AUTHOR PREPRINT

**Inquisitive but Not Discerning: Deprivation Curiosity is Associated with Excessive
Openness to Inaccurate Information**

Claire M. Zedelius*

Madeleine E. Gross

Jonathan W. Schooler

University of California, Santa Barbara

18,575 words (excluding Abstract, References, Figures and Tables)

*Corresponding author

Psychological and Brain Sciences, University of California, Santa Barbara (CA), USA;

ORCID number: 0000-0001-8367-4489; email: claire.zedelius@gmail.com

Abstract

Epistemic curiosity (the desire for knowledge) is typically thought to benefit learning. In four preregistered studies, we show that interest curiosity, a facet of epistemic curiosity characterized by joyful exploration, is indeed associated with traits and abilities that benefit learning. These include general knowledge, intellectual humility, and discernment of the quality of information. In contrast, deprivation curiosity, a facet motivated by uncertainty reduction, is associated with errors and confusion. Individuals high in deprivation curiosity claim familiarity with new information (Studies 1 & 3) and made-up concepts (Studies 1-4). They find meaning in “bullshit” (Studies 3 & 4), believe disinformation (Study 4), and lack intellectual humility (Studies 1-4). We theorize that deprivation curiosity is characterized by an indiscriminate openness to information.

Keywords: Epistemic curiosity; Intellectual humility; Novelty detection; Overclaiming questionnaire; Bullshit receptivity; Analytic thinking; Disinformation; Fake news; Beliefs; Need for closure

Declarations

Transparency and availability of data and materials

All studies reported in this manuscript were pre-registered on the Open Science Framework. Pre-registration protocols and all materials (instructions, scales, tasks, stimulus materials) as well as all data can be downloaded from <https://osf.io/tzs9r/>.

Funding

This research was supported by a grant from the John Templeton Foundation [#60844].

Conflicts of interest/Competing interests

The authors declare that they have no conflict of interest.

Epistemic curiosity, or the desire for knowledge (Berlyne, 1954; Litman & Spielberger, 2003; Kashdan & Silvia, 2009; Loewenstein, 1994), is widely seen as an important virtue (Baehr, 2011; Silvia & Kashdan, 2009), and credited as a driving force behind learning and innovation (e.g., Berliner, 2020; Berlyne, 1966, 1978; Gross, Zedelius, & Schooler, 2020; Gruber, Gelman, & Ranganath, 2014; Hardy, Ness, & Mecca, 2017; Kang et al., 2009; Kashdan & Fincham, 2002; Kaufman, 2017; Litman, 2005). Thus far, the literature has primarily focused on the intellectually beneficial aspects of curiosity. Might there be a dark side to it? Could our thirst for knowledge open our mind not only to true and meaningful information, but also to meaningless nonsense, falsehoods and deliberate disinformation, or what is known as “fake news”? In the present set of studies, we approach this question by taking a closer look at the facets that make up epistemic curiosity and examining how they relate to processes directly relevant to acquiring knowledge. The results reveal a more intellectually beneficial facet and a “darker”, more disadvantageous side.

Facets of Epistemic Curiosity

Observing that the desire for knowledge can be motivated by different emotions and motivations, researchers have identified two distinct facets or sub-types of epistemic curiosity: *interest* and *deprivation* curiosity (Litman, 2008; Litman & Spielberger, 2003; Litman & Silvia, 2006). Interest curiosity is motivated by the joy of exploration (Berlyne, 1960; Litman, 2005; 2008; Litman & Silvia, 2006). It describes an intrinsic motivation for learning new things and diving deeper into complex and unfamiliar topics. It is unspecific in that the primary motivation is exploring and learning *new things*, rather than pursuing one particular topic of interest (e.g., Hidi, 2006).

Deprivation curiosity is more specific, and more emotionally ambivalent. It is motivated by the desire to reduce the unpleasant itch that arises when we are presented with an unanswered question, unsolved problem or mystery (Litman, 2008; Litman & Spielberger, 2003; Litman & Silvia, 2006). We all know the nagging feelings of confusion, frustration and uncertainty when a question is posed and we don't have the answer (Di Leo, Muis, Singh, & Psaradellis, 2019; Kruger & Evans, 2009; Noordewier & van Dijk, 2017; Shani, Tykocinski, & Zeelenberg, 2008). Individuals high in deprivation curiosity find these situations especially unpleasant and can't rest before they have found

the answer. Thus, they engage in specific, targeted exploration and their predominant motivation is uncertainty reduction.¹

Although interest and deprivation curiosity can be thought of as motivational *states*, there are trait-like individual differences in how often people experience these states (e.g., Gross et al., 2020; Hardy et al., 2017; Litman, Hutchins, & Russon, 2005). At the trait level, interest and deprivation curiosity are moderately correlated (around .40 – .50; e.g., Litman, 2005). Nonetheless, they are distinct constructs, and correlate differently with other states and traits. For instance, deprivation curiosity is associated with higher levels of negative emotions and trait level anxiety, anger and depression, whereas interest curiosity is not (Litman Jimerson, 2004; Litman & Silvia, 2006). Interest curiosity is associated with high tolerance for ambiguity and low need for closure, whereas deprivation curiosity is associated with low tolerance for ambiguity (Litman, 2010). Interest curiosity has been linked to mastery-oriented learning goals, whereas deprivation curiosity has been linked to more performance-oriented goals (Litman, 2008). Deprivation curiosity has also been shown to correlate with the “dark triad”, a well-studied cluster of socially aversive personality traits (narcissism, Machiavellianism and subclinical psychopathy), whereas interest curiosity has exclusively been linked to desirable traits (Kaufman, Yaden, Hyde, & Tsukayama, 2019).

Despite these differences in the motivations, emotions and personality traits associated with interest and deprivation curiosity, surprisingly little is known about differences between the two that pertain to learning. This is especially surprising since interest and deprivation curiosity are defined by the desire for acquiring knowledge. While studies on epistemic curiosity have documented various benefits for learning (e.g., Hassan, Bashir, & Mussel, 2015; Powell, & Nettelbeck, 2014; Von Stumm, Hell, & Chamorro-Premuzic, 2011), they have typically not looked at the independent effects of interest and deprivation curiosity. To our knowledge, the current research is the first to show that interest and deprivation curiosity relate differently to a number of “epistemic processes”, that is, processes that relate to acquiring knowledge.

Curiosity and Epistemic Processes

Satisfying the metaphorical thirst for knowledge is not as simple as quenching our literal thirst. To acquire accurate new knowledge, one needs to be discerning of the

quality of different kinds of information. One needs to be attentive to new (vs. old) information and evaluate critically which new information is true and meaningful and which is nonsensical, false, or misleading. And one needs to be aware of the limits of one's existing knowledge. To understand how interest and deprivation curiosity relate to these epistemic processes, the current research examined a number of measures, which we outline in the following sections.

Intellectual Humility

Intellectual humility is the recognition that what you *think* you know might in fact be wrong (e.g., Leary et al., 2017; Hoyle, Davisson, Diebels, & Leary, 2016; Krumrei-Mancuso & Rouse, 2015). It is surprising how much confidence we have in our knowledge, even though it is often based on limited information, and new evidence comes to light all the time. As the writer Chuck Klosterman (2017) puts it, “we usually think we are right, even though history has told us we are almost always wrong.” We engage in an impressive amount of mental gymnastics to inoculate our beliefs from new and contradictory information (Kunda, 1990; Nickerson, 1998). Intellectual humility could be called the “antidote” to this bias. Intellectually humble individuals are aware of the limits of their knowledge and open to updating their beliefs. They also have a low need for certainty and closure (Leary et al., 2017).

Curiosity is often cited as a feature of intellectual humility, since intellectually humble individuals should be actively curious to find out where they are wrong. Research has indeed found a correlation between curiosity and intellectual humility (Krumrei-Mancuso, Haggard, LaBouff, & Rowatt, 2020; Leary et al., 2017). However, this research hasn't examined the independent contributions of interest and deprivation curiosity. It stands to reason that curiosity motivated by the desire to reduce uncertainty—rather than the desire to learn new things—might not be as conducive to intellectual humility. Experiencing discomfort in the face of uncertainty might even make people cling stronger to their existing beliefs.

Responsiveness to New Information

To acquire new information, it is critical to discriminate between what is in fact new and what is already known. The ability to discriminate between new and old information is often measured with recognition memory tasks (e.g., Tulving, & Kroll,

1995; Tulving, Markowitsch, Craik, Habib, & Houle, 1996). Participants learn a list of items and are later shown old and new items. The ability to “detect” novelty and to discriminate between new and old—what we refer to here as responsiveness to novelty—is expressed in a “sensitivity” index, calculated by counting how many *old* items are correctly recognized (“hits”) and subtracting how many *new* items are *mistakenly* recognized as familiar (“false alarms”).

Interestingly, research has found that sensitivity to novelty is correlated with intellectual humility (Deffler et al., 2016). Perhaps intellectually humble individuals are vigilant for new information that might give them reason to update existing beliefs. So far, no research has examined whether the same is true for curiosity.² Since interest curiosity is focused on learning *new* information, we expected that individuals high in interest curiosity would also be highly responsive to new information. It is not clear if the same applies to deprivation curious individuals.

In addition to actual novelty, we were interested in how curiosity relates to people’s responsiveness to what we call “*conceptual*” novelty—when something familiar is viewed in a new light due to new contextual information. When we become more familiar with something, we usually lose interest (Leventhal, Martin, Seals, Tapia, & Rehm, 2007). Consider the photos and paintings on your walls. Once lovingly selected for their potential to bring you joy, they have probably faded into the background. If it suddenly came to light that a picture on your ancestry gallery depicted a famous artist or murderer, this might awaken your fascination. To test if curiosity predicts responsiveness to conceptual novelty, we developed a new task in which we first elicited habituation by showing the same image again and again, and then presented surprising contextual information. We expected that individuals high in interest curiosity would be responsive to this manipulation. The same might not apply to deprivation curiosity.

Real and False Claims of knowledge

Since curious people have a desire for knowledge, one would expect that they have a rich body of knowledge. And there is indirect evidence linking curiosity—in this case inferred from other traits, such as openness to experience—to general knowledge (Furnham, Christopher, Garwood, & Martin, 2007; Furnham, Swami, Arteché, & Chamorro-Premuzic, 2008). Interestingly, being knowledgeable is no antidote to making

false claims of knowledge. Evidence for this comes from studies using the overclaiming procedure. In this procedure, participants are asked about their knowledge of a list of historical events and concepts from politics, religion, geography and other domains—so far, a standard general knowledge test. Unbeknownst to the test-takers, however, the list contains “foils” or made-up terms (Paulhus & John, 1998; Paulhus, Harms, Bruce, & Lysy, 2003). The procedure was originally developed as a measure of lying or egoistic self-enhancement. Self-enhancement motivation indeed explains some proportion of “overclaiming” (i.e., claiming to have knowledge of foils; Bing, Kluemper, Davison, Taylor, & Novicevic, 2011; Paulhus, 2012; Paulhus et al., 2003). However, more recent studies have found that people who overclaim aren’t necessarily lying, but are often confused. Because the foils sound similar to real concepts, people sometimes genuinely think they are familiar with these made-up concepts (Dunlop et al., 2017; Kam et al., 2015; Goecke, Weiss, Steger, Schroeders, & Wilhelm, 2020; Müller, & Moshagen, 2018; Williams, Paulhus, & Nathanson, 2002). Indeed, highly knowledgeable individuals have been found to be prone to overclaiming (Dunlop et al., 2017).

