very unlikely.”; see Table S3). Additionally, participants were asked to indicate both their year of birth as well as their current age. We excluded 17 participants because of an incongruity between the two pieces of information, which implied inattentive or careless responding (Kennedy, et al., 2020). Additionally, five participants were excluded due to extremely low response times of less than 180 seconds (Huang et al., 2012). See S3 of the supplement for more details on the exclusion criteria. The final sample comprised 668 participants ($M = 38.90$ years, $SD = 11.66$ years, 18-78 years, 44.5 % female). With regard to educational attainment, 32.9 % had a high school diploma,

⁸ Due to technical issues at the interface between the software used to create our experiment (Qualtrics and Mechanical Turk), the number of participants having completed the questionnaire was bigger than planned.

50.1 % had a bachelor's degree, 12.7 % had a master's degree, and 1.9 % a Ph.D., while 2.2 % completed some high school or trade school.

Stimuli Selection: Pilot Study

The selection of the stimuli was based on a pilot study that is reported in detail in Supplement S1. Prior to the pilot study, we assembled 32 news posts, half were accurate news posts, half were fake news posts. Our factually accurate news posts were retrieved from US news sources and the accuracy of their content was carefully double-checked either by referring to *Snopes* or *PolitiFact* (third-party fact-checking websites) or by matching the content with at least one additional credible source. For the factually inaccurate news posts, we also relied on *Snopes* and *PolitiFact*, who had flagged these news posts as fake news. Reflecting the composition of fake news found on social media, the fake news posts involved different variants of fabrication, some contained or alluded to conspiratorial ideas. Following prior research (e.g., Pennycook & Rand, 2019; Bago et al., 2020), half of the accurate and half of the fake news posts were favorable for the Democratic Party (= pro-Democrat), the other half was favorable for the Republican Party (= pro-Republican). The news posts were created in a format identical to that of Facebook posts (i.e., a post with an associated photograph above it as well as a headline and teaser below it; see Supplement S2). The pilot study participants (55 MTurk respondents) rated the stimuli according to their perceived accuracy (on a 7-point scale from *very inaccurate* to *very accurate*), perceived political stance (on a 7-point scale ranging from *very pro-Democrat* to *very pro-Republican*), and familiarity. We selected a set of 12 rather unfamiliar stimuli for the main study, 1.8 % to 16.4 % of the pilot study participants stated they had encountered them before. For the selected news posts, pilot study participants could distinguish correctly on average between accurate news (perceived accuracy: $M = 3.68$, $SD = 0.76$) and fake news (perceived accuracy: $M = 2.96$, $SD = 1.16$), $t(54) = 6.18$, $p < .001$, $d = 0.83$. Pilot study participants further

distinguished between pro-Democrat (political stance: $M = 3.06$, $SD = 1.05$) and pro-Republican stimuli (political stance: $M = 5.12$, $SD = 0.83$), $t(54) = 11.88$, $p < .001$, $d = 1.60$.

Main Study Stimuli and Fake News Discernment Measure

In the main study, we presented six accurate news posts and six fake news posts. In each category, three posts were pro-Democrat, three were pro-Republican (see Table 1). Our stimuli covered a wide range of contemporary political topics (excluding COVID-19 - related issues, as the factual knowledge on COVID-19 was comparably volatile when the main study was conducted). All stimuli can be found in the supplement S2. For each of the 12 news posts, participants were asked to indicate how accurate they perceived the news post to be, using a 7-point scale that ranged from *very inaccurate* (1) to *very accurate* (7, item wording: “To the best of your knowledge, how accurate is the claim in the news headline above?”).⁹ Fake news discernment scores were calculated by subtracting the average ratings of fake news posts from the average ratings of accurate news posts. Similar stimuli and measurements were used in prior research on fake news (e.g., Kim & Dennis, 2019; Pennycook et al., 2020; Pennycook & Rand, 2019).

⁹ We also assessed participants’ willingness to share the news posts and performed the same analyses with fake news discernment for willingness to share as the dependent variable. Both dependent variables correlated substantially ($r = .48$). The results on willingness to share are highly similar to the reported results on perceived accuracy. See S5 of the Online Supplement for a detailed report.

Table 1*Example Stimuli for All Types of News Posts*

Accuracy	Political stance	Headlines
Accurate	Pro Democrat	“Trump’s first 3 years created 1.5 million fewer jobs than Obama’s last 3
	Pro-Republican	“Trump signs bi-partisan expansion of \$1.8 billion in autism funding act”
Fake	Pro-Democrat	“Head of Catholic Church says those who own weapons are “hypocrites”, not Christians”
	Pro-Republican	“Americans’ health deteriorating under Obamacare as life expectancies plunge”

Note. Headlines were presented with an associated photograph above it as well as a teaser below it.

Epistemic Beliefs, D, and Political Affiliation

After the stimuli were presented and rated, the trait measures were presented. We used a 12-item questionnaire by Garret and Weeks (2017) to assess the three subscales of epistemic beliefs: Faith in Intuition for Facts (e.g., “I trust my gut to tell what’s true and what’s not”, $\alpha = .91$), Need for Evidence (e.g., “Evidence is more important than whether something feels true”, $\alpha = .86$) and Truth is Political (e.g., “Facts depend on their political context”, $\alpha = .89$). Each subscale consisted of four items that were answered on a 7-point scale reaching from *strongly disagree* (1) to *strongly agree* (7).

We used the D16 short version (Moshagen et al., 2020) to assess the Dark Factor of Personality. It comprises 16 items that were answered on a 7-point scale reaching from *strongly disagree* (1) to *strongly agree* (7) (e.g., “My own pleasure is all that matters”, $\alpha = .78$).

Further, we asked participants whether they self-identified as Democrats ($n = 302$), Republicans ($n = 166$) or Independents ($n = 200$).¹⁰ After all measures were completed, participants were thoroughly debriefed, including information as to which of the 12 news posts contained factually inaccurate information.

Results

On average, accurate news posts were rated as more accurate ($M = 3.72$, $SD = 0.92$) than fake news posts ($M = 2.70$, $SD = 1.06$), $t(667) = 22.69$, $p < .001$, $d = 0.88$. In line with prior research by Pennycook and Rand (2019), we found effects of party affiliation (Democrat, Independent, Republican) on the discernment between (pro-Democrat and pro-Republican) fake and accurate news. Democrats (discernment score: $M_{Diff} = 1.42$; $SE_{Diff} = 0.07$) were better at discerning fake from accurate news than Independents ($M_{Diff} = 0.84$; $SE_{Diff} = 0.09$) and Republicans ($M_{Diff} = 0.004$; $SE_{Diff} = 0.09$), all $p < .001$. See Supplement S7 for a detailed report of related mixed ANOVA results.

For our parallel multiple mediation analyses we used PROCESS version 3.4.1 (Hayes, 2018). The three epistemic belief subscales were included as simultaneous mediators. Predictor variable D was modeled as influencing the dependent variable fake news discernment directly and indirectly through the three mediator variables (Hayes, 2018). All path coefficients, standard errors, and p -values are presented in Figure 2. There was a significant total effect of D on fake news discernment, $B = -.24$, $SEB = .04$, 95% CI $[-.32; -.15]$, $p < .001$, showing that individuals high in D differentiate less between accurate and fake news posts. Importantly, Faith in Intuition for Facts, Need for Evidence, and Truth is Political predicted fake news discernment in the

¹⁰ We also assessed participants' political orientation using a 7-point scale ($M = 3.51$, $SD = 1.86$) reaching from *extremely left* (1) to *extremely right* (7). See S4 of the Online Supplement for the zero-order correlations with all continuous variables.

expected directions. D was significantly associated with all epistemic belief subscales, which led to significant indirect effects for Faith in Intuition for Facts, $B = -.03$, $SEB = .01$, 95%CI [-.05; -.01], for Need for Evidence, $B = -.06$, $SEB = .02$, 95%CI [-.09; -.03], and for Truth is Political, $B = -.09$, $SEB = .02$, 95%CI [-.13; -.05]. Our results show that post-truth epistemic beliefs predict impaired fake news discernment and further explain the link between D and impaired fake news discernment.

Ideology Congruence and Political Orientation

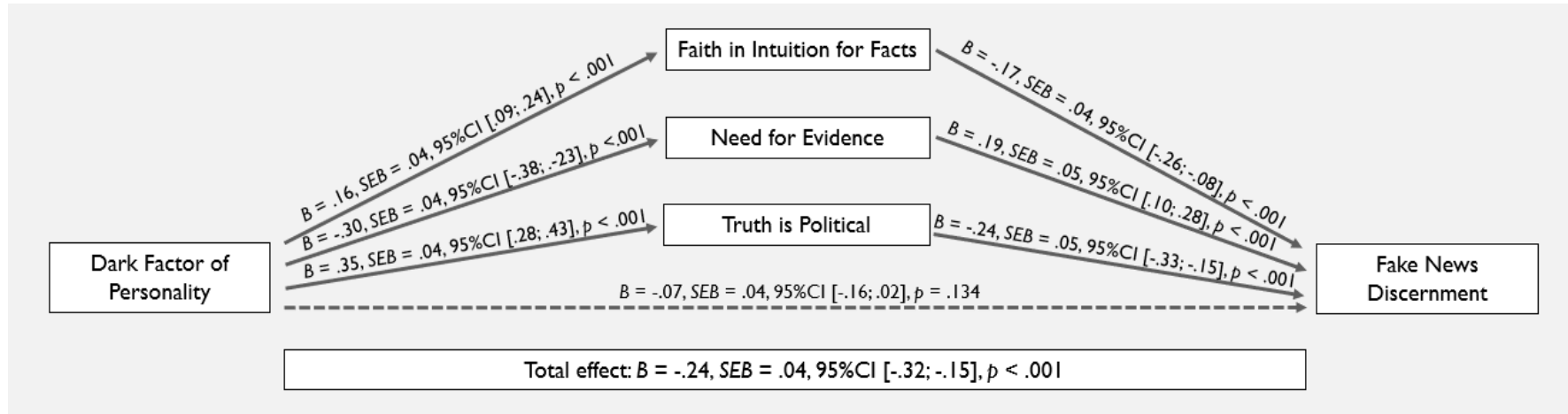
For the analyses of ideology congruence, the subsample of Independents ($n = 200$) was excluded as our stimuli were either pro-Democrat or pro-Republican, leaving us with 468 participants. Participants were better at discerning ideology congruent accurate and fake news ($M_{Diff} = 1.02$, $SD_{Diff} = 1.44$) than ideology incongruent ones ($M_{Diff} = 0.82$, $SD_{Diff} = 1.47$), $t(467) = 4.72$, $p < .001$, $d = 0.23$. We performed the same mediation analyses separately for ideology congruent and incongruent stimuli to explore whether the associations between D, epistemic beliefs and fake news discernment differ depending on whether or not an individual's party affiliation matches the political stance of the news posts. Figure 3 shows all path coefficients, standard errors, and p -values. Note that all significant associations found across the stimuli could also be observed when considering ideology congruent and incongruent items separately. This also applied to the indirect effects. For ideology congruent news posts, we found indirect effects for Faith in Intuition for Facts, $B = -.03$, $SEB = .01$, 95%CI [-.06; -.01], for Need for Evidence, $B = -.08$, $SEB = .02$, 95%CI [-.12; -.04], and for Truth is Political, $B = -.09$, $SEB = .03$, 95%CI [-.16; -.03]. For ideology incongruent news posts, we also found indirect effects for Faith in Intuition for Facts, $B = -.03$, $SEB = .01$, 95%CI [-.07; -.01], for Need for Evidence, $B = -.07$, $SEB = .02$, 95%CI [-.13; -.03], and for Truth is Political, $B = -.11$, $SEB = .03$, 95%CI [-.18; -.05]. Our

results show that the effects of D and post-truth epistemic beliefs apply to both ideology congruent and incongruent fake news discernment, speaking to the robustness of our findings.

We followed a similar approach by examining our model for self-ascribed Democrats ($n = 302$) and self-ascribed Republicans ($n = 166$) separately (see also Supplement S6). For the Democrats, we found that the link between D and fake news discernment was significantly mediated by the epistemic belief factors Faith in Intuition for Facts, $B = -.05$, $SEB = .02$, 95%CI [-.08; -.01] and Need for Evidence, $B = -.08$, $SEB = .03$, 95%CI [-.13; -.03], whereas Truth is Political was no significant mediator, $B = -.04$, $SEB = .03$, 95%CI [-.10; .02]. For Republicans, a different picture emerged. The link between D and fake news discernment was mediated by Truth is Political, $B = -.09$, $SEB = .03$, 95%CI [-.16; -.03], but neither by Faith in Intuition for Facts, $B = .00$, $SEB = .01$, 95%CI [-.01; .02], nor by Need for Evidence, $B = -.02$, $SEB = .02$, 95%CI [-.06; .01]. Results per party affiliation that did not follow our general model were mainly based on a missing link between the respective epistemic belief component and fake news discernment. The hypothesized associations between D and the epistemic beliefs were observed for Republicans and for Democrats, except for the link between D and Faith in the Intuition for Facts among Republicans. Thus, whereas the general model linking D, epistemic beliefs, and (a lack of) fake news discernment holds for Democrats and Republicans, our results also suggest that different post-truth epistemic belief subcomponents are relevant for these subgroups.

Figure 2

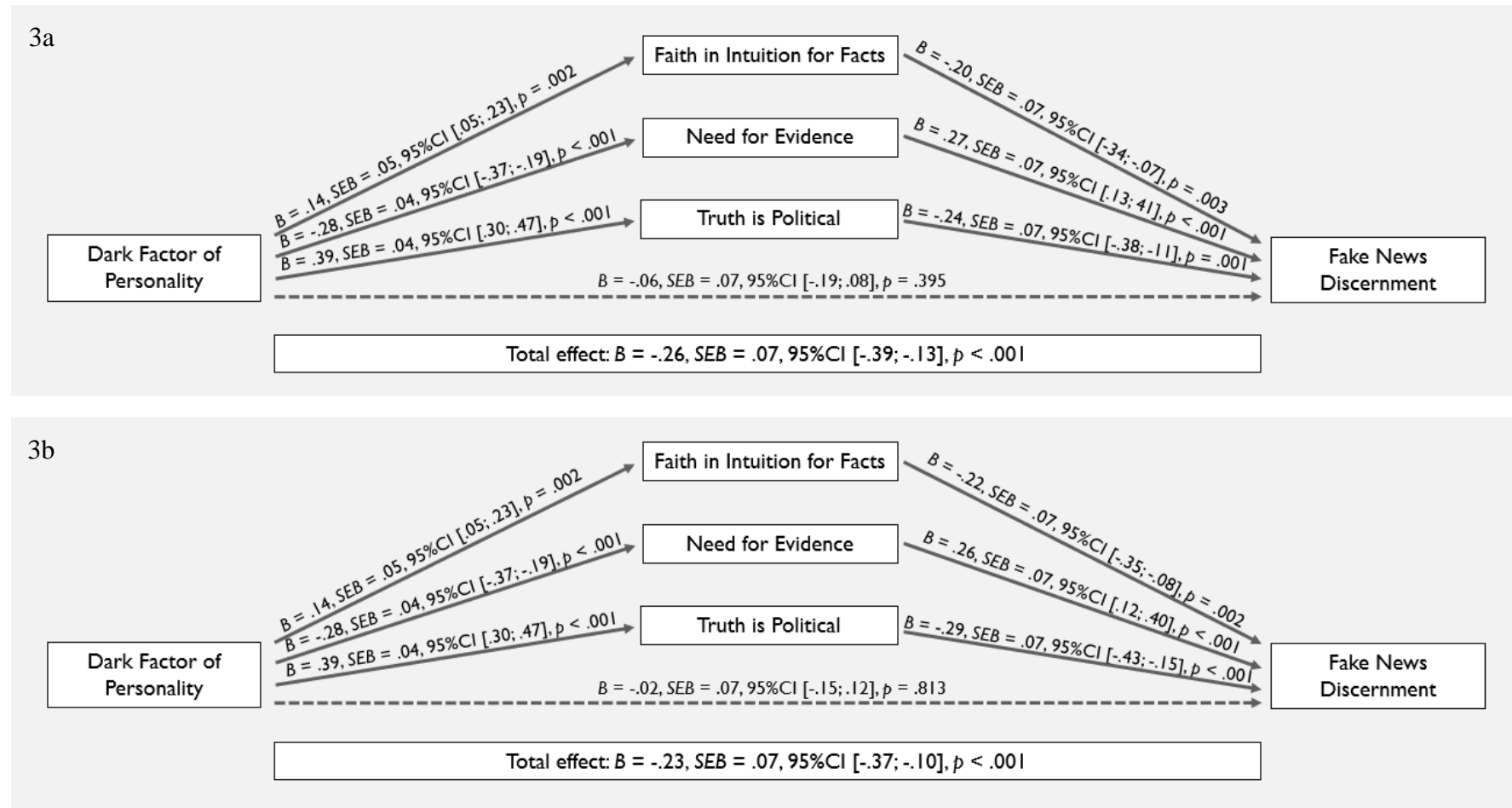
Main Results of the Parallel Mediator Model with Fake News Discernment as the Dependent Variable



Note. $N = 668$. Solid paths indicate significant associations ($p < .05$), dashed paths indicate non-significant associations.

Figure 3

Main Results of the Parallel Mediator Models with Fake News Discernment for Perceived Accuracy for Ideologically Congruent Stimuli (3a) and Incongruent Stimuli (3b)



Note. $n = 468$. Solid paths indicate significant associations ($p < .05$), dashed paths indicate non-significant associations.

Discussion

Fake news are a cause for concern for democratic societies worldwide (Lazer et al., 2018; Lewandowsky et al., 2017). Thus, it is crucial to disentangle the contributing factors to an increased susceptibility to fake news. We found support for our comprehensive model emphasizing the role of post-truth epistemic beliefs, their relationship to the Dark Factor of Personality as their antecedent, and fake news discernment as a consequence. Our study yields four important results: First, post-truth epistemic beliefs, that is, a strong Faith in Intuition for Facts, a low Need for Evidence, as well as the strong conviction that Truth is Political, predict impaired fake news discernment. Thus, general worldviews regarding the nature and generation of knowledge translate into a specific handling of news. This finding complements existing research on analytic thinking (e.g., Pennycook & Rand, 2019) by emphasizing epistemic beliefs as a basic factor contributing to the engagement in a rational processing of information or a lack thereof (Stanovich, 2011). Second, individuals high in D, who are striving towards maximum individual utility, distinguish less between accurate and fake news. For these individuals, assessing the accuracy of news based on actual evidence could interfere with maintaining a worldview that serves their agenda as well as their self-concept. Third, we corroborate prior research by Rudloff et al. (2022) showing that individuals high in D tend to hold post-truth epistemic beliefs. Epistemic beliefs explain the link between D and impaired fake news discernment. This provides support for our assumption that these individuals deploy post-truth epistemic beliefs to evaluate the accuracy of news posts based on their individual utility. Fourth, all of our hypothesized associations remain significant for both ideology congruent and incongruent news, but the roles of the three epistemic belief aspects seem to vary for Democrats and Republicans.

Regarding ideology congruence, we do not suggest that there is no effect of ideology congruence on the accuracy ratings of news posts. As pointed out by Gawronski (2021), no difference in discernment scores between two groups does not necessarily mean that the

processing and handling of news is not influenced by ideology congruence as ideology congruence increases both perceived accuracy ratings for accurate and fake news whereas ideology incongruence reduces ratings for both types of news. Discernment scores do not distinguish between high ratings for both accurate and fake news or low ratings for both. In fact, our mixed ANOVA results reported in the Online Supplement (S7) show that ideology congruence *did* influence participants' judgment of news, to the effect that ideology congruent news were perceived to be more accurate than ideology incongruent news.

When the results of Democrats and Republicans were analyzed separately, different post-truth epistemic belief subcomponents were predictive of fake news discernment for these groups and D was not associated with Faith in the Intuition for Facts among Republicans. These additional analyses were based on rather small subsamples (e.g., 166 Republicans) and MTurk participants may not perfectly reflect the electorate (e.g., Huff & Tingley, 2015). Still, future research is encouraged to examine potentially different roles of epistemic beliefs in the dissemination and processing of accurate and inaccurate information depending on political orientation.

Our research highlights a major potential obstacle to rational communication: Some peoples' deliberate worldviews about how they can and should gain knowledge are fueled by a general prioritizing of individual utility. In other words, not everyone adheres to "the unforced force of the better argument" (Habermas, 1996, p. 305). Given our results, efforts should be made to counteract the development of post-truth epistemic beliefs. We encourage future research on *epistemic literacy* that reflects the opportunities and challenges of rational argumentation and discourse as part of societies' combat against fake news. Altering the epistemic beliefs of those with a pronounced dark personality will be particularly difficult as their beliefs exclusively serve to increase individual utility. Reducing the scope of environments in which endorsing post-truth epistemic beliefs proves to be more useful in

increasing one's individual utility than relying on argument quality and evidence could be a key to altering post-truth epistemic beliefs held by individuals with a dark personality.

There are several limitations that point at perspectives for future research. First, we relied on news posts as stimuli instead of full news articles. Although this approach has been used repeatedly in prior research and is widely accepted within the scientific community (e.g., Kim & Dennis, 2019; Pennycook et al., 2020; Pennycook & Rand, 2019) we encourage future research to investigate whether the found associations can be observed when using full news articles. Second, the relationship between D and epistemic beliefs was examined cross-sectionally, so caution is advised with regard to concluding causality. Although, it is much more likely that stable personality traits such as D influence epistemic beliefs than the other way round, additional research is needed to empirically corroborate causality. On a related note, we acknowledge that not all variables potentially involved in the link between D and fake news discernment were included in our study. For example, individuals high in D may be inclined to engage in purposefully misreporting their veracity assessment of the news posts. Third, our focus was on information processing in terms of fake news discernment. The nexus of D and post-truth epistemic beliefs could be a relevant force underlying related phenomena as well. Connecting our perspective to recent theory and research on shock and chaos disinformation (e.g., Arceneaux et al., 2021; Lewandowsky, 2020; 2021; Vargo et al., 2018), we suggest that individuals high in D use post-truth epistemic beliefs to justify the dissemination of erratic and self-contradictory information. Even if this information does not provide a viable epistemic alternative to (scientific) knowledge and evidence, it may disrupt the information processing of others as well as societal discourse.

Conclusion

We present first evidence for the crucial role of post-truth epistemic beliefs in the processing of fake news as they lead to a diminished discernment between accurate and fake news posts. This opens up new avenues with regard to counteracting fake news: Considering

how crucial they are to the interpretation of knowledge, promoting the development of sophisticated epistemic beliefs emphasizing the significance of evidence in children and adolescents as well as shifting those of adults could be of vital importance in the global combat against mis- and disinformation.

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Online Supplement for the Manuscript

***When Truthiness Trumps Truth. Epistemic Beliefs Predict the Accurate Discernment of
Fake News***

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Supplement S1: Pilot Study

Pilot Study Goals

Prior to the Pilot Study, we selected and adapted 32 news postings. This stimulus pool consisted of 8 pro-Republican fake news posts, 8 pro-Democrat fake news posts, 8 pro-Republican accurate news posts, and 8 pro-Democrat accurate news posts. The goal of the Pilot Study was to substantially reduce the number of items to find the most suitable ones for our main study. We based our selection on three criteria. First, on average the final selection of accurate news posts had to be perceived as more accurate than the final selection of fake news posts. Second, following prior research in the field (e.g., Pennycook & Rand, 2019; Bago et al., 2020), we wanted to balance our stimuli regarding their perceived political stance (pro-Democrat vs. pro-Republican). Thus, we aimed for an equal number of items per type (x pro-Republican fake news posts, x pro-Democrat fake news posts, x pro-Republican accurate news posts, x pro-Democrat accurate news posts). In this regard, our own assessment of whether news posts could be considered as pro-Republican or pro-Democrat had to be confirmed by the judgment of the participants. Third, we wanted to select rather unknown news to avoid effects of prior exposure (Pennycook et al., 2018). The Pilot Study took place on October, 12, 2020.

Participants

A total of 114 MTurk participants completed the questionnaire and received 1.70\$. The following exclusions were made: First, 30 participants were excluded because they deployed a VPN/VPS or a proxy to hide their country of access and/or failed to adequately describe the study in English indicating they were either not native speakers or bots or careless responders (Kennedy et al., 2020). Another 29 participants were excluded because they failed to respond appropriately to at least one of our two control questions (e.g., “This is a control item. Please choose “Very likely (7)”.”). The final sample comprised 55 participants ($M = 38.07$ years, $SD = 11.16$ years, 23-71 years, 36.4 % female). With regard to educational attainment, 30.9 % had a

high school diploma, 58.2 % had a bachelor's degree, 9.1 % had a master's degree, and 1.8 % completed trade school.