Distinguishing real from false information seems obviously important for acquiring knowledge, and hence, one might expect that curious individuals excel in this domain. However, there is reason to expect that curiosity could also make people prone to confusing real and made-up concepts. Research has shown that people who score high on openness to experience—of which curiosity is a defining feature—make more claims of familiarity with both real as well as made-up terms (Dunlop et al., 2017). The authors speculated that this is due to their inquisitive nature, which causes them to generate many vivid associations between the words used to describe made-up concepts and real concepts in their memory. The activation and retrieval of a rich set of memories can lead to the illusion of familiarity. In other words, it *feels* as if the made-up concept was *retrieved* from memory, when in reality it is merely semantically associated with memories (see also Kelley, & Wixted, 2001). Here, we examine how interest and deprivation curiosity relate to general knowledge and the ability to distinguish between real and made-up concepts.

Seeing through Bullshit

Information can be strictly true or false. Another category of information we frequently encounter in the world is “bullshit”. In the psychological literature, the term has been used to describe information that lacks coherent meaning (Pennycook, Cheyne, Barr, Koehler, & Fugelsang, 2015). This type of bullshit is constructed by assembling spiritual- or scientific sounding buzzwords into the syntactic structure of a normal sentence, as in this computer-generated example: “We are being called to explore the totality itself as an interface between serenity and intuition” (Pennycook et al., 2015). Research has shown that some people find meaning in such sentences (e.g., Pennycook et al., 2015; Pennycook & Rand, 2018). Bullshit receptivity has been linked to paranormal and conspiracy beliefs (Čavojová, Secară, Jurkovič, & Šrol, 2019; Pennycook et al., 2015), and conservative political ideology (Evans, Sleegers, & Mlakar, 2020; Nilsson, Erlandsson, & Västfjäll, 2019; Sterling, Jost, & Pennycook, 2016). So far, nobody has looked at how curiosity relates to bullshit receptivity. Since curious individuals are eager to acquire knowledge, one might expect them to be critical of meaningless nonsense. On the other hand, their appetite for information might also make them more open to information, perhaps even bullshit.

Skepticism towards Disinformation, or “Fake News”

Finally, we examined how interest and deprivation curiosity relate to the way people engage with or fake news. We are referring to disinformation that is purposefully designed to deceive, and to provoke a reaction (e.g., moral outrage and sharing; Zimdars, & McLeod, 2020). To achieve this, fake news stories are usually written in an inflammatory, emotional tone (e.g., Brady, Wills, Jost, Tucker, & Van Bavel, 2017).

Studies have shown that some individuals are more prone to believing fake news than others. Pennycook and colleagues introduced the term “reflexive open-mindedness” to describe the tendency to un-skeptically accept disinformation. “Open-mindedness” may sound charitable in the context of fake news, but it fits with the notion that people can potentially fall for disinformation because of genuine curiosity, rather than simply being dense. Thus far, however, belief in fake news has been linked only to a lack of analytic thinking (Bago, Rand, & Pennycook, 2020; Bronstein, Pennycook, Bear, Rand, & Cannon, 2019; Pennycook & Rand, 2018, 2019a, 2019b) and to questionable beliefs (Pennycook et al., 2015) and conservative political ideology (Nilsson et al., 2019). Yet,

there may be multiple reasons for why people believe fake news. Here, we examine if interest and deprivation curiosity predict belief in fake news.

The Current Research

Four preregistered studies tested the effects of interest and deprivation curiosity on processes relevant to acquiring knowledge. The first study tested how interest and deprivation curiosity relate with (1) intellectual humility, (2) sensitivity to novelty in a recognition memory task, and (3) claims of familiarity with real and made-up concepts in the overclaiming procedure. In this first study, we originally did not set out to test differences between interest and deprivation curiosity, rather, we were interested in epistemic curiosity as a unified construct. However, exploratory tests revealed startling differences between the two facets. So, Study 1 is the only study in which we departed from our preregistered data analysis plan. On the basis of Study 1, we formulated the novel hypothesis that interest and deprivation curiosity are associated with different ways of engaging with information; whereas interest curiosity is associated with being humble and discerning with regard to the novelty and truthfulness of information, deprivation curiosity is associated with a lack of humility and failure to discriminate. In Studies 2, 3 and 4 we tested this hypothesis, proceeding according to our preregistered hypotheses and data analysis plans.

Studies 2, 3, and 4 replicated the findings from Study 1 and extended our investigation to the domain of bullshit (Studies 3 and 4), fake news (Study 4) and conceptual novelty (Study 4). In addition, these studies rule out different alternative explanations. Study 2 rules out that the lack of discernment associated with deprivation curiosity is explained by a tendency for self-enhancement and Study 4 rules out a lack of analytic thinking. Study 4 further shows that our findings reveal something unique about epistemic curiosity, which is not accounted for by openness to experience. Although interest and deprivation curiosity are correlated, our results suggest that their collinearity does not seem to pose a problem for interpreting the independent effects of the two types of curiosity and the dependent variables. Instead, the current research suggests that partialling out their independent contributions yields valuable new insights into the nature of curiosity.

All studies were conducted online in the US population. Participants were recruited through Amazon's Mturk, using CloudResearch (a.k.a. TurkPrime; Litman, Robinson, & Abberbock, 2016). We report our sample-size determinations as well as any data exclusions, which were always based on preregistered exclusion criteria. We report all manipulations and dependent measures. All data have been collected in a manner consistent with ethical standards for the treatment of human subjects, and with approval from the local internal review board.

Study 1

The goal of this study was to test how epistemic curiosity relates to intellectual humility, sensitivity to novelty, and real and false claims of knowledge. We predicted that curiosity would be associated with greater humility (replicating Krumrei-Mancuso, 2017) and greater sensitivity in distinguishing new vs. old information and real vs. made-up concepts. We then explored potential differences between interest and deprivation curiosity. The preregistration can be found here <https://osf.io/ue84a> and all data and supplemental materials here <https://osf.io/amgzt/>. In addition to epistemic curiosity, we were interested in other, more specific (spiritual and scientific) types of curiosity. These were not included in the other studies, and the results will be presented elsewhere.

Method

Participants

We sought to collect data from 500 participants. The sample size was determined based on the following considerations. First, a previous study by Deffler et al. (2016) had found a moderate correlation between novelty detection in the recognition memory task and intellectual humility. Based on a power analysis, we determined we would need at least 154 participants to replicate this finding. We reasoned that the unknown correlation between curiosity and novelty detection might be similar or smaller. To have more power to test this and other novel predictions, we aimed for a larger sample.

We collected data from 622 respondents, anticipating that some would be excluded or failing preregistered attention or compliance checks. These checks involved selecting the wrong response to an instruction (e.g., "Please select 'could give an exact description'"), or responding to an open-ended question (i.e., "Please explain which of these topics you feel the most strongly about and why") with gibberish or a non-answer

(e.g., “Very good”). All checks and exclusion criteria can be found in the preregistration. 173 respondents were excluded for failing checks. Exclusions were made blind with regard to the results. We were left with 543 participants (236 men, 304 women, 3 other or undisclosed). The average age was 32.65 years ($SD = 11.23$). Educational demographics were as follows: 8.84% High School/GED, 25.78% Some College, 9.94% 2-year College Degree, 38.86% 4-year College Degree, 11.97% Masters Degree, 2.03% Doctoral Degree, 2.58% Professional Degree (JD, MD).

Measures and Procedure

Participants completed the following measures.

Recognition Memory Task. Responsiveness to novelty was assessed in an old/new recognition memory task modeled closely after Deffler et al. (2016). In a learning phase, participants read statements about four controversial topics (Socialism, e-cigarettes, the minimum wage, concealed handguns). They then performed a filler task (the overclaiming procedure described below) and the recognition phase. Because we wanted the task to be a *surprise* memory task, the task was framed as being about attitudes and attitude change. To this end, participants were first asked if they “agree” or “disagree” with different positions (e.g., “We should have a higher federal minimum wage”), and how strongly they feel about them on a 7-point scale.

In the learning phase, participants read 40 statements, presented one by one, in random order. The statements were ostensibly “statements other people have made about these topics”. To give participants a reason to read the sentences, they were asked to indicate for each statement whether it was for or against a position. After reading the 40 sentences, they were once again asked about their attitudes. For all participants knew, this constituted the end of the task.

In the surprise recognition phase, participants saw 80 sentences; the 40 they had previously read and 40 new ones. Participants indicated whether each sentence was old (“seen before”) or new (“not seen before”), and how confident they were in their answer.

Overclaiming Questionnaire. Participants were presented with terms from the following domains: “Historical events and people”, “geographical and historical landmarks”, “religion”, and “politics”. (Items were presented randomly, but grouped by topic.) Participants were asked to indicate their familiarity with each term using a 1-5

scale with the answer options “never heard to if before”, “heard of it before, but can’t describe it exactly”, “could describe it roughly”, “could describe in relatively precisely”, “could give an exact description”. For every topic, 12 items were real and 6 were foils. Materials were taken from Dunlop et al. (2017), Study 4.

Next, the following five scales were administered in random order.

General Intellectual Humility Scale. This 6-item scale (Leary et al., 2016) assesses the degree to which people recognize that their beliefs might be wrong and seek out new contradictory information (e.g., “I like finding out new information that differs from what I already think is true.”). Participants respond on a 5-point scale from “not at all like me” to “very much like me”. Cronbach’s alpha was .736.

Comprehensive Intellectual Humility Scale. This 22-item scale (Krumrei-Mancuso & Rouse, 2016) assesses the degree to which people are open to new information that contradicts their existing beliefs. The scale also emphasizes the interpersonal aspect of intellectual humility (e.g., “When someone contradicts my most important beliefs, it feels like a personal attack”). Cronbach’s alpha was .856.

Epistemic Curiosity Scale. This 10-item scale consists of two sub-scales interest curiosity (e.g., “I find it fascinating to learn new information”) and deprivation curiosity (e.g., “I can spend hours on a single problem because I just can’t rest without knowing the answer”; Litman, 2008). Participants respond on a 4-point scale with the answer options “almost never”, “sometimes”, “often”, and “almost always”. Cronbach’s alpha was .819 for interest curiosity and .821 for deprivation curiosity.

Spiritual Curiosity Scale. This newly constructed 9-item scale assesses people’s curiosity for spiritual questions and practices (e.g., “I would enjoy attending a church service from an unfamiliar religious tradition”).

Science Curiosity Scale. This 9-item scale is a sub-scale from a more comprehensive measure of interest in science by Landrum, Hilgard, Akin, Li, and Kahan (2016; e.g., “I would like to listen to scientists talk about their jobs”).

Results

Intellectual Humility

Our first research question concerned the relationship between epistemic curiosity and intellectual humility. We replicated previous research (Krumrei-Mancuso, et al.,

2020; Leary et al., 2017) showing a positive correlation between epistemic curiosity (as a whole) and intellectual humility, for both the General Intellectual Humility scale ($r = .327, p < .001$) and the Comprehensive Intellectual Humility scale ($r = .571, p < .001$).

To gain a more nuanced picture of the independent effects of interest and deprivation curiosity, we then proceeded by conducting regression analyses on the two intellectual humility scales with interest and deprivation curiosity as joint predictors.

For the General Intellectual Humility scale, only interest curiosity emerged as a significant predictor ($b = .405, t = 9.18, p < .001, 95\%CI (.318, .491)$), whereas deprivation curiosity was non-significant ($b = .013, t = .35, p = .728, 95\%CI (-.062, .088)$), $F(2, 540) = 59.74, p < .001$). For the Comprehensive Intellectual Humility scale, the effects of interest and deprivation curiosity diverged even more: Interest curiosity positively predicted increased intellectual humility ($b = .346, t = 9.10, p < .001, 95\%CI (.272, .421)$), whereas deprivation curiosity was associated with decreased humility ($b = -.149, t = -4.53, p < .001, 95\%CI (-.214, -.084)$), $F(2, 540) = 41.43, p < .001$).