Stimuli

Our initial pool of 32 stimuli (8 pro-Republican fake news posts, 8 pro-Democrat fake news posts, 8 pro-Republican accurate news posts, 8 pro-Democrat accurate news posts) was designed in the format of Facebook posts (i.e., a post with an associated photograph above it as well as a headline, a teaser and a source below it; see S2). On social media it is common to engage with news solely based on reading story headlines (Gabiolkov et al., 2016). Note, that a very similar approach was used in prior research (e.g., Kim & Dennis, 2019; Pennycook & Rand, 2020, Pennycook & Rand, 2019). The factually accurate news posts (accurate news) were retrieved from US news sources and the accuracy of their content was carefully double-checked either by *Snopes* or *PolitiFact*, which are third-party fact-checking websites or by matching the content with at least one additional credible source. For the factually inaccurate news posts (fake news), we also relied on *Snopes* and *PolitiFact* who had identified these news items as fake. Whenever possible, we used the photographs from the original posts. In cases where no suitable photographs were attached to the original posts, we used the photographs from the fact-checking websites' article citing the original posts. In two cases, in which no suitable photograph could be retrieved from neither the original source nor the fact-checking websites, we attached a suitable one. Whenever possible, we provided the original source at the bottom of each post – in cases where the original source was untraceable or inaccessible, we used a fictitious source matching the style of the actual sources of other posts. For one accurate news post (“Democratic state senator Leland Yee arrested for gun trafficking“), we refrained from presenting the original source (Minuteman Militia), as this outlet was known for spreading conspiratorial ideas as well as factually inaccurate information, which could have interfered with participants' judgement. We did use the original photograph, but presented a fictitious source instead of the original one. Our news posts covered a wide range of

contemporary political topics to increase generalizability. The fake news posts consist of items that contain or evoke conspiratorial ideas (e.g., fake news post 6) and items that are simply objectively false (e.g., fake news post 2; see S2). At the time of assessment in fall 2020, COVID-19 was still a highly controversial subject with the state of knowledge expanding from day to day. As our investigation was dependent on the actual accuracy of our news posts, we refrained from using any material related to COVID-19.

Measures

For each of the 32 news posts, participants were asked to indicate how accurate they perceived the news posts to be, using a 7-point scale that ranged from *very inaccurate* (1) to *very accurate* (7, item wording: “To the best of your knowledge, how accurate is the claim in the news headline above?”). Further, participants were asked to indicate how they perceived the political stance of the news posts, (item wording: “Please rate the political message of the news headline. “Pro-Democrat” refers to the Democratic Party whereas “pro-Republican” refers to the Republican Party.”). Ratings were given on a 7-point scale that ranged from *very pro-Democrat* (1) to *very pro-Republican* (7). Participants were also asked whether they had encountered the news posts before (item wording: “Have you already seen this news headline somewhere?”; response options: “no”, “not sure”, and “yes”).¹¹

Results for the final selection of stimuli

Based on the aforementioned selection criteria, 12 news posts were chosen for the main study. They consisted of 3 pro-Republican fake news posts, 3 pro-Democrat fake news posts, 3 pro-Republican accurate news posts, and 3 pro-Democrat accurate news posts (see S2). The ratings for perceived accuracy for accurate news posts ($M = 3.68$, $SD = 0.76$) were significantly higher than the ratings for fake news posts ($M = 2.96$, $SD = 1.16$), $t(54) = 6.18$, $p < .001$, $d =$

¹¹ Participants were also asked to indicate their willingness to share the news post on a 7-point scale, ranging from *very unlikely* (1) to *very likely* (7, item wording: “I would consider sharing this news post online (for example, through Facebook or Twitter).”). This measure was not used for item selection.

0.83. With respect to the perceived political stance, ratings of the pro-Democrat news posts ($M = 3.06$, $SD = 1.05$) differed from the pro-Republican posts ($M = 5.12$, $SD = 0.83$) in the expected direction, $t(54) = 11.88$, $p < .001$, $d = 1.60$. Moreover, we wanted to test whether the political stance ratings for the pro-Democrat and pro-Republican news posts were equally distant from the scale midpoint (i.e., 4 = “neutral”), that is whether they were perceived to be equally partisan. To do so, we recoded the political stance ratings for all of the final pro-Democrat news posts (1 = 7; 2 = 6; 3 = 5; 4 = 4; 5 = 3; 6 = 2; 7 = 1). We then tested whether the *recoded* political stance ratings for pro-Democrat news posts ($M_{\text{rec}} = 4.94$, $SD_{\text{rec}} = 1.05$) differed from the political stance ratings for pro-Republican news posts ($M = 5.12$, $SD = 0.83$). They did not differ significantly, which indicates that the pro-Democrat news posts were neither perceived as more nor as less partisan than the pro-Republican news posts, $t(54) = 0.19$, $p = .333$, $d = 0.13$. The familiarity of the final items ranged from 1.8 % to 16.4 % of the participants stating they had encountered them before.

Supplement S2: Main Study Stimuli

Fake News Post 1 (Pro-Democrat)

Retrieved from: <https://www.snopes.com/fact-check/north-dakota-shoot-protesters/>

Photograph retrieved from Snopes

Presented source: Original

Perceived accuracy ratings (main study): $M = 1.85$, $SD = 1.38$

Fake News Post 2 (Pro-Democrat)

Retrieved from: <https://www.politifact.com/factchecks/2020/apr/07/blog-post/theres-still-no-evidence-hollywood-striking-becaus/>

Photograph: Original

Presented source: Original

Perceived accuracy ratings (main study): $M = 3.16$, $SD = 1.83$

Fake News Post 3 (Pro-Democrat)

Retrieved from:

<https://www.politifact.com/factchecks/2018/may/10/thenewyorkeveningcom/no-pope-francis-didnt-say-gun-owners-cant-call-the/>

Photograph: Original

Presented source: Original

Perceived accuracy ratings (main study): $M = 3.23$, $SD = 1.61$

Fake News Post 4 (Pro-Republican)

Retrieved from: <https://www.snopes.com/fact-check/nra-founded-protect-black-people-kkk/>

Photograph retrieved from Snopes

Presented source: Fictitious

Perceived accuracy ratings (main study): $M = 2.58$, $SD = 1.53$

Fake News Post 5 (Pro-Republican)

Retrieved from: <https://www.snopes.com/fact-check/life-expectancy-in-the-united-states-declining-thanks-to-obamacare/>

Photograph added independently

Presented source: Original

Perceived accuracy ratings (main study): $M = 2.79$, $SD = 1.70$

Fake News Post 6 (Pro-Republican)

Retrieved from: <https://www.snopes.com/fact-check/soros-michigan-el-sayed-brotherhood/>

Photograph: Original

Presented source: Original

Perceived accuracy ratings (main study): $M = 2.61$, $SD = 1.59$

Accurate News Post 1 (Pro-Democrat)

Retrieved from: <https://www.snopes.com/fact-check/obama-created-more-jobs-trump/>

Photograph added independently

Presented source: Original

Perceived accuracy ratings (main study): $M = 4.22, SD = 1.82$

Accurate News Post 2 (Pro-Democrat)

Retrieved from: <https://www.snopes.com/fact-check/alabama-mayor-mark-chambers/>

Photograph added independently

Presented source: Original

Perceived accuracy ratings (main study): $M = 3.25, SD = 1.65$

Accurate News Post 3 (Pro-Democrat)

Retrieved from: <https://www.snopes.com/fact-check/trump-russia-wildfires-california/>

Photograph retrieved from Snopes

Presented source: Fictitious

Perceived accuracy ratings (main study): $M = 3.10$, $SD = 1.79$

Accurate News Post 4 (Pro-Republican)

Retrieved from: <https://www.snopes.com/fact-check/was-yee-arrested-for-gun-trafficking/>

Photograph: Original

Presented source: Fictitious

Perceived accuracy ratings (main study): $M = 3.22$, $SD = 1.70$

Accurate News Post 5 (Pro-Republican)

Retrieved from: <https://www.fox35orlando.com/news/trump-administration-rules-gun-shops-essential-amid-virus>

Photograph: Original

Presented source: Original

Perceived accuracy ratings (main study): $M = 4.74$, $SD = 1.60$

Accurate News Post 6 (Pro-Republican)

Retrieved from: <https://www.snopes.com/fact-check/trump-autism-1-8-billion/>

Photograph: Original

Presented source: Original

Perceived accuracy ratings (main study): $M = 3.78$, $SD = 1.66$

Supplement S3: Additional Information on the Exclusion Criteria

The assessment took place on October, 29 – 30, 2020. All participants had an approval rating of 97% or better, and had engaged in a minimum of 1,000 previous tasks (HITs) on MTurk. We followed a two-step process: First, potential participants were subjected to a screening procedure in accordance with recommendations by Kennedy et al. (2020). As our study required an U.S. American sample, individuals who deployed a VPN/VPS or a proxy to hide their country of access or who failed to pass a CAPTCHA test, were automatically prevented from completing the study. Participants were also presented a picture of an eggplant and asked to name it (item wording: “Please name the vegetable shown below. Use the box below to provide your answer. If you are unsure, please click on the blue button below”). Providing an answer was not obligatory. Only those who answered “Brinjal” (Indian English for eggplant) were automatically prevented from completing the study as they were likely from India instead of the US. This procedure is in accordance with Kennedy et al. (2020), who report high numbers of Indian users who deployed VPS to fraudulently participate in surveys designed for US samples. In total, 821 participants passed the screening procedure and completed the questionnaire. In a second step, we manually excluded 67 participants who either deployed a VPN/VPS or a proxy to hide their country of access and had not been detected automatically by the initial screening procedure or who failed to adequately describe the study in English indicating they were either not native speakers or bots or careless responders. Seven participants who provided the answer “Padlizsan hatterkepek” when asked to identify the picture of an eggplant, were excluded as their response suggested that they were from Hungary instead of the US.¹² Another 57 participants were excluded because they failed to respond appropriately to at least one of our control questions (e.g., “This is a control item.

¹² In the main article, these seven participants are reported together with the 67 participants (= total of 74 participants) who either deployed a VPN/VPS or a proxy to hide their country of access and had not been detected automatically by the initial screening procedure or who failed to adequately describe the study in English to avoid confusion due to the complexity of the exclusion process.

Please choose "Very unlikely"."; see Table S3). Additionally, participants were asked to indicate both their year of birth as well as their current age. We excluded 17 participants because of an incongruity between the two pieces of information, which indicated careless or inattentive responding (Kennedy, et al., 2020). Additionally, five participants were excluded due to unreasonably low response times of less than 180 seconds. The exclusion criterion of 180 seconds is based on the assumption that people need at least two seconds to attentively answer to one survey item (Huang et al, 2012).¹³ Our study comprises 81 items, which would lead to a minimum response time of 162 seconds. However, the items are rather complex. Especially reading the news posts, the introduction and the debriefing text at the end takes more time than answering typical survey items. Therefore, the exclusion threshold was set at 180 seconds. The final sample comprised 668 participants ($M = 38.90$ years, $SD = 11.66$ years, 18-78 years, 44.5 % female).

Table S3

Exact Wordings of Attention Check Items Used

Wording Attention Check Items

"This is a control item. Please choose "Very unlikely"."

"This is a control question. Please select "Strongly disagree"."

Note. Both items were presented twice during the survey

¹³ Note that we preregistered that we would conduct outlier analysis for the total response time, but in retrospect we deemed the procedure recommended by Huang et al. (2012) more appropriate.

Supplement S4: Zero-Order Correlations**Table S4***Means, Standard Deviations, and Zero-Order Correlations of the Continuous Variables*

	<i>N</i>	<i>M (SD)</i>	(1)	(2)	(3)	(4)	(5)	(6)	(7)
(1) Dark Factor of Personality	668	2.71 (0.66)	-						
(2) Faith in Intuition for Facts	668	4.34 (1.36)	.16*	-					
(3) Need for Evidence	668	6.00 (0.97)	-.30*	-.36*	-				
(4) Truth is Political	668	3.21 (1.54)	.36*	.24*	-.32*	-			
(5) Perceived accuracy (fake news discernment)	668	1.01 (1.16)	-.21*	-.27*	.30*	-.32*	-		
(6) Willingness to share (fake news discernment)	668	0.39 (0.74)	-.13*	-.11*	.19*	-.18*	.48*	-	
(7) Political Orientation	668	3.51 (1.86)	.17*	.16*	-.20*	.27*	-.48*	-.19*	
(8) Political Affiliation (Democrats/Republicans)	468	-	.09	.18*	-.20*	.24*	-.46*	-.13*	.81*

Note. * $p < .01$. Fake news discernment scores were calculated by subtracting the average ratings of fake news posts from the average ratings of accurate news posts. Political orientation was assessed on a 7-point scale ranging from *extremely left* (1) to *extremely right* (7). Democrats were coded as 0, Republicans as 1, which means that a significant correlation indicates that Democrats and Republicans differed significantly in the according variable.

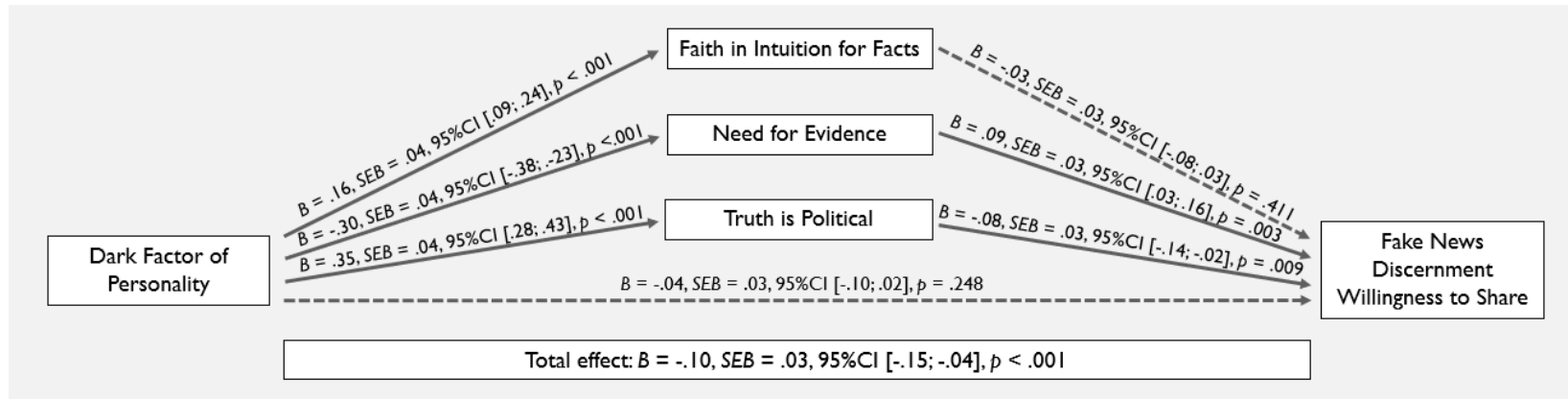
Supplement S5: Additional Results for Willingness to Share

For the sake of brevity and conciseness, we moved the additional analyses for willingness to share to the supplement as their results were very similar to those for perceived accuracy, which are reported in the main body. For each of the twelve news posts, participants were asked to indicate their willingness to share the news post on a 7-point scale, ranging from *very unlikely* (1) to *very likely* (7, item wording: “I would consider sharing this news post online (for example, through Facebook or Twitter).”). Participants were more likely to share accurate news posts ($M = 2.40, SD = 1.27$) than fake news posts ($M = 2.02, SD = 1.20$), $t(667) = 13.39, p < .001, d = .52$.

The analysis yielded a total effect of D on fake news discernment for willingness to share, $B = -.10, SEB = .03, 95\%CI [-.15; -.04], p < .001$, indicating that individuals high in D tend to differentiate less between accurate and fake news posts regarding their willingness to share them (Figure S5.1). D was associated with all three epistemic beliefs components in the expected directions. Also, supporting our hypotheses, Need for Evidence and Truth is Political were associated with fake news discernment for willingness to share. Faith in Intuition for Facts, however, was unrelated to it. As expected, we found a significant indirect effect for Need for Evidence, $B = -.03, SEB = .01, 95\%CI [-.05; -.01]$ as a mediator, as well as for Truth is Political, $B = -.03, SEB = .01, 95\%CI [-.06; -.01]$. Faith in Intuition for Facts did not serve as a mediator, $B = -.004, SEB = .01, 95\%CI [-.02; .01]$. These results show that post-truth epistemic beliefs predict impaired fake news discernment for willingness to share and further explain the link between D and impaired fake news discernment for willingness to share.

Figure S5.1

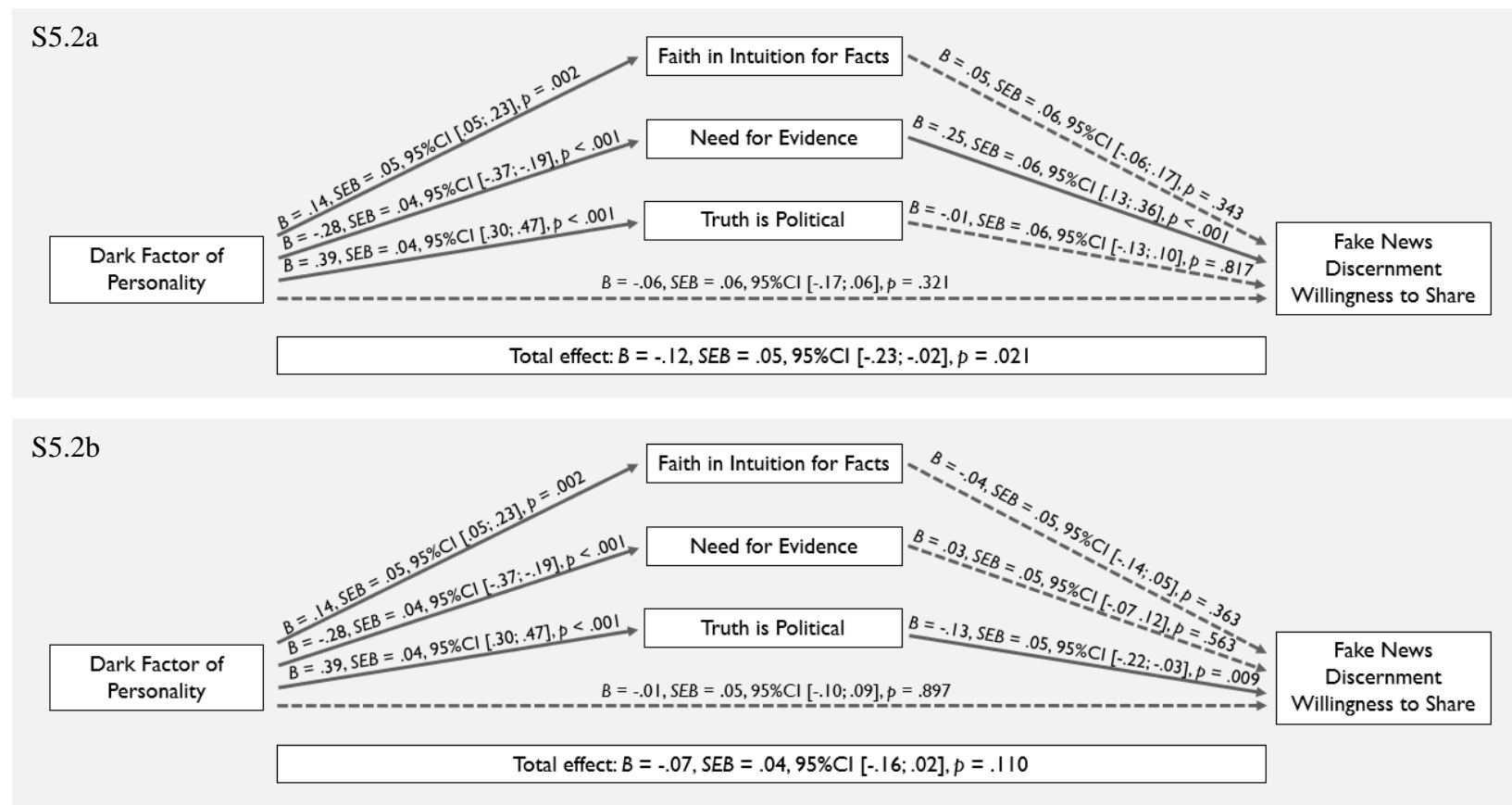
Main Results of the Parallel Mediator Model with Fake News Discernment for Willingness to Share as the Dependent Variable



Note. $N = 668$. Solid paths indicate significant associations ($p < .05$), dashed paths indicate non-significant associations.

Figure S5.2

Main Results of the Parallel Mediator Models with Discernment for Willingness to Share for Ideology Congruent Stimuli (S5.2a) and Incongruent Stimuli (S5.2b) as the Dependent Variables



Note. $n = 468$. Solid paths indicate significant associations ($p < .05$), dashed paths indicate non-significant associations.

Effects of Ideology Congruence: Willingness to Share

We performed the same analyses separately for ideology congruent and incongruent stimuli to explore whether the associations between D, epistemic beliefs and fake news discernment for willingness to share differ depending on ideology congruence. Independents ($n = 200$) were excluded as we relied on either Pro-Democrat or Pro-Republican stimuli leaving us with 468 participants. All path coefficients, standard errors, and p -values are presented in Figure S5.2. We found an indirect effect of D on fake news discernment for willingness to share ideology congruent stimuli, mediated by Need for Evidence (Table S5.1) and an indirect effect of D on fake news discernment for willingness to share ideology incongruent stimuli, mediated by Truth is Political (Table S5.2). Our results show that the effects of D and post-truth epistemic beliefs apply to both ideology congruent and incongruent fake news discernment for willingness to share, though they are not as pronounced as across all stimuli.

Table S5.1

Indirect Effects on Fake News Discernment for Willingness to Share for Ideology Congruent News Posts

	Coefficient	SE	95%CI LL	95%CI UL
Faith in Intuition for Facts	.01	.01	-.01	.03
Need for Evidence	-.07	.02	-.12	-.03
Truth is Political	-.01	.03	-.06	.05

Note. $N = 468$.

Table S5.2

Indirect Effects on Fake News Discernment for Willingness to Share for Ideology Incongruent News Posts

	Coefficient	SE	95%CI LL	95%CI UL
Faith in Intuition for Facts	-.01	.01	-.02	.01
Need for Evidence	-.01	.02	-.04	.02
Truth is Political	-.05	.02	-.09	-.01

Note. $N = 468$.

Supplement S6: Mediation Analyses Separately for Democrats and Republicans

Originally, we planned to conduct moderation analysis to address potential moderating effects of political orientation (7-point scale; *extremely left* [1] to *extremely right* [7]) on all paths proposed in our mediation model. Links between this measure and all other major variables are presented in Table S4. Specifically, we hypothesized that the effect of D on fake news discernment would increase with a more conservative political orientation. In hindsight, we deemed it more appropriate to examine whether our model holds for both ideology congruent and incongruent stimuli as well as for self-ascribed Democrats and Republicans, when considered separately. This approach is more parsimonious and suited our design better. Additionally, it corresponds more to the political circumstances in the USA, e.g., the pronounced political polarization in the USA and their de facto two-party system. Also, we think it is more difficult for participants to grasp the one-item measure of political orientation ranging from *extremely left* (1) to *extremely right* (7), than the well-established differentiation between Democrats and Republicans. Note that the following analyses were also preregistered. We performed the same mediation analyses as in the main article, but separately for self-identifying Democrats and Republicans across all stimuli as well as for Pro-Democrat and Pro-Republican posts separately, leading to six mediation models in total. The path coefficients, standard errors, and *p*-values for all six models are shown in Figure S6.1-S6.3. Table S6.1 and S6.2 show the indirect effects of D on fake news discernment for Democrats and Republicans. Note that sample sizes were significantly smaller than in the main analyses, especially for analyses only including Republicans ($n = 166$). We consider the Republican vs. Democrat aspect of our results as relevant – but also as preliminary. This is due to the fact that, the subsample of the Republicans was rather small, opening the possibility for Type 2 (and Type 1) errors. Moreover, some prior work pointed out differences between Republicans on MTurk and Republicans outside of MTurk (e.g., Huff & Tingley, 2015). Also, the links between D, Faith in Intuition for Facts and the processing of (mis-)information seem to be comparably

more complex as discussed in Rudloff et al. (2022), where similar and unexpected findings regarding Faith in Intuition for Facts are reported. Note that Republicans scored significantly higher on Faith in Intuition for Facts ($M = 4.70$, $SD = 1.34$) than Democrats ($M = 4.20$, $SD = 1.37$), $t(466) = 3.79$, $p < .001$, $d = 0.37$. This finding is in line with Garrett and Weeks (2017), who also found higher scores of Faith in Intuition for Facts to be associated with conservatism. Thus, it is possible that for Republicans there was less variance in Faith in Intuition of Facts to be explained by D.

Table S6.1

Indirect Effects for Fake News Discernment Separately for Self-Identifying Democrats and Pro-Democrat and Pro-Republican Posts and for All Posts

	Effect	Standard Error	95%CI LL	95%CI UL
Pro-Democrat Posts				
Faith in Intuition for Facts	-.05	.02	-.10	-.01
Need for Evidence	-.11	.03	-.18	-.04
Truth is Political	-.04	.04	-.12	.04
Pro-Republican Posts				
Faith in Intuition for Facts	-.05	.02	-.08	-.01
Need for Evidence	-.08	.03	-.13	-.03
Truth is Political	-.04	.03	-.10	.02
All Posts				
Faith in Intuition for Facts	-.05	.02	-.08	-.01
Need for Evidence	-.08	.03	-.13	-.03
Truth is Political	-.04	.03	-.10	.02

Note. $n = 302$.