Responsiveness to Novelty

Next, we looked at novelty detection in the recognition memory task. We scored task according to signal detection theory, as is typical (Snodgrass & Corwin, 1988; Stanislaw & Todorov, 1999). We counted the number of hits (i.e., correctly recognized old statements) and false alarms (i.e., incorrectly recognized new statements). We then created a sensitivity index (d') by subtracting false alarms from the hits. (The hit and false alarm rates were first standardized, i.e., $z(\text{hits}) - z(\text{false alarms})$). For completeness, we also computed the index of response bias (calculated as $(z(\text{hits}) + z(\text{false alarms})) / 2$), which quantifies the general tendency to respond in the affirmative (i.e., “seen before”). Missing values can occur for both indices when a person has a perfect hit rate or no false alarms. Different adjustments have proposed for these situations (e.g., see Hautus, 1995; Miller, 1996). We decided to perform our analyses on unadjusted data (hence, the degrees of freedom can differ from other analyses), but the pattern of results does not substantially change if we apply an adjustment.

We found that epistemic curiosity—as a whole—was not correlated with sensitivity ($r = .035, p = .457$; nor bias, $r = .062, p = .182$). However, when we partialled out interest and deprivation curiosity as separate predictors in a regression model, we

found that interest curiosity was associated with increased sensitivity ($b = .320, t = 3.73, p < .001, 95\%CI (.151, .488)$) and deprivation curiosity with decreased sensitivity ($b = -.235, t = -3.09, p = .002, 95\%CI (-.384, -.086)$), $F(2, 462) = 8.01, p < .001$. See Figure 1. (Bias was not predicted by either type of curiosity, $F(2, 462) = 1.25, p = .29$, both coefficients $< .03, p > .38$).³

Follow-up analyses regressing interest and deprivation curiosity on the components of sensitivity—hits and false alarms—revealed that interest curiosity was associated with an increased hit rate ($b = .043, t = 3.80, p < .001, 95\%CI (.021, .065)$) and fewer false alarms ($b = -.040, t = -2.50, p = .013, 95\%CI (-.072, -.009)$). Deprivation curiosity was associated with a marginally lower hit rate ($b = -.019, t = -1.93, p = .055, 95\%CI (-.038, .001)$) and significantly more false alarms ($b = .049, t = 3.51, p < .001, 95\%CI (.021, .076)$).

Real and False Claims of Knowledge

Next, we looked at real and false claims of knowledge in the overclaiming task. This task was scored using the same sensitivity and bias indices. One additional step here involved dichotomizing responses to count hits (i.e., claims of familiarity with real items) and false alarms (i.e., claims of familiarity with foils), since familiarity was assessed with a continuous or ordinal scale. This is standard procedure for the overclaiming task. We used a cut-off at 1, such that the lowest response, (1) “never heard of it before”, was counted as being *unfamiliar* with an item, and all other responses (2-5 on the 1-5 scale) were counted as *familiar*.⁴

Our main measure of interest was sensitivity, or the degree to which a person distinguishes between familiar and made-up concepts. To interpret differences in sensitivity, we also looked at hit and false alarm rates. Raw false alarm rates are sometimes used as a simple measure of overclaiming (e.g., Dunlop et al., 2017). However, people can of course *falsely* claim to know real existing concepts just as well. Therefore, sensitivity, hits and false alarms are best interpreted in conjunction. (For completeness, we also calculated bias.)

We initially examined the correlation between epistemic curiosity (as a whole) and sensitivity. This correlation was negative ($r = -.112, p = .013$). However, when we partialled out interest and deprivation curiosity in a regression analysis, interest curiosity

predicted increased sensitivity ($b = .085, t = 1.99, p = .047, 95\%CI (.001, .170)$), whereas deprivation curiosity predicted decreased sensitivity ($b = -.164, t = -4.48, p < .001, 95\%CI (-.235, -.092)$), $F(2, 496) = 10.09, p < .001$. See Figure 2. (Bias was marginally significantly predicted by both interest ($b = .073, t = 1.69, p = .091, 95\%CI (-.012, .159)$) and deprivation curiosity ($b = .096, t = 1.89, p = .060, 95\%CI (-.004, .197)$), $F(2, 496) = 6.53, p < .001$).⁵

Follow-up analyses on hits and false alarms revealed that interest curiosity was associated with an increased hit rate, that is, greater familiarity with real items ($b = .055, t = 3.32, p = .001, 95\%CI (.022, .088)$) but not false alarms ($b = .016, t = .77, p = .440, 95\%CI (-.025, .057)$). In contrast, deprivation curiosity did not predict hits ($b = -.002, t = -.11, p = .912, 95\%CI (-.030, .027)$), but it did predict false alarms, or overclaiming ($b = .057, t = 3.17, p = .002, 95\%CI (.022, .092)$).

Diagnosing Collinearity

Since interest and deprivation curiosity are correlated (here $r = .516, p < .001$), collinearity is a concern when interpreting the current regression results (e.g., Lynam, Hoyle, & Newman, 2006). Aside from correlation, the degree of collinearity can be expressed in the Variance Inflation Factor (VIF). The VIF estimates how much the variance of a regression coefficient is inflated due to correlations between predictor variables. It is calculated as follows: $1 / 1 - R^2$, where R^2 is the variance explained by regressing one predictor on all other predictors in the auxiliary regression model (in this case, interest on deprivation curiosity, or vice versa). Values greater than 4 or 5, sometimes 2.5, are typically regarded as being moderate to high (e.g., Adeboye, Fagoyinbo, & Olatayo, 2014; Akinwande, Dikko, & Samson, 2015; Marcoulides, & Raykov, 2019). The VIF in the current study was 1.36, suggesting that high collinearity is likely not a concern for interpreting the regression results.

Discussion

The current results reveal a previously overlooked side of epistemic curiosity, which emerges when we separate interest and deprivation curiosity. Previous research has linked epistemic curiosity with intellectual humility, and we replicate this result. However, when we partial out interest and deprivation curiosity, we find that this is driven purely by interest curiosity. Highly deprivation curious individuals are not

humble. If anything, they are somewhat intellectually arrogant. This could be explained by the fact that deprivation curiosity is motivated by the desire to reduce uncertainty (Litman, 2008; Litman & Spielberger, 2003; Litman & Silvia, 2006). Having your beliefs challenged can evoke a feeling of uncertainty. More deprivation curious individuals might be more motivated to avoid this feeling by clinging to their existing beliefs.

Interest and deprivation curiosity also had opposite relationships with novelty discrimination. Highly interest curious individuals are accurate at discriminating between new and old information. Deprivation curiosity, on the other hand, was associated with errors discriminating new and old items. Importantly, this was not driven by poor memory for old items, but by a tendency to falsely ascribe familiarity to novel items.

A similar pattern occurred in the overclaiming task. Here, interest curiosity was associated with a greater number of hits and greater sensitivity. This can be interpreted as being both knowledgeable and discerning. In contrast, highly deprivation curious individuals were less sensitive (i.e., less discerning) and they falsely claimed familiarity with made-up concepts.

One could sum up these results by saying that deprivation curiosity is associated with a tendency to “claim to know more than one knows”. Different explanations could account for that. Individuals higher in deprivation curiosity could have an *over-inclusive* information processing bias, erring on the side of accepting *all* kinds of information, rather than being selective. This openness may inflate their judgments of familiarity. In other words, people high in deprivation curiosity might *genuinely believe* they have heard or seen some of the foils and novel items in the memory and overclaiming task. This could stem from a “promiscuous” desire for information. We refer to this explanation as the “promiscuous information bias” hypothesis.

Consistent with this hypothesis, studies show that people can experience an illusory sense familiarity with items they have never seen before. For instance, fluent processing increases the chances that novel items are perceived as familiar (e.g., Jacoby & Whitehouse, 1989; Kelley & Rhodes, 2002; Kelley, & Wixted, 2001; Kurilla, & Westerman, 2008; Olds, & Westerman, 2012; Unkelbach, 2006). Similarly, fluent processing of falsehoods increases truth ratings (Begg, Anas, & Farinacci, 1992; Fazio,

Brashier, Payne, & Marsh, 2015; Schwartz, 1982; Unkelbach, 2007). A similar process may be going on here.

Alternatively, individuals high in deprivation curiosity might claim to know things they don't because they want to appear superior to others. (see Mesmer-Magnus, Viswesvaran, Deshpande, & Joseph, 2006; Paulhus, 2012; Paulhus, Harms, Bruce, & Lysy, 2003) We call this the self-enhancement account. This account would be in line with our finding that more deprivation curious individuals are less humble. In Study 2, we sought to replicate key findings from Study 1 and test evidence for the self-enhancement account.

Study 2

To test if deprivation curiosity is associated with a tendency to present oneself as superior, we drew on methods from the self-enhancement literature. A classic finding is that most people think they are better (e.g., better drivers, better leaders, funnier and more creative) than most other people. This is known as the better-than-average effect (Guenther & Alicke, 2010; Zell, Strickhouser, Sedikides, & Alicke, 2020). Related phenomena are overplacement (overestimating one's ranking relative to others; Anderson, Brion, Moore, & Kennedy, 2012; Ehrlinger, Mitchum, & Dweck, 2016; Logg, Haran, & Moore, 2018) and overconfidence (overestimating one's performance relative to one's true scores; Mayer, Panter, & Caruso, 2020). The classic better-than-average effect can only be interpreted at the population level, since *some* people *are* better than average. Overconfidence is a problematic concept in its own way, because a person may overestimate their performance without feeling superior to others (e.g., they might believe they scored 60 on a test when their true score was 50, yet they believe the average score is 70). Despite these complexities, a number of measures have been developed to assess self-enhancement.

One measure involves asking people to rate themselves on various attributes, rate *other people* on the same attributes, and rate how *desirable* they find each attribute. If desirability predicts self-evaluations better than other evaluations, this is thought to be a sign of self-enhancement (Guenther & Alicke, 2010; Krueger, 1998; Taylor, Lerner, Sherman, Sage, & McDowell, 2003). The benefit of this method is that it yields a quantitative self-enhancement score that can be compared across individuals. However, it

lacks objectivity. Another method is to have people perform a task and then ask them to estimate their scores relative to others (Heck & Krueger, 2015; Krueger, Heck, & Asendorpf, 2017). Anybody who ranks themselves higher than average while objectively performing below average is categorized as a self-enhancer. While objective, this method yields a categorical self-enhancement index, which is not as nuanced as an individual differences measure. To offset the strengths and weaknesses of each method, we included both the subjective measure and two objective tasks in the current study. We further included two self-report scales that capture tendencies for self-enhancement: A narcissism questionnaire, which assesses explicit claims of superiority, and a goal orientation questionnaire, which assesses the extent to which people are motivated by the desire to learn or to perform better than others.

Our main prediction was that we would replicate the differences between interest and deprivation curiosity observed in Study 1 with respect to intellectual humility and overclaiming. (Due to the number of additional tasks included in this study, we did not include the recognition memory task here. However, we did include it in Study 3.) Our second prediction was that deprivation curiosity would be associated with self-enhancement. If true, we also planned to test whether self-enhancement mediates the relationship between deprivation curiosity and overclaiming. The preregistration can be found here <https://osf.io/mn5uz> and all data and supplemental materials here <https://osf.io/ar3kx/>.

Methods

Participants

We collected data from 550 respondents. 25 were excluded for failing attention or compliance checks similar to those in Study 1. All checks can be found in the preregistration. Exclusions were made blind to the results. We were left with 525 participants (206 men, 313 women, 6 other or undisclosed). The average age was 33.73 (SD = 12.10). Educational demographics were as follows: 8.21% High School/GED, 24.81% Some College, 8.78% 2-year College Degree, 40.27% 4-year College Degree, 14.89% Masters Degree, 1.72% Doctoral Degree, 1.34% Professional Degree (JD, MD).