Table S6.2

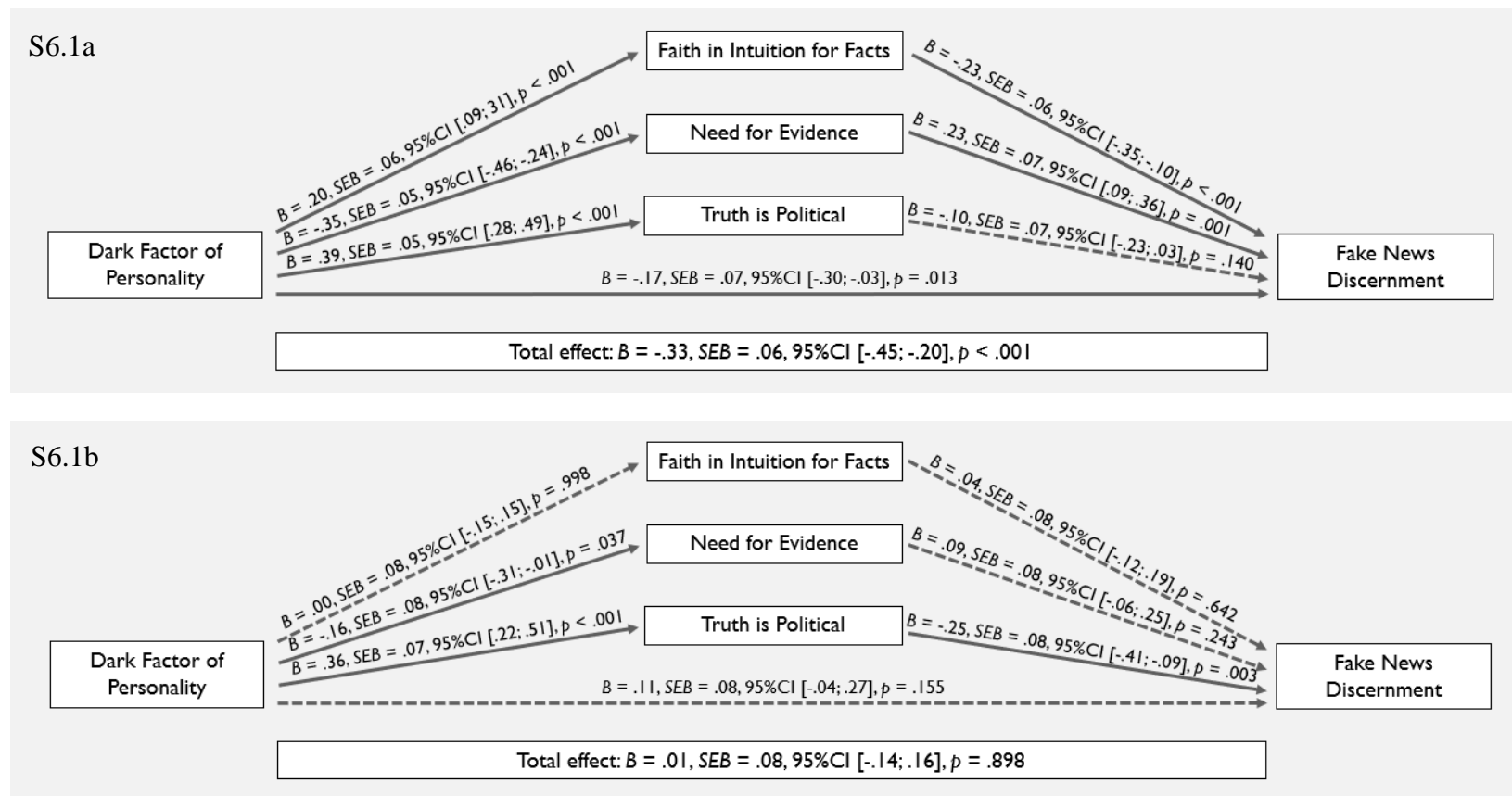
Indirect Effects for Fake News Discernment Separately for Self-Identifying Republicans and Pro-Democrat and Pro-Republican Posts and for All Posts

	Effect	Standard Error	95%CI LL	95%CI UL
Pro-Democrat Posts				
Faith in Intuition for Facts	.00	.01	-.02	.02
Need for Evidence	-.01	.02	-.06	.03
Truth is Political	-.09	.05	-.18	-.001
Pro-Republican Posts				
Faith in Intuition for Facts	.00	.01	-.01	.02
Need for Evidence	-.02	.02	-.06	.01
Truth is Political	-.09	.04	-.17	-.03
All Posts				
Faith in Intuition for Facts	.00	.01	-.01	.02
Need for Evidence	-.02	.02	-.06	.01
Truth is Political	-.09	.03	-.16	-.03

Note. $n = 166$.

Figure S6.1

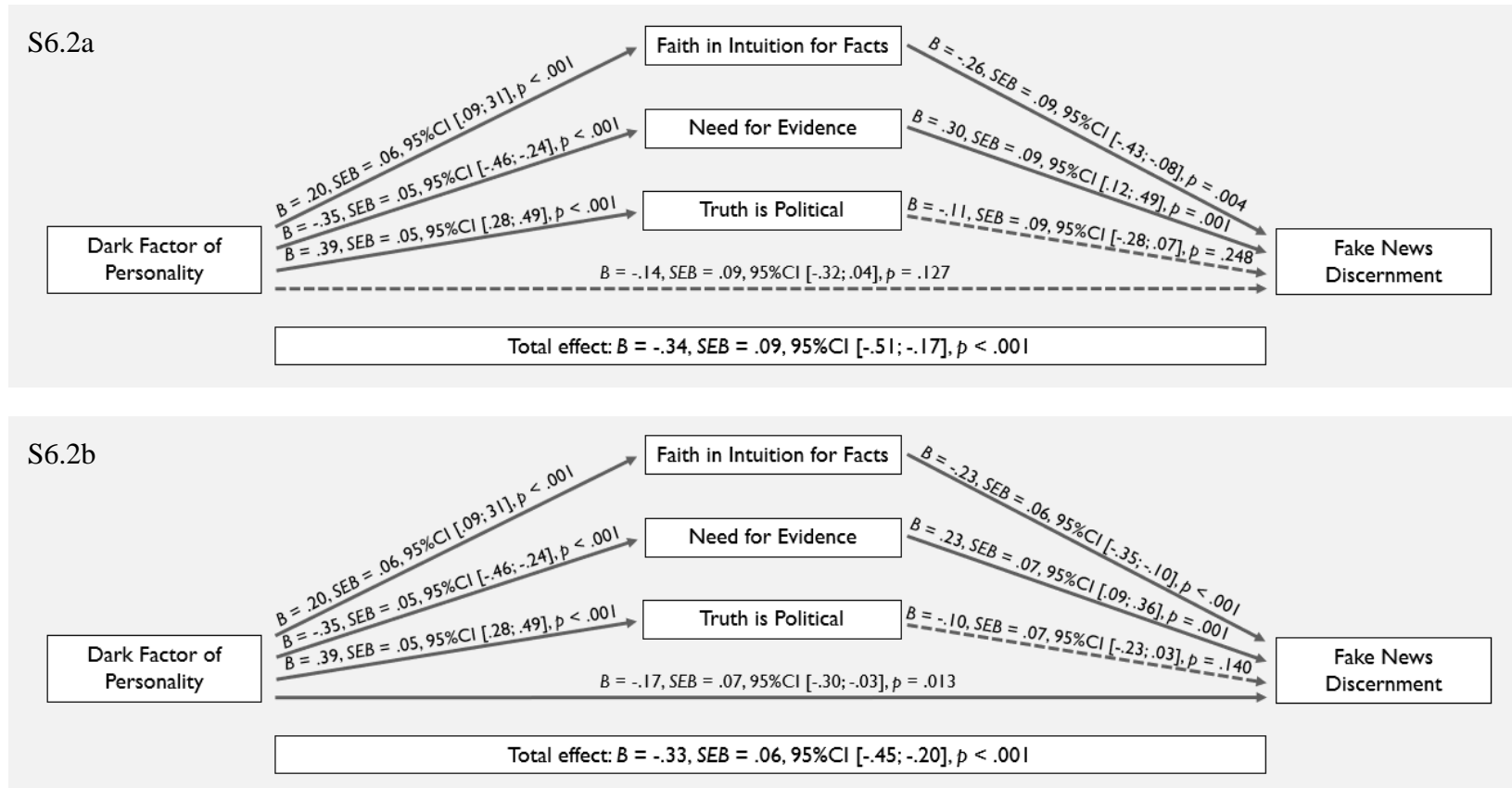
Main Results of the Parallel Mediator Models for Democrats (S6.1a) and Republicans (S6.1b)



Note. Solid paths indicate significant associations ($p < .05$), dashed paths indicate non-significant associations.

Figure S6.2

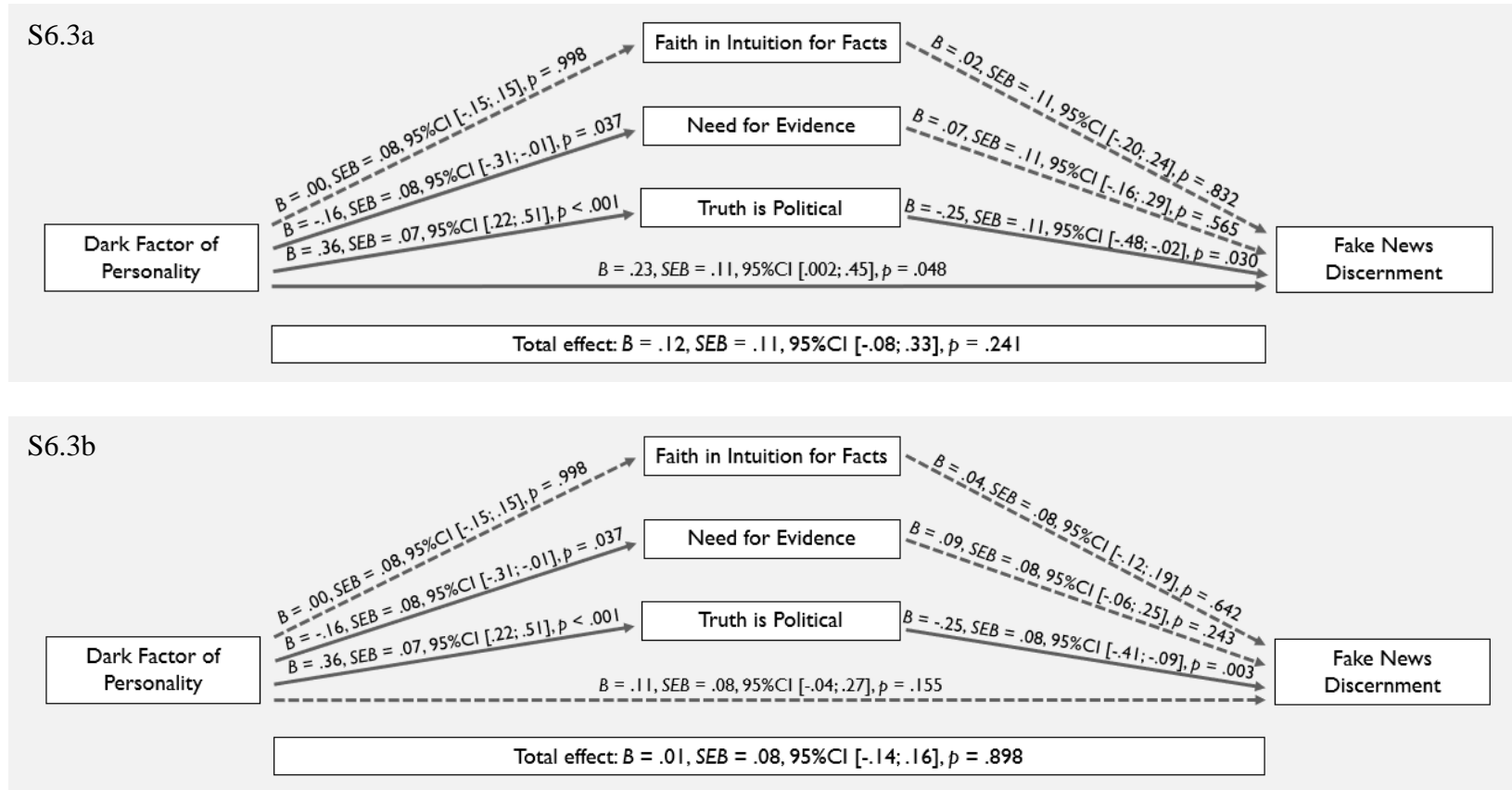
Main Results of the Parallel Mediator Models for Democrats and Pro-Democrat News Posts (S6.2a) and Pro-Republican News Posts (S6.2b)



Note. $n = 302$. Solid paths indicate significant associations ($p < .05$), dashed paths indicate non-significant associations.