Measures and Procedure

Participants completed the following measures.

Subjective Self-Enhancement. Participants read a list of 24 personality traits (e.g., boring, strong, selfish, friendly, logical, empathetic) and were asked to rate each trait using the following prompts (presented in counterbalanced order, i.e., A-B-C, A-C-B, B-A-C, B-C-A, C-A-B, C-B-A): A) “Please rate how well the following personality traits describe you.” B) “Please rate how well the following personality traits describe the average person.” C) “Please rate how desirable you find the following personality traits” (see Guenther & Alicke, 2010; Zell et al., 2020). Participants responded on a 5-point scale from “not at all” to “extremely”.

Overclaiming task. See Study 1.

Objective Self-Enhancement Measure 1: Math Task. This task was adapted from Anderson et al. (2012), and was presented as an “intuitive math task”. On each trial, participants were briefly (2 seconds) presented with six two-digit numbers and were asked to estimate the average. They purposefully were not given enough time to calculate the average to create a condition of ambiguity, under which self-enhancement can occur (see Logg et al. 2018). After 10 trials, participants were told we would count all answers as correct that fall within five points on either side of the actual answer. They were told to use this criterion when evaluating their own and other people’s performance. We then asked the following questions, on separate screens and in random order: “Now, we want to know how well you think you did on the task. Out of the 10 questions, how many do you think you got right?”, “Now, we want to know how well you think other participants did on task. Out of the 10 questions, how many do you think our study participants got right, on average?”

Objective Self-Enhancement Measure 2: Trivia Task. Participants answered 20 trivia questions, including 13 multiple-choice (e.g., “What product is second, only to oil, in terms of the largest trade volumes in the world? A) flower, B) gold, C) cotton, D) coffee”) and 7 open-ended questions (e.g., “What gas forms almost 80% of Earth’s atmosphere?”). Multiple-choice questions were included to make the task ambiguous enough to create the conditions under which self-enhancement can occur (see Logg et al., 2018). After each question, participants were asked how curious they were to see the answer. (This question was included for exploratory purposes.) After the last question, participants were asked to estimate their own and average (i.e., other people’s) scores.

Specifically, we asked the following two questions, presented on separate screens and in counterbalanced order: “We are interested in how well you think you did on the task. Out of the 20 questions, how many do you think you got right?”, “We are interested in how well you think other participants did on the task. Out of the 20 questions, how many do you think our study participants got right, on average?”

Next, we administered the following three scales, in random order.

General Intellectual Humility Scale. See Study 1. Cronbach’s alpha was .787.

Comprehensive Intellectual Humility Scale. See Study 1. Cronbach’s alpha was .856.

Epistemic Curiosity Scale. See Study 1. Cronbach’s alpha was .811 for interest curiosity and .836 for deprivation curiosity.

Breadth of Categorization Task. This task (see Isen & Daubman, 1984) was included for exploratory purposes, to test if interest and deprivation curiosity are associated with differences in cognitive organization. Participants were asked how well various exemplars (e.g., suit, shirt, cane, purse) belong within a category (e.g., clothes). We used two categories (clothing and vehicles), and for each category listed three prototypical exemplars and three poor exemplars. Participants categorized each exemplar using a 10-point scale. Cronbach’s alpha for untypical items was .891, and .753 for typical items.

Narcissistic Personality Inventory Short Form. This 16-item scale assesses sub-clinical individual difference in narcissism, or a “grandiose but fragile sense of self” (Ames Rose, & Anderson, 2006). Each item consists of two statements, one of which is indicative of narcissism (e.g., “I can make anybody believe anything I want them to” vs. “People sometimes believe what I tell them”). Cronbach’s alpha was .753.

Learning and Performance Goal orientation scale. This 16-item scale (Button, Mathieu, & Zajac, 1996) assesses the extent to which people’s learning experiences are motivated by the desire to learn new skills (e.g., “The opportunity to do challenging work is important to me”) and the desire to perform well (e.g., “I feel smart when I can do something better than most other people”). Cronbach’s alpha .875 was for the learning orientation subscale and .799 for the performance orientation subscale.

Results

Intellectual Humility

Repeating our analyses in Study 1, we conducted two regression analyses on the two intellectual humility scales, with interest and deprivation curiosity as predictors. For General Intellectual Humility, this time both interest curiosity and deprivation curiosity emerged as significant predictors, although the coefficient for interest curiosity was notably larger ($b = .402, t = 10.13, p < .001, 95\%CI (.324, .480)$) than for deprivation curiosity ($b = .132, t = 3.77, p < .001, 95\%CI (.063, .201)$), $F(2, 525) = 85.88, p < .001$). For the Comprehensive Intellectual Humility scale, only interest curiosity predicted humility ($b = .320, t = 9.63, p < .001, 95\%CI (.254, .385)$), deprivation curiosity did not ($b = -.038, t = -1.29, p = .199, 95\%CI (-.095, .020)$), $F(2, 525) = 49.80, p < .001$).

Real and False Claims of Knowledge

To replicate our findings for the overclaiming task, we again conducted a regression analysis with interest and deprivation curiosity as predictors and sensitivity in distinguishing real from made-up concepts as the dependent measure. Interest curiosity again predicted increased sensitivity ($b = .147, t = 2.83, p = .005, 95\%CI (.045, .249)$), while deprivation curiosity did not ($b = -.075, t = 1.62, p = .106, 95\%CI (-.166, .016)$), $F(2, 310) = 4.12, p = .017$. See Figure 3. (Bias was likewise predicted by interest curiosity ($b = .115, t = 2.70, p = .007, 95\%CI (.031, .199)$) but not deprivation curiosity ($b = .016, t = .43, p = .667, 95\%CI (-.058, .091)$), $F(2, 310) = 5.11, p = .007$).

Follow-up analyses on hits and false alarms revealed that interest curiosity was again associated with more hits (i.e., greater familiarity with real items, $b = .057, t = 4.17, p < .001, 95\%CI (.030, .084)$) but no more false alarms ($b = .015, t = 1.03, p = .305, 95\%CI (-.014, .044)$). In contrast, deprivation curiosity again did not predict hits ($b = -.001, t = -.01, p = .991, 95\%CI (-.024, .024)$), but it was again associated with more false alarms (i.e., false claims of familiarity with made-up concepts, $b = .028, t = 2.14, p = .033, 95\%CI (.002, .053)$).

To find out to what extent this tendency to overclaim reflects self-enhancement, we computed correlations between the overclaiming task and all measures of self-enhancement. See Table 1 for the results.

Subjective Self-Enhancement

To examine whether self-enhancement plays a role in explaining the differences

between interest and deprivation curiosity, we first calculated subjective self-enhancement based on people's self- and other- evaluations on various traits. We regressed participants' desirability ratings for each trait on their self-ratings on the same trait, then regressed desirability ratings on other-ratings, and subtracted the two coefficients from each other (i.e., $b(\text{self-evaluations, desirability}) - b(\text{other-evaluations, desirability})$).⁶ Thus, self-enhancement was expressed as the degree to which desirability ratings predicted self-ratings *better* than they predicted other-ratings (e.g., Taylor et al., 2003; Zell et al., 2020).

Overall, participants exhibited the typical self-enhancement bias, as shown in a positive differences score between the two coefficients ($M = .168$, $SD = .259$), which deviated significantly from zero, $t(524) = 14.857$, $p < .001$, $95\%CI (.146, .190)$). To test if deprivation (but not interest) curiosity is associated with increased self-enhancement, we performed a regression analysis predicting self-enhancement scores from interest and deprivation curiosity. Against our prediction, and speaking against the self-enhancement account, deprivation curiosity was unrelated to self-enhancement ($b = -.010$, $t = -.42$, $p = .672$, $95\%CI (-.055, .036)$). However, unexpectedly, interest curiosity was associated with higher self-enhancement scores ($b = .098$, $t = 3.74$, $p < .001$, $95\%CI (.047, .150)$, $F(2, 525) = 7.59$, $p = .001$).⁷

Objective Self-Enhancement

Next, we analyzed our objectively verifiable self-enhancement measures. Following Krueger, Heck, and Asendorpf, (2017), we defined self-enhancement in the math and trivia tasks as a function of two factors: a) whether a person placed themselves above or below average, and b) whether their performance was in fact above or below average. This generates four cells: Individuals who are *correct* in thinking they scored above average, those who *correctly* assume they are below average, those who *underplace* themselves despite scoring *above* average ("self-effacers") and those who *overplace* themselves while scoring below average ("self-enhancers"). For the current purposes, and in following Krueger et al. (2017), we then categorized participants as being self-enhancers versus not.

It is worth noting that self-enhancement was not widespread. In the trivia task, only 133 out of 525 participants overplaced, and of those, only 47 were self-enhancers.

(165 were self-effacers.) In the math task, 135 overplaced, and of those 37 were self-enhancers. (229 were self-effacers.) Roughly half the participants assessed their performance accurately in these tasks.

To test if interest and deprivation curiosity affect people's chances of falling in the self-enhancer category, we conducted two logistic regression analyses, one on self-enhancement in the trivia task and one for the math task. In the trivia task, neither interest ($b = .070, z = .24, p = .811$) nor deprivation curiosity ($b = .292, z = 1.16, p = .248$) predicted self-enhancement, $\chi^2 = 1.88, p = .391$. The same was true for the math task. Neither interest ($b = -.207, z = -.64, p = .519$) nor deprivation curiosity ($b = -.135, z = -.47, p = .642$) predicted self-enhancement, $\chi^2 = 1.02, p = .602$.

Trivia and Math Accuracy

Since we had participants' objective scores from the trivia and math tasks, we were interested if these scores were differentially predicted by interest and deprivation curiosity. Accuracy was coded as 0 (incorrect) or 1 (correct) for each question/trial, and scores for each task were averaged over trials, so mean accuracy ranged between 0 and 1 ($M = .476, SD = .129$ for the trivia task; $M = .561, SD = .280$ for the math task). A linear regression on trivia scores showed that interest curiosity predicted increased accuracy ($b = .033, t = 3.07, p = .002, 95\%CI (.012, .053)$), whereas deprivation curiosity was predictive of poorer trivia performance ($b = -.025, t = -2.65, p = .008, 95\%CI (-.043, -.006)$), $F(2, 525) = 5.98, p = .003$. On the math task, there was only a marginally significant positive effect of interest curiosity ($b = .045, t = 1.95, p = .052, 95\%CI (-.001, .091)$), and none of deprivation curiosity ($b = .002, t = .14, p = .887, 95\%CI (-.037, .043)$). The overall model for this measure was only marginally significant, $F(2, 525) = 2.37, p = .095$.

Narcissism

Next, we looked for evidence of self-enhancement in the narcissism scale. Regressing interest and deprivation curiosity on narcissism scores showed that narcissism was unrelated to interest curiosity ($b = .006, t = .50, p = .617, 95\%CI (-.019, .032)$), and was at most weakly related to deprivation curiosity, though this latter effect was only marginally significant ($b = .022, t = 1.94, p = .053, 95\%CI (-.002, .044)$) and the overall model did not reach significance, $F(2, 525) = 2.80, p = .062$.

Despite the only trending results, we followed up with a mediation analysis, using structural equation modeling, to test whether narcissism might mediate the relationship between deprivation curiosity and overclaiming. The model is shown in Figure 4. As can be seen, the indirect effect of deprivation curiosity on overclaiming through narcissism is not significant.