Figure S6.3

Main Results of the Parallel Mediator Models for Republicans and Pro-Democrat News Posts (S6.3a) and Pro-Republican News Posts (S6.3b)



Note. $n = 166$. Solid paths indicate significant associations ($p < .05$), dashed paths indicate non-significant associations.

Supplement S7: Additional Results from a mixed Design ANOVA

We entered perceived accuracy scores into a 2 (accurate news/fake news) x 2 (pro-Democrat news/pro-Republican news) x 3 (self-ascribed Democrat/Independent/Republican) mixed design ANOVA to explore differences due to news characteristics (within subjects), party affiliation (between subjects) and potential interactions. There was a main effect of the type of news posts (accurate news/fake news), $F(1, 665) = 451.76, p < .001, \eta^2 = .41$, which means that participants perceived accurate news posts to be more accurate ($M = 3.68, SE = 0.04$) than fake news posts ($M = 2.78, SE = 0.04$). In addition, pro-Republican news posts were rated as more accurate ($M = 3.37, SE = 0.04$) than pro-Democrat news posts ($M = 3.08, SE = 0.04$), $F(1, 665) = 59.10, p < .001, \eta^2 = .08$.

We also found a main effect of party affiliation, $F(2, 665) = 4.31, p = .014, \eta^2 = .01$: Republicans showed the highest ratings for both accurate and fake news combined ($M = 3.37, SE = 0.06$), followed by Democrats ($M = 3.18, SE = 0.05$) and Independents ($M = 3.14, SE = 0.06$). Pairwise comparisons yielded significant differences between ratings for Democrats and Republicans, $p = .039, d = -0.24$, and between ratings for Independents and Republicans, $p < .020, d = -0.29$. Ratings for Democrats and Independents were not significantly different, $p > .05, d = 0.05$. These findings deviate from the results reported by Pennycook and Rand (2019), who found that Democrats showed higher ratings for accurate and fake news combined than Republicans.

More importantly, there was a significant interaction effect between the type of news posts (accurate news/fake news) and the political affiliation (Democrat/Independent/Republican) of the participants, $F(2, 665) = 60.98, p < .001, \eta^2 = .16$. Figure S7.1 shows perceived accuracy scores for accurate and fake news posts separately for Democrats, Independents and Republicans. Pairwise comparisons showed that perceived accuracy scores for Democrats were significantly higher for accurate ($M = 3.90, SE = 0.05, 95\% \text{ CI } [3.80; 4.00]$) than for fake news posts ($M = 2.46, SE = 0.06, 95\% \text{ CI } [2.34; 2.57]$), $p < .001, d = 1.35$. Likewise, perceived accuracy scores for

Independents were significantly higher for accurate ($M = 3.62$, $SE = 0.06$, 95%CI [3.49; 3.75]) than for fake news posts ($M = 2.66$, $SE = 0.07$, 95%CI [2.51; 2.80]), $p < .001$, $d = 0.91$. For Republicans, perceived accuracy scores were also significantly higher for accurate ($M = 3.52$, $SE = 0.07$, 95%CI [3.38; 3.66]) than for fake news posts ($M = 3.22$, $SE = 0.08$, 95%CI [3.06; 3.37]), $p < .001$, $d = 0.31$.

Further, there was a significant interaction effect between the political stance of news posts (pro-Democrat news/pro-Republican news) and the political affiliation (Democrat/Independent/Republican) of the participants, $F(2, 665) = 106.40$, $p < .001$, $\eta^2 = .24$. Perceived accuracy scores for Democrats were significantly higher for pro-Democrat news posts ($M = 3.36$, $SE = 0.05$, 95%CI [3.26; 3.47]) than for pro-Republican news posts ($M = 2.99$, $SE = 0.05$, 95%CI [2.88; 3.09]), $p < .001$, $d = 0.40$. In contrast, perceived accuracy scores for Independents were significantly lower for pro-Democrat news posts ($M = 2.97$, $SE = 0.07$, 95%CI [3.84; 3.10]) than for pro-Republican news posts ($M = 3.30$, $SE = 0.07$, 95%CI [3.18; 3.43]), $p < .001$, $d = -0.35$. Likewise, perceived accuracy scores for Republicans were significantly lower for pro-Democrat news posts ($M = 2.92$, $SE = 0.07$, 95%CI [2.77; 3.06]) than for pro-Republican news posts ($M = 3.82$, $SE = 0.07$, 95%CI [3.68; 3.96]), $p < .001$, $d = -0.97$.

Furthermore, there was a significant three-way interaction between of the type of news posts (accurate news/fake news), the political stance of news posts (pro-Democrat news/pro-Republican news) and the political affiliation (Democrat/Independent/Republican) of the participants, $F(2, 665) = 28.06$, $p < .001$, $\eta^2 = .08$. See Table S7 for pairwise comparisons. Democrats and Independents were able to differentiate between accurate and fake news for both pro-Democrat and pro-Republican posts. Republicans, however, could only differentiate between accurate and fake news for pro-Republican posts, but not for pro-Democrat ones.

In the following, we present our mixed design ANOVA results with fake news discernment scores as the dependent variable for a comparison of fake news discernment scores in dependence of political stance of the news posts and party affiliation of the participants.

Table S7

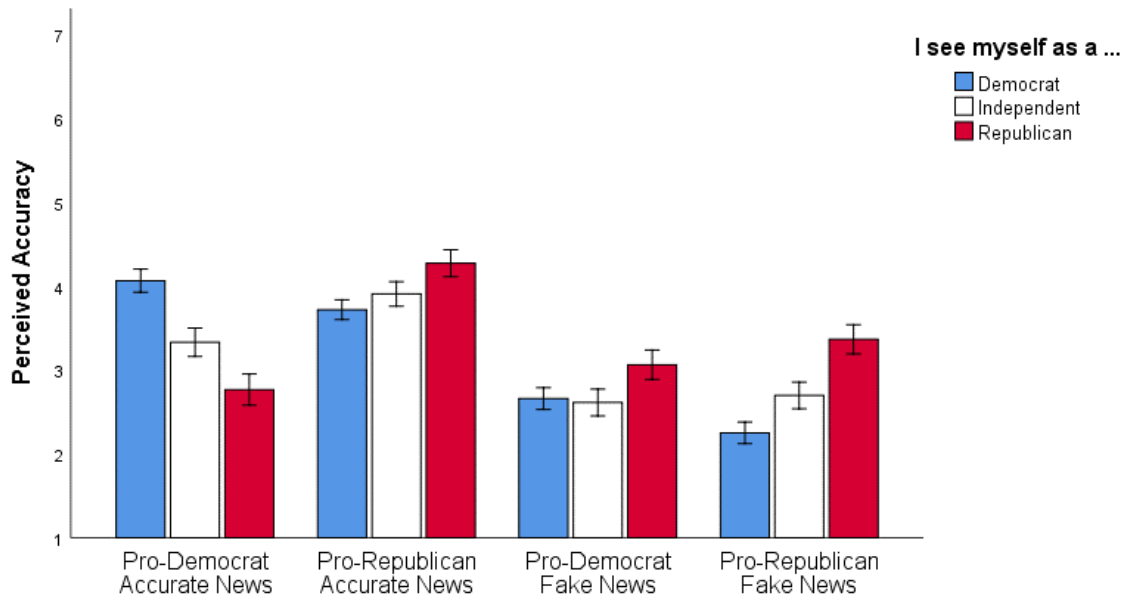
Means, Standard Errors and Confidence Intervals for Perceived Accuracy Separately for Democrats, Independents and Republicans and All News Types

Affiliation	News Type	Political Leaning	<i>M</i>	<i>SE</i>	<i>p</i>	LL95%CI	UL95%CI	<i>d</i>	
Democrat	Accurate	Pro-Democrat	4.07	0.07		3.93	4.20		
		Pro-Republican	3.72	0.06	< .001	3.60	3.84	0.11	
	Fake	Pro-Democrat	2.66	0.07		2.53	2.79		
		Pro-Republican	2.25	0.07	< .001	2.12	2.38	0.39	
	Independent	Accurate	Pro-Democrat	3.32	0.09		3.16	3.50	
			Pro-Republican	3.91	0.07	< .001	3.76	4.05	-0.42
Fake		Pro-Democrat	2.61	0.08		2.45	2.77		
		Pro-Republican	2.70	0.08	.248	2.54	2.86	-0.08	
Republican		Accurate	Pro-Democrat	2.77	0.09		2.58	2.95	
			Pro-Republican	4.28	0.08	< .001	4.12	4.44	-1.09
	Fake	Pro-Democratic	3.06	0.09		2.89	3.24		
		Pro-Republican	3.37	0.09	< .001	3.19	3.54	-0.29	

Note. *N* = 668.

Figure S7.1

Perceived Accuracy for of Pro-Democrat Accurate News, Pro-Republican Accurate News, Pro-Democrat Fake News and Pro-Republican Fake News for Self-Identifying Democrats, Independents and Republicans



Note. $N = 668$.

To explore differences in fake news discernment depending on the political stance of the news posts and party affiliation of the participants, we entered fake news discernment scores for perceived accuracy in a 2 (pro-Democrat news posts/pro-Republican news posts) x 3 (Democrat/Independent/Republican) mixed design ANOVA. There was a main effect of the political stance of the news posts, $F(1, 665) = 86.97, p < .001, \eta^2 = .12$, which means that participants differentiated stronger between accurate and fake pro-Republican news posts ($M = 1.01, SE = 1.16$) than between accurate and fake pro-Democrat posts ($M = 0.78, SE = 1.60$).

We also found a main effect of the political affiliation of the participants, $F(2, 665) = 74.25, p < .001, \eta^2 = .18$, which means that Democrats differentiated the most between accurate and fake news posts ($M = 1.42, SE = 0.07$), followed by Independents ($M = 0.84, SE = 0.09$) and Republicans ($M = 0.004, SE = 0.09$). Pairwise comparisons showed that the difference between Democrats and Independents was significant ($p < .001, d = 0.48$) as well as the difference

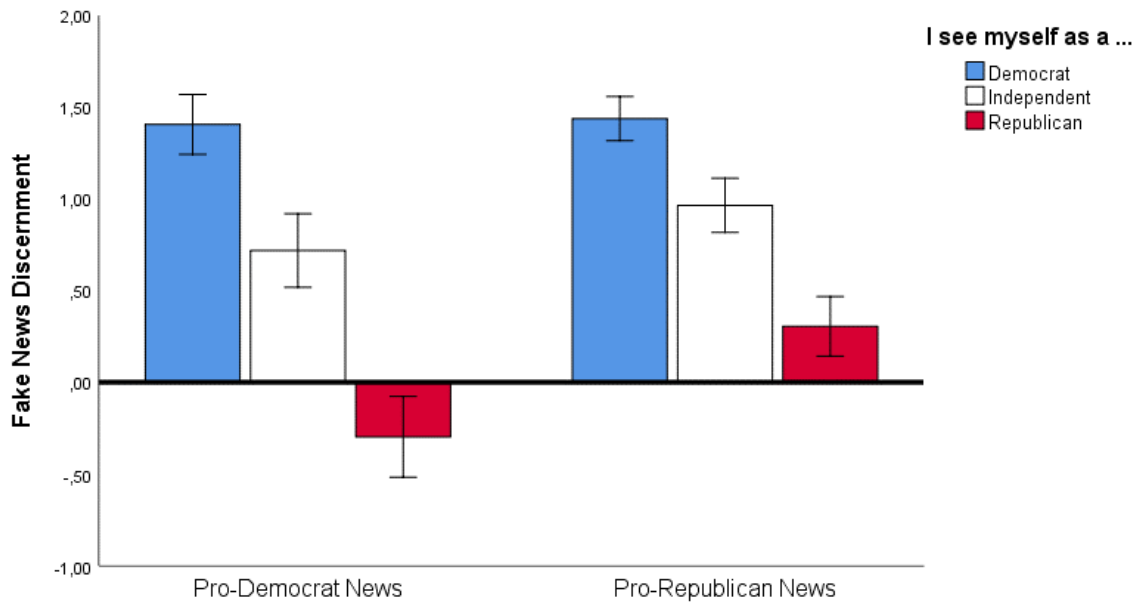
between Democrats and Republicans ($p < .001$, $d = 1.17$) and the difference between Independents and Republicans ($p < .001$, $d = 0.69$).

Additionally, there was a significant interaction effect between the political stance of the news posts and the political affiliation of the participants, $F(2, 665) = 28.06$, $p < .001$, $\eta^2 = .08$. For Republicans, fake news discernment scores for pro-Democrat news posts ($M = -0.30$, $SE = 0.11$, 95% CI [-0.52; -0.08]) were significantly lower than for pro-Republican news posts ($M = 0.31$, $SE = 0.08$, 95% CI [0.14; 0.47]), $p < .001$, $d = -0.76$. Likewise, for Independents, fake news discernment scores for pro-Democrat news posts ($M = 0.72$, $SE = 0.10$, 95% CI [0.52; 0.92]) were significantly lower than for pro-Republican news posts ($M = 0.96$, $SE = 0.08$, 95% CI [0.82; 1.11]), $p < .001$, $d = -0.31$. Democrats, however, were the only group that differentiated between pro-Democrat fake and accurate news posts ($M = 1.40$, $SE = 0.08$, 95% CI [1.24; 1.57]) to the same degree as for pro-Republican fake and accurate news posts ($M = 1.44$, $SE = 0.06$, 95% CI [1.32; 1.56]), $p = .481$, $d = -0.04$. Figure S7.2 shows fake news discernment scores for Democrats, Independents and Republicans separately for pro-Democrat and pro-Republican news posts.

Overall, our findings are mostly in line with the first study by Pennycook and Rand (2019), but differ from the results of their second study. Whereas, the latter found that Republicans were better at discerning Pro-Republican fake from accurate news than Democrats, we found that Democrats were not only better at discerning fake from accurate news across all items, but also when considering Pro-Democrat and Pro-Republican news separately. Also deviating from both studies reported by Pennycook and Rand (2019), Republicans could only discern accurate and fake news that were Pro-Republican.

Figure S7.2

Fake News Discernment for Pro-Democrat and Pro-Republican News and Self-Identifying Democrats, Independents and Republicans



Note. $N = 668$, Higher scores indicate greater difference in perceived accuracy ratings for accurate and fake news posts. Values above 0 indicate greater perceived accuracy ratings for accurate than fake news posts, values above indicate greater perceived accuracy ratings for fake than accurate news posts

Supplement References

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3. Final Discussion

Post-truth phenomena such as conspiracy theories and fake news undermine rational decision-making and are often considered a threat for democratic societies (Lazer et al., 2018; Lewandowsky et al., 2017). A substantial number of individuals disregard rational arguments and refuse to align their behavior with scientific evidence (Ghasemiyeh et al., 2021; Huang et al., 2022; Wu et al., 2021). Thus, it is vital to investigate and unravel the factors driving irrational cognition and behavior to develop effective countermeasures that foster rational decision-making and behavior.

In short, **Manuscript #1** demonstrated that post-truth epistemic beliefs rooted in the Dark Factor of Personality predict the endorsement of COVID-19 conspiracy theories and neglect of health-protective behavior. A total of four online studies were conducted in the USA via Mechanical Turk (Study 1-3) and in Germany via Prolific (Study 4) over the course of the COVID-19 pandemic (April – December 2020). Study 1 ($N = 321$) provides evidence that post-truth epistemic beliefs, that is, a strong Faith in one's Intuition for Facts, a low Need for Evidence, and the strong conviction that Truth is Political are linked to a broader personality disposition, the Dark Factor of Personality. In Study 2 ($N = 453$) this finding was replicated and a mediation model was tested that included D as an antecedent of post-truth epistemic beliefs, and the endorsement of COVID-19 related conspiracy theories and less engagement in health-protective behavior against the virus as consequences. Study 2 showed that post-truth epistemic beliefs predicted the endorsement of COVID-19 conspiracy theories and less engagement in health-protective behavior at an early point of the pandemic (April 2020). Study 2 also showed that D predicted the endorsement of COVID-19 conspiracy theories and less health-protective behavior, and that this association could be explained by post-truth epistemic beliefs held by individuals high in D. More precisely, Faith in Intuition for Facts, and Truth is Political mediated the effect of D on COVID-19 conspiracy theories whereas the effect of D on the engagement in less health-protective behavior was mediated by Faith in Intuition for Facts and Need for

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Evidence. Interestingly, the effect of Faith in Intuition for Facts on health-protective behavior was positive, whereas a negative effect was expected. The specific role played by Faith in Intuition for Facts in this context will be addressed later (see 3.3 Limitations and Open Questions). During the pandemic, circumstances were changing constantly, which made replicating these preliminary findings particularly important: Study 3 ($N = 923$) largely yielded the same findings as Study 2 at a later stage of the pandemic (October 2020) and in a larger sample. More precisely, the effect of D on COVID-19 conspiracy beliefs and engagement in health-protective behavior was mediated by Need for Evidence and Truth is Political. Note that in the joint model the link between D and Faith in Intuition for Facts was not significant. Again, the association between Faith in Intuition for Facts and health-protective behavior was positive. As Study 1-3 were conducted in the USA, the next step was to test the cross-cultural validity of the proposed model. Study 4 ($N = 523$) was conducted in Germany in December 2020 and yielded largely similar results as Study 3. Taken together, these findings indicate that prioritizing one's individual utility is linked to certain views on the nature and generation of knowledge. Further, it shows that individual perspectives about knowledge and knowing predict the endorsement of COVID-19 conspiracy theories and neglect of health-protective behavior. Additionally, post-truth epistemic beliefs explain the observed link between D and the endorsement of COVID-19 conspiracy theories and related behavior.

Vaccinations present one of the most efficient public health measures against COVID-19. However, at the time when Study 1-4 of Manuscript #1 were conducted in 2020, COVID-19 vaccinations were not yet available. Even though by July 2022 almost everyone in the USA who was willing to get vaccinated has had the chance to do so (U.S. Department of Health & Human Services, 2022), a substantial number of individuals refused to get immunized. The goal of **Manuscript #2** was to shed light on the reasons behind uptake refusal using the proposed mediation model. Manuscript #2 presented the results from a large US nationally representative study ($N = 1268$) that was conducted in July 2022 via Prolific and yielded that post-truth

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epistemic beliefs rooted in the Dark Factor of Personality predicted whether individuals had been vaccinated against COVID-19. These links were significant for two different definitions of having been vaccinated: First, D and post-truth epistemic beliefs were linked to a lower probability of having been vaccinated against COVID-19 at least *once*; second, an additional analysis yielded that they were also associated with a lower probability of having received at least *two* doses of a COVID-19 vaccine (i.e., being fully vaccinated). Note that in the joint model, Faith in Intuition for Facts was not significantly associated with COVID-19 vaccination status. Thus, it did not mediate the effect of D on COVID-19 vaccination status. The findings reported in Manuscript #2 complement initial evidence presented in Manuscript #1 for the link between D, post-truth epistemic beliefs, and less engagement in protective behavior such as social distancing or wearing hygienic face masks. Rather than relying on self-report measures of health-protective behavior against COVID-19 (Manuscript #1), individuals' actual *vaccination status* was assessed (Manuscript #2). Further, the large US nationally representative sample increased the robustness the results and their generalizability for the US American public.

After having found consistent and cross-cultural support for the proposed model comprising D, post-truth epistemic beliefs, and COVID-19 conspiracy theories and related behavior, the goal was to extend the scope beyond the context of COVID-19 and towards the conceptually distinct post-truth phenomenon of fake news. **Manuscript #3** demonstrated that D and post-truth epistemic beliefs predicted a reduced discernment between fake news and accurate news. In a repeated measures experiment ($N = 668$) that was conducted via Mechanical Turk, participants rated the accuracy of six factually accurate and six factually inaccurate news posts. The stronger participants endorsed post-truth epistemic beliefs, the less they differentiated correctly between fake and accurate news posts. The same applied to the Dark Factor of Personality: The higher participants scored on D, the less they discerned fake from accurate news posts. These links led to a mediation effect of D via post truth epistemic beliefs. In contrast to Manuscript #1 and #2, all epistemic beliefs subscales were significant mediators. Further, all

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links remained significant when controlling for ideology congruence between participants' political affiliation (Democrat/Republican) and the political stance of the news posts (pro-Democrat/pro-Republican). This means that D and post-truth epistemic beliefs are linked to judging the accuracy of both ideology congruent and incongruent fake and accurate news. However, this does not imply that ideology congruence does not have an effect on individuals' accuracy judgments (for detail cf., Supplement S7 of Manuscript #3). Discernment scores do not distinguish between high accuracy ratings for accurate and fake news posts and low ratings for both (Gawronski et al., 2021). When considering self-ascribed Democrats and Republicans separately, different epistemic beliefs subscales were predictive of fake news discernment, and the link between D and Faith in Intuition for Facts was not significant for Republicans (see 3.3 Limitations and Open Questions). In sum, the results indicated that different worldviews on the nature and generation of knowledge translate into a specific processing and veracity assessment of news.

The consistent support for the proposed model across all studies highlights the need to consider post-truth epistemic beliefs and the Dark Factor of Personality as pivotal factors driving irrational cognition and behavior. Individual worldviews about the nature and generation of knowledge as well as information processing based on individual utility instead of rational arguments must be addressed in the efforts to counteract post-truth phenomena such as conspiracy theories, fake news, and related behavior. In the following, I will address these findings in more detail. I will then discuss potential practical implications of the findings and open questions.

3.1 Theoretical Considerations

The results of the six studies outlined above raise several theoretical issues. First, post-truth epistemic beliefs and D are associated with irrational cognition and behavior. Second, individuals high in D tend to endorse post-truth epistemic beliefs, which explains the link

between D and irrational cognition and behavior. These issues will be discussed in the following chapters.

3.1.1 Post-Truth Epistemic Beliefs and Irrational Cognition and Behavior

The six studies presented show that post-truth epistemic beliefs predict a reduced willingness (and ability) to align one's cognitions and behavior with existing evidence. More precisely, they were linked to increased susceptibility for fake news and COVID-19 conspiracy theories and less engagement in health-protective behavior against COVID-19 including vaccination refusal. As post-truth epistemic beliefs accompany the decision-making process, irrational cognition and behavior could be the result of poor and ill-advised decision-making due to the deliberate disregard of evidence and rational arguments both in the context of the pandemic and beyond. This insight complements existing perspectives focusing on motivated reasoning (see, e.g., Hutmacher et al., 2022; Kunda, 1990), cognitive biases (e.g., Lazer et al., 2018; Meppelink et al., 2019; Zhou & Shen, 2022) or thinking styles (see, e.g., Bronstein et al., 2019; Pennycook & Rand, 2019; Swami et al., 2014). The nexus between the Dark Factor of Personality and post-truth epistemic beliefs will be discussed in the following section.

3.1.2 D, Post-Truth Epistemic Beliefs, and Irrational Cognition and Behavior

Across studies, evidence consistently suggests that D is associated with post-truth epistemic beliefs. According to both theory and empirical research (Hilbig et al., 2022; Moshagen et al., 2018, Moshagen et al., 2020), individuals high in D should endorse beliefs that they deem advantageous. Post-truth epistemic beliefs can be considered beneficial for those with high levels in D because evidence and rational arguments bear the risk of contradicting one's behavior, for example by advocating prosocial instead of selfish behavior (Jin et al., 2021; Zelenski & Desrochers, 2021). Arguably, the less one is determined to align one's views and behaviors with evidence and rational arguments, the less restricted one is to live as one pleases. As a *result* of deliberately disregarding rational arguments and evidence, individuals high in D are prone to irrational cognition and behavior, including reduced fake news discernment, increased

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endorsement of COVID-19 conspiracy theories and less engagement in health-protective behavior.

Apart from this line of argumentation, in which post-truth epistemic beliefs are considered the primary factor driving irrational cognition and behavior, they might also *accompany* and *guide* another process that adds to explaining the found associations: Drawing on the core motive of those high in D (Moshagen et al., 2018), it seems likely that they primarily hold beliefs and show behavior that they deem advantageous for themselves (Hilbig et al., 2022). Thus, their decision-making and information processing should be driven by a desire to maximize their *perceived* individual utility. Mirroring the discussed *perceived* benefits of endorsing post-truth epistemic for those high in D, new information may have at least three purposes that could all be connected to a *perceived* increase in individual utility. First, information, for example in the form of news, can be used to justify ethically questionable behavior. For example, believing in conspiracy theories that deny the danger of COVID-19 justifies not engaging in health-protective behavior. In contrast, health-protective guidelines have often restricted the freedom of the individual for the sake of societal health (Jin et al., 2021), which is not in line with D. Second, individuals high in D could use new information to justify their worldview. Even though the concept of D explicitly does not imply any one particular set of beliefs, it seems likely that D should be linked to worldviews that justify malevolent acts (Moshagen et al., 2020; Hilbig et al., 2022). For example, the idea of powerful agents secretly conspiring against the will of the people fits within a self-serving worldview in which everyone has to look out for themselves and is not to trust anyone (Bader et al., 2021; Douglas & Sutton, 2011). Third, information could justify maintaining the positive, but fragile self-concepts that are associated with dark traits (Doerfler et al., 2021), for example feelings of superiority. Feeling superior could be derived from the idea that one supposedly knows more than other people (Imhoff & Lamberty, 2017). Information processing and decision-making based on individual utility maximization could be accompanied by post-truth epistemic beliefs. For example, they could help to disregard rational arguments

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and/or scientific evidence advocating health-protective behavior against the virus. Thus, instead of basing their veracity assessment on indicators of truthfulness, individuals high in D could judge the accuracy of information based on the individual utility they contain. Importantly, individuals high in D should not always be able to correctly identify the most beneficial behavioral option. Habitually and deliberately not adhering to rational arguments could well lead to a reduced ability to judge the validity of arguments and evidence due to a lack of practice. Thus, unwillingness and inability to make rational decisions should go hand in hand. This could particularly explain why individuals high in D refused to get vaccinated, which does not seem to have any actual benefits. Perceived utility could stem from feelings of superiority (Chávez-Ventura et al., 2022) and, thus, not needing to get vaccinated or from a desire to oppose authorities (Bader et al., 2022).