Goal Orientation

Our final self-enhancement measure was the goal orientation scale, whose two sub-scales assess learning goals and performance orientation goals, or the desire to outperform others. We conducted two regression analyses with interest and deprivation analyses as predictors. The results showed that learning goals were predicted by both interest and deprivation curiosity, though the coefficient was notably larger for interest ($b = .607, t = 11.33, p < .001, 95\%CI (.502, .713)$) than deprivation curiosity ($b = .269, t = 5.69, p < .001, 95\%CI (.176, .362)$), $F(2, 525) = 123.42, p < .001$. Performance goals were neither predicted by interest curiosity ($b = -.007, t = -.11, p = .909, 95\%CI (-.133, .147)$) nor deprivation curiosity ($b = .036, t = .64, p = .521, 95\%CI (-.074, .147)$), $F(2, 525) = .220, p = .805$.

Breadth of Categorization Task

The breadth of categorization task was included for exploratory purposes, to test if interest and deprivation curiosity are associated with a more or less inclusive way of categorizing information. The task is scored by summing up responses to untypical exemplars. A regression analysis on categorization scores indicated no effect of interest ($b = 1.344, t = 1.50, p = .135, 95\%CI (-.418, .3.106)$) nor deprivation curiosity ($b = .084, t = .11, p = .916, 95\%CI (-1.470, .1.638)$), $F(2, 525) = 1.40, p = .248$.

Diagnosing Collinearity

The VIF for interest and deprivation curiosity was 1.17, indicating that high collinearity is not a concern for interpreting the current results.

Discussion

The results from Study 2 mostly replicate the differences between interest and deprivation curiosity found in Study 1. With regard to intellectual humility, the results are not as clear-cut as in Study 1. This time we do not find a negative relationship between deprivation curiosity and intellectual humility. What we do find is that deprivation

curiosity predicts intellectual humility to a lesser extent than interest curiosity, or not at all, depending on the scale. Given the differences with Study 1, we will continue to test the robustness of these differences in the following studies.

We also largely replicate the findings for the overclaiming task. Interest curiosity is once again associated with increased sensitivity (i.e., discernment), and with hits. The increased hit rate, in the absence of false alarms, can be interpreted as evidence of greater general knowledge. In contrast, deprivation curiosity was not predictive of sensitivity. While we don't directly replicate the negative relationship with sensitivity, we replicated the previous pattern of an increased false alarm rate in the absence of increased hits. The fact that deprivation curiosity specifically predicts claims of familiarity with made-up items *but not real items* is noteworthy. It suggests that highly deprivation curious individuals do not inflate their knowledge across the board. That would be evident in a high number of false alarms but also a high number of hits (and increased bias). Rather, they seem to be less likely to notice that the made-up items are in fact made-up.

In light of Study 1, we had proposed two explanations for the counter-intuitive effects of deprivation curiosity. One, individuals higher in deprivation curiosity might have a more inclusive (in fact, over-inclusive) information processing style—which we termed the promiscuous information bias hypothesis. Alternatively, they might have a stronger self-enhancement motive. The current results are in line with the promiscuous information bias, but do not support the self-enhancement account.

We found no sign that deprivation curiosity was associated with greater self-enhancement. Surprisingly, though, interest curiosity was associated with greater subjective self-enhancement. This might be explained by social desirability. Interest curiosity is a highly desirable trait—perhaps more so than deprivation curiosity, with its more fervent or “tortured” hunger for answers. So, people who want to present themselves favorably may score higher on both interest curiosity and our subjective self-enhancement measure. Alternatively, it is possible that highly interest curious individuals have a particularly cheerful outlook, which is also reflected in their self-evaluations. It is also possible that the elevated self-evaluations among highly interest curious individuals reflect *accurate* self-assessment, and not self-enhancement. Highly interest curious

participants performed better on the trivia task and math tasks, so there is some evidence for their objective superiority in some intellectual domains.

Interestingly, we found correlations (albeit small) between behavior on the overclaiming task and our measures of self-enhancement (see Table 1). Sensitivity (i.e., discernment) was negatively correlated with narcissism, self-enhancement on the trivia task and (marginally) self-enhancement on the math task. Moreover, false alarms were correlated with narcissism and subjective self-enhancement. Thus, our data show that self-enhancement plays *some* role in overclaiming. However, deprivation curiosity affects responses on the overclaiming task through a different, independent mechanism. We previously proposed that more deprivation curious individuals may be more open towards all kinds of information, erring on the side of accepting rather than dismissing information. If this is the case, their “promiscuous” or over-inclusive information bias may not only cloud their judgments of familiarity, it may also express itself in a willingness to engage with other types of wrong or useless information. In Study 3, we test this possibility by extending our investigation into the domain of “bullshit”.

Study 3

Our first goal for Study 3 was to replicate our previous findings with respect to intellectual humility, overclaiming, and responsiveness to novelty. Our second goal was to test a new hypothesis brought fourth by the promiscuous information bias account. According to this account, individuals high in deprivation curiosity are overly accepting of *all* information. If true, this should make them prone to accepting even meaningless information, or bullshit. Thus, we hypothesized that deprivation, but not interest curiosity, would be associated with a greater tendency to find truth and meaning in bullshit. To test this prediction, we included two measures of bullshit receptivity. One focused on pseudo-scientific and one on pseudo-profound bullshit.

We further included a measure of the psychological need for closure. This, first of all, served to clarify the theoretical constructs of interest and deprivation curiosity, by empirically confirming that deprivation (but not interest) curiosity is indeed motivated by the desire to avoid the unpleasant emotions elicited by uncertainty. This is theorized to be a key difference between interest and deprivation curiosity, but thus far only one study (Litman, 2010) has directly tested this, and the authors called the results “very weak”.

(This could have been an issue of sample size. While their sample was not small ($N = 158$), we were able to test the prediction in a much larger sample.) We predicted that deprivation curiosity would be positively and interest curiosity negatively related to the need for closure. We also wanted to test if need for closure plays a mediating role in explaining why deprivation curiosity is associated with a relative lack of discernment and intellectual humility. The preregistration for Study 3 can be found here <https://osf.io/unh2p> and all data and supplemental materials here <https://osf.io/3mt5y/>.

Method

Participants

We collected data from 510 respondents. 74 were excluded for failing attention or compliance checks similar to those in Studies 1 and 2. All checks and exclusion criteria can be found in the preregistration. Exclusions were made blind to the results. We were left with 436 participants (261 men, 154 women, 4 other, 17 undisclosed). The average age was 34.54 ($SD = 11.55$). Educational demographics were as follows: 8.35% High School/GED, 26.01% Some College, 10.26% 2-year College Degree, 37.23% 4-year College Degree, 15.75% Masters Degree, 1.19% Doctoral Degree, 1.19% Professional Degree (JD, MD).⁸

Measures and Procedure

Participants completed the following measures.

Recognition Memory Task. The task was identical to Study 1. The overclaiming procedure was once again used as the filler task between the learning phase and the recognition phase.

Overclaiming Questionnaire. See Study 1.

Next, two bullshit receptivity scales were presented in counterbalanced order.

Bullshit Receptivity Scale. This scale lists 20 pseudo-profound but nonsensical computer-generated sentences (e.g., “Attention and intention are the mechanics of manifestation”; Pennycook, Cheyne, Barr, Koehler, & Fugelsang, 2015; Pennycook & Rand, 2020). Participants indicate how profound they find each sentence on a 5-point from “not at all profound” to “very profound”. Profoundness is defined for participants as “of deep meaning” and “of great and broadly inclusive significance”. Cronbach’s alpha was .937.

Scientific Bullshit Receptivity Scale. This scale lists 10 scientific-sounding bullshit sentences (e.g., “The sum of the derivative differences encountered in an alternating current during any destructive interference is zero”; Evans et al., 2020). Participants rate each item on how truthful they find it, using a 5-point scale from “not at all truthful” to “very truthful”. Truthfulness is defined for participants as “being in accord with fact or reality”. Chronbach’s alpha was .875.

Epistemic Curiosity Scale. See Study 1. Cronbach’s alpha was .832 for interest curiosity and .818 for deprivation curiosity.

Next, the following two scales were presented in counterbalanced order:

General Intellectual Humility scale. See Study 1. Chronbach’s alpha was .806.

Comprehensive Intellectual Humility Scale. See Study 1. Chronbach’s alpha was .852.

Need for Closure Scale. This 41-item scale (Webster and Kruglanski, 1994) assesses the desire for “closure”, meaning predictability, order, and a lack of ambiguity and uncertainty (e.g., “I don’t like situations that are uncertain”; “I feel uncomfortable when I don’t understand the reason why an event occurred in my life”). Cronbach’s alpha was .888.

Results

Intellectual Humility

To replicate our previous findings with regard to intellectual humility, we again conducted two regression analyses on the two intellectual humility scales, with interest and deprivation curiosity as predictors. For the General Intellectual Humility scale, only interest curiosity emerged as a significant predictor ($b = .373$, $t = 7.49$, $p < .001$, 95%CI (.275, .471)), and deprivation curiosity did not ($b = .005$, $t = .11$, $p = .913$, 95%CI (-.082, .092), ($F(2, 418) = 36.81$, $p < .001$). For the Comprehensive Intellectual Humility scale, interest curiosity positively predicted humility ($b = .241$, $t = 6.01$, $p < .001$, 95%CI (.162, .320)), and deprivation curiosity negatively ($b = -.072$, $t = -2.04$, $p = .042$, 95%CI (-.142, -.003)), $F(2, 419) = 18.48$, $p < .001$.

Responsiveness to Novelty

For responsiveness to novelty in the recognition memory task, we once again computed the sensitivity and bias indices, as well as hits and false alarms. Our main

measure of interest was sensitivity, or the ability to accurately distinguish between old and new items. A regression analysis on sensitivity with interest and deprivation curiosity as predictors revealed once again that interest curiosity is associated with increased sensitivity ($b = .371, t = 4.94, p < .001, 95\%CI (.223, .518)$) and deprivation curiosity with decreased sensitivity ($b = -.224, t = -3.40, p = .001, 95\%CI (-.354, -.095), F(2, 350) = 12.92, p < .001$). See Figure 5. (Bias was not predicted by interest curiosity ($b = .003, t = .09, p = .925, 95\%CI (-.066, .072)$), but was slightly increased for deprivation curiosity, $b = .083, t = 2.69, p = .008, 95\%CI (.022, .143), F(2, 350) = 4.83, p = .027$.)

Follow-up analyses regressing interest and deprivation curiosity on hits and false alarms revealed once again that interest curiosity was associated with significantly more hits ($b = .043, t = 3.74, p < .001, 95\%CI (.020, .066)$) and fewer false alarms ($b = -.038, t = -3.02, p = .003, 95\%CI (-.063, -.013)$). In contrast, deprivation curiosity once again did not predict hits ($b = -.007, t = -.71, p = .479, 95\%CI (-.027, .013)$), but did once again predict more false alarms ($b = .050, t = 4.44, p < .001, 95\%CI (.028, .072)$).

Real and False Claims of Knowledge

For the overclaiming task, we repeated our analyses from Studies 1 and 2. A regression on sensitivity showed that interest curiosity did not predict sensitivity ($b = .008, t = .16, p = .876, 95\%CI (-.089, .104)$), while deprivation curiosity again predicted reduced sensitivity ($b = -.113, t = -2.58, p = .010, 95\%CI (-.198, -.027), (F(2, 391) = 4.03, p = .019)$). See Figure 6 (Bias was predicted by interest curiosity ($b = .185, t = 3.67, p < .001, 95\%CI (.086, .284)$) but not deprivation curiosity ($b = -.013, t = -.29, p = .774, 95\%CI (-.101, .075), F(2, 394) = 8.00, p < .001$.)

Follow-up analyses on hits and false alarms once again showed that interest curiosity was associated with an increased hit rate ($b = .070, t = 4.17, p < .001, 95\%CI (.037, .102)$) but this time also slightly more false alarms ($b = .049, t = 2.46, p = .014, 95\%CI (.010, .089)$). In contrast, deprivation curiosity predicted marginally significantly fewer hits ($b = -.026, t = -1.78, p = .076, 95\%CI (-.055, .003)$), but no more false alarms ($b = .017, t = .94, p = .349, 95\%CI (-.018, .051)$).

Bullshit Receptivity

The new prediction we wanted to test was that deprivation but not interest curiosity would be associated with greater receptivity to bullshit. To test this prediction,

we performed two regression analyses, one on the Bullshit Receptivity Scale (i.e., spiritual bullshit), and one on the Scientific Bullshit Receptivity Scale. As expected, deprivation curiosity predicted greater receptivity to pseudo-profound bullshit, ($b = .354$, $t = 5.32$, $p < .001$, 95%CI (.223, .485)), whereas interest curiosity did not ($b = .075$, $t = .21$, $p = .835$, 95%CI (-.132, .164), $F(2, 423) = 19.00$, $p < .001$). Deprivation curiosity also predicted greater receptivity to pseudo-scientific bullshit, ($b = .220$, $t = 3.75$, $p < .001$, 95%CI (.105, .446)), while interest curiosity did not ($b = .070$, $t = 1.05$, $p = .293$, 95%CI (-.061, .200), $F(2, 423) = 12.22$, $p < .001$).

Need for Closure

Finally, we tested how interest and deprivation curiosity relate to the need for closure. Previous research had found a negative correlation between interest curiosity and need for closure, but only a trending positive correlation between deprivation curiosity and need for closure (Litman 2010). Given that we had more power to detect even a small effect, we predicted that deprivation curiosity would be significantly associated with increased need for closure. Regressing both types of curiosity on need for closure scores confirmed that interest curiosity was associated with less need for closure ($b = -.237$, $t = -4.62$, $p < .001$, 95%CI (-.331, -.142), and deprivation curiosity with more need for closure, ($b = .196$, $t = 4.62$, $p < .001$, 95%CI (.112, .280), $F(2, 420) = 15.50$, $p < .001$).⁹

Inter-correlations between need for closure and all other dependent measures are listed in Table 2. As can be seen, need for closure is correlated with intellectual humility, but not with the other measures. Thus, the need for closure cannot play a mediating role in explaining why deprivation curiosity is associated with a lack of discernment in the overclaiming and memory tasks or with bullshit receptivity. However, it might mediate the relationship with intellectual humility. We explored this in a mediation model predicting scores on the Comprehensive Intellectual Humility scale. Since interest and deprivation curiosity both independently predict scores on this scale (albeit in opposite directions), we included both as covariates in the model. As can be seen in Figure 7, both indirect effects are significant. Thus, both the negative relationship between deprivation curiosity and humility and the positive relationship between interest curiosity and humility are mediated by need for closure. For interest curiosity, there also is a significant direct effect.

Diagnosing Collinearity

The VIF for interest and deprivation curiosity in this study was 1.29, indicating that collinearity was not a concern for interpreting the current results.

Discussion

The results replicate key findings from Studies 1 and 2. With regard to intellectual humility, we directly replicate the pattern of results from Study 1; Individuals high in deprivation curiosity are not humble, and even appear to be somewhat intellectually arrogant. Interest curiosity, on the other hand, is unambiguously associated with being more humble. (These results were not as strong in Study 2, where we found clear differences between interest and deprivation curiosity, but a small positive relationship between deprivation curiosity and the General Intellectual Humility scale. Since sampling variation may account for such small differences, we replicate the current findings again in Study 4 to see how robust these associations are.)

A novel finding was that the relationships between interest and deprivation curiosity and intellectual humility are mediated by the need for closure—and in case of deprivation curiosity, fully mediated. This suggests that highly deprivation curious individuals cling to their beliefs because they don't like to be confronted with uncertainty and ambiguity. For interest curiosity, we found both an indirect and a direct effect. This suggests individuals high in interest curiosity may in part be humble because they tolerate—even embrace—uncertainty and ambiguity. In addition, their humility is to some extent motivated directly by their desire to learn new things.

We directly replicate our findings from Study 1 with regard to novelty discrimination. Interest curiosity was associated with being accurate in identifying what is old and what is new information. Individuals high in interest curiosity not only have better memory for information they have learned, they are also less likely to falsely identify new information as familiar. The opposite is the case for deprivation curiosity. Individuals higher in deprivation curiosity are less sensitive to novelty and more prone to illusions of familiarity. We also largely replicate our findings on the overclaiming task. Although we do not observe a benefit of interest curiosity with regard to sensitivity this time, we again find that deprivation curiosity is associated with being *less* sensitive to the

differences between real and made-up concepts. Importantly, these effects are not mediated by the need for closure.

To explain why more deprivation curious individuals make more errors distinguishing between old and new information and real and made-up concepts, we had previously evoked the idea of a promiscuous, nonselective desire for information. That is, we proposed that more deprivation curious individuals have a more inclusive information processing style, and err on the side of accepting information—even wrong or meaningless information—rather than risking to dismiss potentially useful information. We tested this idea here in the context of bullshit. As expected, deprivation curiosity predicted receptivity to both spiritual- and scientific sounding bullshit. This is consistent with our idea of the overly inclusive information processing style.

Defaulting on accepting information may not be a bad thing, most of the time. We are probably surrounded by more good (i.e., true and useful) than bad information, and mostly operate under the default assumption that information is true (Levine, 2014). Thus, if deprivation curiosity is associated with an excessive openness towards all kinds of information, this may not usually be to their disadvantage. However, it would be a hindrance when confronted with deliberate disinformation. In the next study, we therefore extend our investigation to this domain and test the connection between interest and deprivation curiosity and engagement with fake news.

We also wanted to extend our understanding of the connection between curiosity and responsiveness to novelty. Since this seems to be a domain where striking differences between interest and deprivation curiosity become apparent, we wanted to further explore how interest and deprivation curiosity relate to people's responsiveness to *conceptual* rather than actual novelty.

Study 4

Study 4 tested a number of new predictions, in addition to replicating our previous findings with regard to intellectual humility, overclaiming and bullshit receptivity. A novel prediction based on Studies 1-3 was that deprivation but not interest curiosity would be associated with an excessive openness towards false news. We tested this prediction using a news discernment task (see Pennycook & Rand, 2019b), in which participants are asked to evaluate the truthfulness of real and false news headlines. We

also asked how likely participants would be to share the news articles if they came across them on social media. Willingness to share serves as an additional measure for the tendency to accept or engage with false information. While it is likely strongly correlated with belief, recent research suggests that willingness to share reflects more than just belief (Pennycook, Epstein, Mosleh, Arechar, Eckles, & Rand, 2021). It is also an outcome with more direct relevance for real-world behavior.

We wanted to replicate our findings from Study 3 with regard to bullshit receptivity. We also wanted to add an element of discernment to that measure. To do so, we added truly meaningful sentences to the list of bullshit sentences. This allowed us to test whether individuals high in deprivation curiosity are in fact less discerning about the relative difference between meaningful information and bullshit, or whether they merely rate *all* information as more meaningful.

Since both bullshit receptivity and belief in fake news have been linked to a lack of analytic thinking, we also wanted to test if that might play a role in explaining our findings. It seemed plausible that deprivation curious individuals, in their hunger for information, might compromise their analytic thinking skills in assessing the veracity of information. To measure analytic thinking, we included a version of the Cognitive Reflection Test (Frederick, 2005). This test consists of a number of puzzle-type questions. Each has an intuitive answer, which is incorrect. Coming up with the correct answer requires more careful deliberation. If more deprivation curious individuals are less discerning because they engage in less analytic thinking, then deprivation curiosity should predict performance on this test, and this should mediate the effects on bullshit receptivity, belief in fake news, and the lack of sensitivity in the overclaiming task.

We included another new measure to follow up on our findings regarding responsiveness to novelty. Studies 1 and 3 showed that interest curiosity is associated with greater sensitivity to novelty. We wanted to extend this to the realm of conceptual novelty. With conceptual novelty, we refer to the situation where one gains a new perspective on a familiar stimulus as a result of receiving new contextual information. To measure responsiveness to conceptual novelty, we adapted an affective habituation task, in which participants are shown the same image repeatedly for several seconds each time. After each exposure, they are asked how pleasurable they find it. Pleasure usually

declines with repeated exposure (e.g., Bornstein, 1989; Leventhal, Martin, Seals, Tapia, & Rehm, 2007).¹⁰ We then presented participants with contextual information about the image. We used a photograph by an artist depicting an art installation. To elicit a sense of conceptual novelty, participants were provided with information about the image and the artwork. In a final phase, participants were re-exposed to the same image and once again rated how pleasurable they found it. We predicted that interest, but not deprivation curiosity would be associated with a steeper decline in pleasure (i.e., habituation) over the habituation period, and a greater increase in pleasure after reading the new contextual information.

Finally, one more addition to the current study was a measure of the personality trait openness to experience. Openness to experience has theoretical overlap with epistemic curiosity (e.g., McCrae & Costa, 1997; Silvia & Crompton, 2020), so much so that it is sometimes treated as a proxy for curiosity (Furnham et al., 2007), and vice versa (e.g., Jach, Smillie, & Fajkowska, 2020). Like epistemic curiosity, openness to experience can be further divided into two facets, one labeled *Openness*, which describes an aesthetic component (e.g., an appreciation for art and nature), and one labeled *Intellect*, which describes a curiosity for intellectual pursuits (e.g., DeYoung, Quilty, & Peterson, 2007; Nusbaum & Silvia, 2011). Researchers have suggested that openness to experience (particularly the intellect aspect) and epistemic curiosity may be somewhat redundant constructs (e.g., DeYoung, 2015; Mussel, 2010). Therefore, we wanted to test if openness to experience produces similar results as we have found for interest or deprivation curiosity, or if there is something unique to curiosity. The preregistration for this study can be found here <https://osf.io/xt28e> and additional materials and pilot data here <https://osf.io/mjubg/>.

Methods

Participants

We collected data from 623 respondents. 107 were excluded for failing checks similar to those in Studies 1-3. Checks can be found in the preregistration. As always, data exclusions were made blind to the results. We were left with 516 participants (215 men, 290 women, 6 other, 5 undisclosed). The average age was 32.81 (SD = 11.11). Educational demographics were as follows: 10.94% High School/GED, 28.12% Some

College, 11.91% 2-year College Degree, 33.79% 4-year College Degree, 12.30% Masters Degree, 1.17% Doctoral Degree, 1.76% Professional Degree (JD, MD).

Measures and Procedure

First, the News Discernment task and the Bullshit Receptivity Scale were presented, in random order.

Media Truth Discernment Task. This task was adapted from Pennycook and Rand (2020; also see Pennycook, Binnendyk, Newton, & Rand, 2020). Participants were shown true and false news headlines presented in the style of a social media post, accompanied by an image. Headlines were gathered from various websites, and were fact-checked by reputable fact checking organizations such as snopes.com. To select headlines, we first conducted a pilot study, in which we had 346 participants evaluate 54 headlines for truthfulness, partisan favoritism, familiarity, and emotional reactions provoked by the headlines (anxiety, anger, humor). Based on the pilot, we selected 16 headlines for the study. 8 were true (e.g., “ICE Expelled 33 Immigrant Children Back To Guatemala After A Judge Said They Couldn’t”) and 8 false (e.g., “CA Start-Up Will Bury Covid Victims In Discarded Trump Flags”). We selected headlines that were rated as relatively unfamiliar by most participants and that could be reasonably accurately identified as true or false, at least *collectively* by the sample of our pilot study. (Average truth ratings for the headlines we selected were 4.07, (SD = .75) for true headlines and 2.22 (SD = .76) for false headlines. Ratings were made on a 1-6 scale. The difference was significant, $t(346) = 37.57$, $p < .001$. Other results from the pilot can be found here: <https://osf.io/mjubg/>.)