This process shares similarities to the notion of motivated reasoning but differs from it in that it rests on an explicit and deliberate disregard for truth. More precisely, one may engage in motivated reasoning, but still be erroneously convinced to arrive at a truthful conclusion (Kunda, 1990), whereas truth should be of no concern for those high in D whose primary aim is to maximize their individual utility. Taken together, individuals high in D could be prone to irrational cognition and behavior as a result of post-truth epistemic beliefs *and* due to their inclination to prioritize maximizing their perceived individual utility. The fact that some individuals deliberately disregard rational arguments and evidence poses a serious challenge to rational communication in the context of health issues such as COVID-19 and in general. However, this insight also implies potential countermeasures against irrational cognition and behavior, which will be outlined in the following section.

3.2 Practical Implications

There are effective measures specifically designed for countering fake news such as prebunking (Lewandowsky & van der Linden, 2021; van der Linden et al., 2017) or debunking (Cook, 2019; Walter et al., 2020). These measures are either based on countering potential fake news by warning individuals against it and/or educating them about typical strategies used to deceive *before* they have been spread (prebunking) or correcting fake news *after* they have already been disseminated (debunking). This work highlights another important but broader approach that complements these measures. It relies on fostering epistemic literacy, which has been linked to more critical thinking (Greene & Yu, 2016) and more accurate opinions (Hofer & Bendixen, 2012; Garrett & Weeks, 2017).

As established in the introduction, there are at least two causes for developing post-truth epistemic beliefs. First, individuals fail to acknowledge that not all arguments are equally valid in a sense that they may be backed by more or less evidence, for example externally validated scientific data (cf., e.g., to Kuhn et al.'s notion of the multiplist level; 2000). Second, post-truth epistemic beliefs are deliberately entertained because they are perceived as advantageous. Based on this distinction, I will begin by highlighting the need to counteract the development of post-truth epistemic beliefs and to foster epistemic literacy in general. Importantly, the practical implications of this work will not be discussed solely with regard to epistemic beliefs, but in the broader context of epistemic cognition to which they belong (see chapter 1.2.1; Hofer & Bendixen, 2012; Greene & Yu, 2016). The development of dark traits seems to rest on a complex interaction of environmental factors such as parental care and heritable dispositions (Campbell et al., 2009; Jonason et al., 2014; Yendell et al., 2022). Addressing it in more detail would go beyond the scope of this work. Rather, I will highlight specific problems that might arise regarding individuals with a pronounced Dark Factor of Personality.

3.2.1 Counteracting the Development of Post-Truth Epistemic Beliefs

As established, post-truth epistemic beliefs shield individuals from engaging in a rational discourse and immunize them against attempts to convince them via “the unforced force of the better argument” (Habermas, 1996; p. 305). Accordingly, efforts to counteract the development of post-truth epistemic beliefs should be made at a time when individuals develop their personal epistemological understanding, which is typically during childhood and adolescence (Garret & Weeks, 2017; Schommer, 1990). The fact that this process is shaped by socialization (Kuhn et al., 2000) implies that attempts to foster a complex epistemological understanding could be fruitful, which is supported by prior evidence (Kienhues et al., 2008; Muis & Duffy, 2013). As outlined in the first chapter about different perspectives on knowledge and truth, it is a complex subject (see chapter 1.1) and a major challenge for educators (Maggioni & Parkinson, 2008). The primary goal should be to teach children and adolescents the significance of evidence and the evaluation of arguments in terms of epistemic merit as the basis for rational decision-making (Hofer, 2001; Greene & Yu, 2016; Hofer & Bendixen, 2012). More precisely, students must be taught to identify indicators of truthfulness, for example evaluate the trustworthiness of experts and other sources such as newspapers, magazines, or scientific journals (Britt et al., 2014; Goldman, 2011). Students who understand the scientific process are better at evaluating different claims about issues such as vaccines or climate change than students who solely know the scientific facts (Sandoval, 2014). Moreover, prior research indicates that attempts to foster general critical thinking skills are not as effective as discipline-specific interventions that pay tribute to the specific approaches of acquiring knowledge that are used in different disciplines (Abrami et al., 2015, Huber & Kuncel, 2015). For instance, an experiment may be a reliable source of knowledge in many natural and social sciences but is of little use in history or other academic sciences (Greene & Yu, 2016). Also, between specific disciplines there are different degrees of certainty of knowledge that are deemed acceptable (Bromme et al., 2008; Hofer & Bendixen, 2012). Thus, teachers are not only required to have sufficient disciplinary knowledge, but also to

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share a deep understanding how knowledge is acquired within their field, for example via analysis, evaluation, and argument (Alexander, 2014; Sandoval et al., 2014). In addition, teachers' epistemic beliefs predict which pedagogic practices they deem appropriate to best stimulate the epistemological development of their students (Hofer & Bendixen, 2012; Maggioni & Parkinson, 2008). Therefore, efforts to foster student's personal epistemology should be accompanied by providing professional development programs for teachers and educators (Maggioni & Parkinson, 2008). Several studies yield promising results from interventions designed to promote epistemological development in teachers (Gill et al., 2004; Howard et al., 2000). Unfortunately, pre-service training programs too rarely include pedagogical strategies that aim at fostering students' personal epistemology (Greene & Yu, 2016; Sinatra & Chinn, 2012).

3.2.2 Reducing the Scope of Decision-Making Based on Prioritizing One's Individual Utility

In some cases, post-truth epistemic beliefs are not solely rooted in a limited understanding of truth, but also serve a strategic purpose, that is, they help to deliberately disregard evidence and rational arguments as a basis for one's decision making to be able to live as one pleases (Jin et al., 2021; Zelenski & Desrochers, 2021). In these cases, it is unlikely that interventions highlighting the significance of evidence and argument quality will be effective. The probability of individuals high in D to act in accordance with science should be higher if they perceive it to be advantageous for themselves. Thus, one may argue that science-based decision-making needs to be strongly incentivized. Although providing incentives might work in some cases, their efficacy depends on various contextual factors (Campos-Mercade et al., 2021; Salali & Uysal, 2021) as will be illustrated by the following example. Incentives could work particularly well in cases where individuals fail to acknowledge the *individual* benefits of getting vaccinated due to unwillingness and/or inability to process information rationally. However, individuals high in D might also decide *not* to get vaccinated against COVID-19 because it fuels feelings of superiority ("I am strong enough, I do not need the vaccine"; Chávez-Ventura et al., 2022) or the feeling of being smarter than the majority ("I understand things about this vaccine that others do not",

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Imhoff & Lamberty, 2017). In these cases where *perceived* utility is gained from vaccination refusal, incentivizing might have only limited effects. This line of argumentation is in line with the finding that incentives work more effectively for vaccine-*hesitant* individuals than for those *refusing* to get vaccinated (Salali & Uysal, 2021).

3.3 Limitations and Open Questions

First of all, all studies rely at least partly on cross-sectional designs, thus, causality cannot be concluded for most of the found associations. This pertains specifically to the nexus between D and post-truth epistemic beliefs (Manuscript #1, #2, and #3) and their effect on the endorsement of COVID-19 conspiracy theories and irrational behavior in the context of COVID-19 (Manuscript #1 and Manuscript #2). However, it is much more compelling to assume that a stable personality disposition such as the Dark Factor of Personality affects an individual's epistemic beliefs and resulting cognitions and behaviors than vice versa. Note that the repeated measures experiment presented in Manuscript #3 provides at least some evidence for causal links between D and fake news discernment as well as for post-truth epistemic beliefs and fake news discernment. Nevertheless, future research is encouraged to address the issue of causality.

Second, not all links in the proposed mediation model were significant across all studies. The fact that most of the zero-order correlations between the major variables were significant implies a statistical explanation. The common variance shared by D, Faith in Intuition for Facts, Need for Evidence, and Truth is Political could have led to non-significant associations in the joint model. However, this may only explain some of the non-significant links. Particularly, the links between D, Faith in Intuition for Fact and irrational cognition and behavior seem to be more complex than for the other two epistemic beliefs subscales and may depend on various contextual factors. During the pandemic, individuals might have developed different intuitions depending on the type of media they consumed. Those who primarily followed mainstream media were likely mainly exposed to the view that health protective behavior including vaccine uptake is necessary, safe, and effective (Christensen et al., 2022). Thus, they might have adjusted their intuition

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accordingly. In contrast, individuals who mostly consumed alternative media were likely more often exposed to the view that health-protective behavior was ineffective or even harmful (Waldman, 2021) and might have developed an according intuition. While this explanation may hold for Manuscript #2, it does not explain the non-significant links when considering self-ascribed Democrats and Republicans separately (Manuscript #3). Note that the subsample of the Republicans was rather small ($n = 166$) and Republicans on Mechanical Turk may not be representative of Republicans outside of Mechanical Turk (e.g., Huff & Tingley, 2015). In sum, further research on potential contextual factors influencing the way Faith in Intuition for Facts translates into (irrational) cognition and behavior is needed. This also pertains to the non-significant associations between D and Faith in Intuition for Facts in Study 3 and 4 of Manuscript #1.

Third, most of the present studies were conducted in the context of the COVID-19 pandemic. Although, Manuscript #3 provides evidence that the proposed mediation model also holds for other major challenges that society is confronted with and beyond the context of COVID-19, we encourage future research to further explore its scope. Testing the proposed model with regard to irrational cognition and behavior in the context of climate change seems to be of particular importance.

Fourth, not all variables potentially involved in the link between D and COVID-19 conspiracy theories and protective behavior or fake news were included in the studies. Individuals with pronounced aversive personality traits are prone to trolling (Craker & March, 2016; March et al., 2017) and deceiving (Jonason et al., 2014) and may, thus, tend to purposefully misreport their beliefs, veracity assessment of news posts or their vaccination status. At the same time, they may hold post-truth epistemic beliefs, but the causal pathways may be different than assumed (cf., e.g., Lewandowsky, 2021).

Fifth, as suggested in the introduction section, this work focuses on individuals high in D as *recipients* of information. In this regard, the mediating role of post-truth epistemic is discussed

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primarily in the context of information processing. Preliminary findings reported in the supplement of Manuscript #3 show that the proposed mediation model holds for individuals' willingness to share fake news posts, even though the effects are less pronounced than for their accuracy judgments. Thus, future research is encouraged to investigate the *communicator* perspective of those high in D as the nexus of the Dark Factor of Personality and post-truth epistemic beliefs could also be an antecedent of *shock and chaos communication* (Lewandowsky, 2021; Vargo et al., 2018). More precisely, individuals with high levels in D may also hold post-truth epistemic beliefs so that can spread fake news and conspiracy theories or create diversions to promote their own agenda or to distract (e.g., Arceneaux et al., 2021; Lewandowsky et al., 2020; Vargo et al., 2018).

3.4 Conclusion

The technologies of the 21st century have provided access to a vast array of information and immense multitude of different and sometimes controversial perspectives (Goldman et al., 2010), which include conspiracy theories and fake news (Basch et al., 2021; Lewandowsky et al., 2012). Successfully navigating through this complex media landscape requires that individuals not only know the facts, but also know how to evaluate competing arguments in terms of epistemic merit (Greene & Yu, 2016). However, some individuals are not willing to base their opinions, decisions, and behavior on scientific facts and seem to deliberately disregard rational arguments, which can have detrimental consequences. In the context of the COVID-19 pandemic, not getting vaccinated as a result from misinformed, ill-advised or a lack of reasoning can have detrimental consequences and can even be a life and death decision (Mohammed et al., 2022). The empirical work brought together in this dissertation highlights the pivotal role of post-truth epistemic beliefs and the Dark Factor of Personality as antecedents of irrational cognition and behavior both in the context of COVID-19 and beyond. Across a total of six studies, it provides consistent evidence that post-truth epistemic beliefs predict the endorsement of COVID-19 conspiracy theories, less engagement in health-protective behavior, and less discernment between

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fake and accurate news. The main insight of this work reveals a major problem to (health) communication but also highlights potentially efficient measures to combat post-truth phenomena and associated behavior by fostering the development of a complex understanding of truth and knowledge.

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