We presented the 16 headlines in random order. For each headline, participants answered the following questions: “What is the likelihood that the above headline is true?”, “If you were to see this article on social media, how likely would you be to share it?” Participants responded on a 6-point scale from “extremely unlikely” to “extremely likely”. Finally, they also indicated if they had seen the headline before (Yes/No/Not sure).

Bullshit Receptivity Scale. The scale was the same as in Study 3, with one modification. In addition to the 20 bullshit items, we also included 10 truly profound control items, taken from Pennycook et al. (2015; e.g., “A river cuts through a rock, not

because of its power but its persistence”). All items were presented in random order. Cronbach’s alpha for bullshit items was .943, and .830 for profound items.

Overclaiming Questionnaire. See Study 1.

Affective Habituation Task. This task served to measure responsiveness to conceptual novelty. The task was adapted from Leventhal et al. (2007). In the first phase—the habituation phase—participants were repeatedly shown the same image. The image was a color photograph by the artist Gordon Matta-Clark depicting a desolate-looking house with a subtle cut through the middle. The image was shown 14 times, for 5 seconds each, with an intra-trial interval of 5 seconds. After each image presentation, participants rated how pleasurable they found the viewing experience, using a slider scale from 0 to 100 with the anchors “not at all pleasurable” to “very pleasurable”. Participants were informed that the same image could be repeated multiple times. To prevent that they would give the same rating each time in order to appear consistent, participants were told: “We don't want you to evaluate the image itself, but rather, your experience looking at the image. Your experience can depend on how interesting or how pretty you find the image, but it can also depend on your current mood or other things. So, if you see the same image multiple times, you may rate those two experiences the same or differently, depending on how you feel in the moment.”

After 15 exposures, participants came to a page with background information about the artwork. The text was 426 words long and can be found in the materials in our preregistration. Here is an excerpt: “The last picture you just saw is a photograph of an artwork by Gordon Matta-Clark called ‘Splitting’. Gordon Matta-Clark was an artist who lived and worked New York in the 1970s until his death at the age of 35. [...] At the time, New York was in a state of crisis resulting from economic downturns. Abandoned and neglected places were a common sight. Matta-Clark had a particular interest in these places, and the voids they created in communities. For “Splitting”, Matta-Clark found a suburban home in Englewood, New Jersey, that was slated for demolition. In 1974, authorities had ordered the families residing in this house to vacate to make room for an urban renewal project. The family had to leave the building in a hurry, leaving it piled with personal belongings. Matta-Clark enlisted a group of friends to help him slice the building neatly in half. Dangling on a rope fixed to the roof, acetylene torch in hand, he

sawed through the exterior and interior walls of the house, the window frames, the roof, floors, staircases and banisters. Sparks rained from his torch, cascading through the building's empty void."

After reading the text, participants were shown the image one more time. This time the presentation time was self-paced. This allowed us to look at differences in viewing times as an additional measure of interest. Then, participants were asked once more to rate how pleasurable they found the viewing experience.

Cognitive Reflection Test (CRT). This test measures a person's tendency to override an incorrect "gut" response and engage in further reflection (Frederick, 2005). Because the test is frequently used in social science research, a proportion of participants in some samples is familiar with the classic problems. New problems have recently designed to address this problem. We included the three original items, three non-numeric problems developed by Thomson and Oppenheimer (2016), three problems by Primi and colleagues (Primi, Morsanyi, Chiesi, Donati, & Hamilton, 2016), and one by Toplak, West, and Stanovich (2014). The problems can be found in the preregistration. The test was scored by adding up the number of correctly solved problems.

Epistemic Curiosity Scale. See Study 1. Cronbach's alpha was .821 for interest curiosity and .814 for deprivation curiosity.

Next, the following three scales were presented in random order.

General Intellectual Humility Scale. See Study 1. Cronbach's alpha was .776.

Comprehensive Intellectual Humility Scale. See Study 1. Cronbach's alpha was .838.

Openness to Experience. This 20-item subscale from the Big Five Aspects Scale (DeYoung, Quilty, & Peterson, 2007) assesses the personality trait openness to experience with the aspects *Openness* (e.g., "I believe in the importance of art") and *Intellect* (e.g., "I like to solve complex problems"). Cronbach's alpha was .799 for Intellect and .764 for Openness.

Mindful Attention and Awareness Scale. (Brown & Ryan, 2003). This scale was included for purposes of an unrelated investigation.

Political Identity. Following demographic questions (age, gender, education), we also asked several questions to assess participants' political views (taken from Evans et

al., 2020). Conservative political views have previously found to predict receptivity to bullshit (Evans et al., 2020; Nilsson et al., 2019; Sterling et al., 2016), and likelihood of sharing false news (Guess, Nagler, & Tucker, 2019; Grinberg et al., 2019). Therefore, we wanted to test if deprivation curiosity may be associated with more conservative political views as well. Three items assessed trust in democratic and conservative led government (and general trust) on a 7-point scale (“I can trust [a Democratic/Republican-led government] to represent my interests to the best of their ability”). Three items assessed participants’ self-declared political identity as: “democrat”, “republican”, “libertarian”, “independent”, or “other”. (Items read: “I most strongly lean ...”; “On social issues I most strongly lean ...”; “On economic issues I most strongly lean ...”).

Results

Intellectual Humility

To replicate our previous findings with regard to intellectual humility, we once again conducted two regression analyses, regressing interest and deprivation curiosity on the two intellectual humility scales. For the General Intellectual Humility scale, interest curiosity was a significant predictor ($b = .360$, $t = 8.26$, $p < .001$, 95%CI (.275, .446)), deprivation curiosity was not ($b = .004$, $t = .10$, $p = .921$, 95%CI (-.075, .083), ($F(2, 514) = 46.75$, $p < .001$). For the Comprehensive Intellectual Humility scale, interest curiosity positively predicted humility ($b = .234$, $t = 7.06$, $p < .001$, 95%CI (.169, .299)), and deprivation curiosity negatively ($b = -.132$, $t = -4.31$, $p < .001$, 95%CI (-.192, -.072)), ($F(2, 515) = 25.29$, $p < .001$).

Real and False Claims of Knowledge

To replicate our findings with regard to overclaiming, we once again conducted a regression analysis on sensitivity. Interest curiosity was not predictive of sensitivity ($b = .040$, $t = .85$, $p = .394$, 95%CI (-.052, .132)), but deprivation curiosity once again predicted reduced sensitivity ($b = -.109$, $t = -2.56$, $p = .011$, 95%CI (-.194, -.025), ($F(2, 486) = 3.41$, $p = .034$). See Figure 8. (For bias, there was a marginal effect interest curiosity ($b = .079$, $t = 1.72$, $p = .087$, 95%CI (-.011, .170)) and a significant effect of deprivation curiosity ($b = .092$, $t = 2.19$, $p = .029$, 95%CI (.009, .175), ($F(2, 486) = 7.89$, $p < .001$)).

Further analyses on hits and false alarms revealed that interest curiosity was

associated with an increased hit rate ($b = .041, t = 2.72, p = .007, 95\%CI (.011, .071)$) but no more false alarms ($b = .023, t = 1.22, p = .224, 95\%CI (-.014, .061)$). In contrast, deprivation curiosity was associated with more false alarms ($b = .044, t = 2.47, p = .014, 95\%CI (.009, .079)$) but not hits ($b = .006, t = .41, p = .680, 95\%CI (-.022, .033)$).

Bullshit Receptivity

For bullshit receptivity, we first repeated our analysis from Study 3 by regressing interest and deprivation curiosity on participants' evaluations of the bullshit sentences. We replicated our previous finding that deprivation curiosity was associated with greater receptivity to spiritual bullshit, ($b = .215, t = 3.29, p = .001, 95\%CI (.087, .343)$), whereas interest curiosity did not ($b = .077, t = 1.09, p = .275, 95\%CI (-.062, .216), F(2, 516) = 10.61, p < .001$).

Next, we wanted to know if individuals high in deprivation curiosity have a special affinity for spiritual non-sense, or if they might see deeper meaning in *all* information. To this end, we first repeated the previous analysis, this time with profundity ratings for truly profound sentences as the dependent variable. Here, deprivation curiosity again emerged as a significant predictor ($b = .172, t = 2.19, p = .004, 95\%CI (.056, .289)$), whereas interest curiosity did not ($b = .097, t = 1.51, p = .131, 95\%CI (-.029, .224), F(2, 516) = 10.29, p < .001$).

It is possible to ascribe greater meaning to all information, while still being discerning about the *relative difference* between truly profound information and meaningless bullshit. To test if more deprivation curious individuals are in fact less discerning, we performed a final regression on bullshit sentences, this time including evaluations of profound sentences as a covariate (following Pennycook & Rand, 2019b). Evaluations of profound sentences predicted evaluations of bullshit sentences ($b = .585, t = 14.23, p < .001, 95\%CI (.504, .666)$). However, even when controlling for evaluations of profound sentences, deprivation curiosity still significantly predicted higher profundity ratings for bullshit sentences ($b = .114, t = 2.04, p = .042, 95\%CI (.004, .223)$). The effect for interest curiosity remained non-significant ($b = .020, t = .34, p = .735, 95\%CI (-.098, .138), F(2, 516) = 77.36, p < .001$).

Belief in Fake News

Next, we tested our new hypothesis that deprivation curiosity would be associated

with a greater belief in false news. We proceeded in the same way as with bullshit receptivity. We first conducted a regression analyses on truth ratings for objectively false news headlines with interest and deprivation curiosity as predictors. As hypothesized, deprivation curiosity was predictive of a greater belief in false news headlines ($b = .179$, $t = 2.88$, $p = .004$, 95%CI (.057, .300)), while interest curiosity was not ($b = .179$, $t = -.17$, $p = .868$, 95%CI (-.143, .121)), $F(2, 516) = 5.31$, $p = .005$.

To test if this effect is specific to *false* news, we repeated the analysis but this time on truth ratings for objectively true headlines. Here, neither deprivation curiosity ($b = .044$, $t = .73$, $p = .467$, 95%CI (-.075, .162) nor interest curiosity ($b = .027$, $t = .42$, $p = .675$, 95%CI (-.101, .156)) were significant predictors, and the overall model was not significant, $F(2, 516) = .69$, $p = .504$. This indicates deprivation curiosity is associated with a lack of discernment, rather than a tendency to believe all information.

There was a small to moderate correlation between believing false news and believing true news, though, $r = .278$ $p < .001$. To control for that, we conducted one more analysis regressing interest and deprivation curiosity on belief in *false* news headlines, this time including belief in *true* headlines as a covariate. Deprivation curiosity still predicted belief in false news ($b = .166$, $t = 2.79$, $p = .006$, 95%CI (.049, .284)), and interest curiosity still did not ($b = -.019$, $t = -.29$, $p = .770$, 95%CI (-.146, .108)), $F(2, 516) = 17.76$, $p < .001$.

Willingness to Share Fake News

We repeated the same set of analyses with participants' willingness to share the news headlines. Deprivation curiosity was associated with a greater willingness to share false news headlines ($b = .288$, $t = 3.76$, $p < .001$, 95%CI (.138, .439)), while interest curiosity was not ($b = -.020$, $t = -.24$, $p = .809$, 95%CI (-.184, .144)), $F(2, 516) = 8.96$, $p < .001$.

Deprivation curiosity was also associated with a greater willingness to share *true* headlines ($b = .268$, $t = 3.11$, $p = .002$, 95%CI (.099, .438)), while interest curiosity was not ($b = .125$, $t = 1.33$, $p = .184$, 95%CI (-.059, .309)), $F(2, 516) = 10.56$, $p < .001$. To account for this, we also regressed interest and deprivation curiosity on willingness to share *false* news, while including willingness to share the *true* news as a covariate. Willingness to share true news predicted willingness to share false news ($b = .604$, $t =$

21.00, $p < .001$, 95%CI (.547, .660)). Deprivation curiosity still independently predicted willingness to share false news ($b = .126$, $t = 2.22$, $p = .027$, 95%CI (.015, .238)), while interest curiosity did not ($b = -.096$, $t = -1.56$, $p = .119$, 95%CI (-.216, .025)), $F(2, 516) = 158.15$, $p < .001$.

Because willingness to share false news appeared to be strongly correlated with believing false news ($r = .608$, $p < .001$, see Table 3), we wanted to test if deprivation curiosity still predicts willingness to share false news when controlling for belief. To test this, we performed another analysis regressing interest and deprivation curiosity on willingness to share false news while including belief in false news as a covariate. The results show that deprivation curiosity still predicted willingness to share false news ($b = .156$, $t = 2.52$, $p = .012$, 95%CI (.034, .278)). Not surprisingly, given the strong correlation, belief also predicted willingness to share ($b = .740$, $t = 16.89$, $p < .001$, 95%CI (.654, .826)). And as before, interest curiosity did not predict willingness to share ($b = -.012$, $t = -.18$, $p = .860$, 95%CI (-.143, .119), $F(2, 516) = 158.15$, $p < .001$).

Cognitive Reflection Test

A regression analysis on Cognitive Reflection Test scores with interest and deprivation curiosity as predictors yielded only a marginally significant effect of interest curiosity ($b = .415$, $t = 1.80$, $p = .072$, 95%CI (-.037, .866)) and no effect of deprivation curiosity ($b = .005$, $t = 2.02$, $p = .980$, 95%CI (-.410, .421)). The overall model was not significant, $F(2, 516) = 2.23$, $p = .109$.

As can be seen in Table 3, we replicate previous findings by showing that Cognitive Reflection scores correlate negatively with bullshit receptivity, belief in false news, and willingness to share false news. But since we did not find a relationship between Cognitive Reflection scores and deprivation curiosity, our results show that analytic thinking cannot mediate our other results regarding information discernment.

Political identity

To test if deprivation or interest curiosity predict participants' self-declared political identity, we performed a multinomial logistic regression with interest and deprivation curiosity as predictors on participants' response to lean democrat, republican, libertarian, independent or other, with democrat serving as the base category. The model was not significant, $\text{Chi}^2 = 4.47$, $p = .812$, indicating no relationship between either type

of curiosity and political identity. (There was only a small trend for interest curiosity predicting more frequent “independent” responses ($b = .408$, $z = 1.79$, $p = .073$), otherwise all p 's $> .48$).

We also performed two linear regressions, one on the degree to which participants indicated trusting democrat-led governments, and one on trusting and republican-led governments, both with interest and deprivation curiosity as predictors. Neither model was significant (trusting democrat-led government, $F = 1.90$, $p = .151$; trusting republican-led government, $F = .08$, $p = .926$), further indicating no relationship between curiosity and political views.¹¹

Responsiveness to Conceptual Novelty

Next, we tested our novel hypotheses with regard to the relationship between interest curiosity and responsiveness to conceptual novelty. Our first hypothesis was that interest, but not deprivation curiosity, would be associated with a greater decline in pleasure when repeatedly being exposed to the same image. As can be seen in Figure 9, pleasure went down over the 15 times the image was shown. To examine individual differences in *how much* of a decline in pleasure participants experienced, we calculated a habituation slope for each participant by regressing their pleasure ratings on time (time being operationalized as the 15 exposures). (As predicted in our preregistration, the average slope was negative (Mean slope = $-.875$, $SD = 1.846$) and significantly different from zero, $t(515) = -10.777$, $p < .001$.) We then conducted a regression analysis predicting participants' habituation slopes from interest and deprivation curiosity. The results showed that neither interest ($b = .244$, $t = 1.57$, $p = .117$, 95%CI $(-.061, .549)$) nor deprivation curiosity ($b = -.040$, $t = -.28$, $p = .780$, 95%CI $(-.321, .241)$) predicted individual differences in habituation, $F(2, 516) = 1.41$, $p = .244$.

Next, we tested our hypothesis that interest, but not deprivation curiosity, would be associated with an increased gain in pleasure after learning new contextual information. As can be seen in Figure 9, participants generally experienced a stark increase in how much pleasure they gained from seeing the familiar image again (for the 16th time) after they had learned new contextual information about it. (This average increase of 24.09 scale points ($SD = 30.67$) was significant, $t(515) = 17.848$, $p < .001$.) To test if the jump in pleasure was predicted by interest and deprivation curiosity, we

conducted a regression analysis on difference scores between pleasure ratings from the 15th to the 16th exposure. The results showed that interest curiosity was associated with a greater jump in pleasure ($b = 8.894$, $t = 3.51$, $p < .001$, 95%CI (3.910, 13.878)), whereas deprivation curiosity was not ($b = -1.880$, $t = -.80$, $p = .421$, 95%CI (-6.468, 2.708)), $F(2, 516) = 6.80$, $p = .001$.

Finally, we examined how long participants viewed the image during the final image presentation (i.e., after having read the contextual information), since viewing time might function as a behavioral indicator of how much participants enjoyed looking at the image. A regression on viewing time revealed a marginally significant effect of interest ($b = 1.050$, $t = 1.68$, $p = .094$, 95%CI (-.179, 2.279)) but no effect of deprivation curiosity ($b = .051$, $t = .09$, $p = .930$, 95%CI (-1.081, 1.182), $F(2, 516) = 2.01$, $p = .135$. (This last analysis was exploratory.)

Diagnosing Collinearity

The VIF for interest and deprivation curiosity in the above-described models with only those two factors was 1.35. This indicates that high collinearity was once again not a major concern for interpreting the distinct effects of interest and deprivation curiosity.

Openness to Experience

Since openness to experience has theoretical overlap with epistemic curiosity, we wanted to test to what extent the current findings are specific to curiosity per-se, and whether openness to experience might produce similar results as we have found for interest and deprivation curiosity. As can be seen in Table 4, both the Openness and the Intellect facet of openness to experience are more strongly correlated with interest curiosity than with deprivation curiosity. To test for redundancies between Openness/Intellect and curiosity, we first repeated our key analyses with Intellect and Openness as independent variables, to see if they would produce similar effects. We tested this for our key dependent measures: Intellectual humility, sensitivity on the overclaiming task, bullshit receptivity, belief in false news, and responsiveness to novelty. The results are shown in Table 5. Next, we also repeated these analyses with both Openness and Intellect as well as interest and deprivation curiosity as joint predictors. The results are shown in Table 6. As can be seen, including the openness subscales does not substantially change our findings for interest and deprivation curiosity

with regard to any of the dependent measures.

Discussion

The current results once again replicate the key findings from Studies 1-3 with regard to intellectual humility and overclaiming, and thus strengthen our evidence for the remarkable differences between interest and deprivation curiosity in areas relevant to acquiring knowledge. We also replicate our finding from Study 3 that deprivation, but not interest curiosity, is associated with receptivity to pseudo-profound bullshit. Deprivation curiosity was also associated with finding greater meaning in profound information. However, even when taking this into account, an increased receptivity to bullshit remains. This fits with the notion that deprivation curiosity is associated with promiscuous desire for information and a lack of discernment.

Our new findings with regard to fake news fit with that as well. Deprivation, but not interest curiosity, was associated with a greater tendency to believe false news headlines, and this was true even when taking into account belief in true headlines. This is particularly interesting because it suggests that individuals high in deprivation curiosity not only default to accepting false information when doing so is inconsequential or potentially beneficial for them. They are also prone to accepting disinformation when they are specifically warned that they may be deceived.

Deprivation curiosity was also associated with a greater willingness to share false news. This remained the case when taking into account participants' willingness to share true news. Thus, it is further evidence that deprivation curiosity is associated with a lack of discernment, rather than a greater general desire to share information.

Interestingly, deprivation curiosity also still predicted participants' willingness to share false news when controlling for belief. This means their willingness to share false content reflects more than just how much they believe it to be true. Apparently, highly deprivation curious individuals are both more open to entertaining false news for themselves, and more eager to share it with others. These results are consistent with recent research, which has shown that people's willingness to share false news is not necessarily a function of believing it to be true (Pennycook et al., 2021). Willingness to share becomes more strongly aligned with belief when the question of accuracy is made salient, for instance (as in our study) by asking people to evaluate the truthfulness of

news before asking them about their willingness to share it (Pennycook et al., 2021). Nonetheless, other factors also affect people's willingness to share disinformation. The current results suggest that deprivation curiosity is one such factor. The current results also illustrate a real cost to deprivation curiosity, not only for the individual, but also for their social environment, since highly deprivation curious individuals may inadvertently expose their friends and family to disinformation.

Susceptibility to bullshit and fake news has previously been linked with lack of analytic thinking (Bago et al., 2020; Bronstein et al., 2019; Pennycook & Rand, 2019a, 2019b). While we replicate this finding from the literature, we also find that the relationship between deprivation curiosity and susceptibility to bullshit and fake news is not accounted for by individual differences in analytic thinking. Thus, lack of analytic thinking and deprivation curiosity represent independent paths to believing fake news. (This jives with real life observations that even smart and inquisitive people can occasionally fall for fake news, conspiracy theories and the like. Perhaps precisely because they are a little too curious for their own good, and engage with fringe ideas and unorthodox sources of information others would quickly dismiss without thinking twice about it.)

Deprivation curiosity is also not associated with a particular partisan identity or greater trust in a democratic- or republican-led government. While political views have been linked to receptivity to bullshit and engagement with false news (findings we replicate in our data, see Footnote 11), this does not seem to play any role in explaining our findings regarding deprivation curiosity. While deprivation curiosity explains only a small part of the variance in people's susceptibility to disinformation, and other factors likely play a bigger role (e.g., Van Bavel, Harris, Pärnamets, Rathje, Doell, & Tucker, 2021), it is remarkable that curiosity, which is usually portrayed as a virtue, can have this negative aspect to it.

The current study also tested a new hypothesis focused more on the specific characteristics of interest curiosity. We had previously found that interest curiosity is associated with responsiveness to novel information, which makes sense given that interest curiosity is defined as the desire to learn new things. Here, we tested if interest is also uniquely associated with sensitivity to conceptual novelty, which we measured with

a newly developed art-viewing task. Contrary to our expectation, we did not find that individuals high in interest curiosity get more easily bored when repeatedly exposed to the same image. Perhaps they preempt boredom by exploring different parts or aspects of the image each time the image is shown anew. We did confirm, however, that participants high in interest curiosity gain more pleasure from seeing the image again after learning new things about it. This is noteworthy. People often avoid revisiting the same aesthetic experience. For instance, people show little interest in going to the same art exhibition twice. Yet, when they do, they often get more pleasure from it than they expected, precisely because they discover new aspects of it and experience what we call conceptual novelty (O'Brien, 2019). Our data suggest that individuals high in interest curiosity should be especially likely to enjoy such experiences.

The current study also addresses an implicit question that may have lingered in some readers' minds. Are these different effects of interest and deprivation curiosity really specific to curiosity, or are they explained by overarching personality differences? Given the theoretical overlap between curiosity and the trait openness to experiences, we wanted to examine whether the two produce similar effects. While openness to experience (and especially the Openness subscale) was indeed related to most of our key dependent measures (particularly intellectual humility and responsiveness to conceptual novelty), neither Openness nor Intellect mirror the detrimental effects of deprivation curiosity. Moreover, including the openness subscales in our analyses did not make interest curiosity obsolete as a predictor either. Thus, it is clear that interest and deprivation curiosity and Openness and Intellect are not redundant concepts.

General discussion

Epistemic curiosity is generally thought to be an important motivator for learning (Berliner, 2020; Berlyne, 1966, 1978; Gross et al., 2020; Gruber et al., 2014; Hardy et al., 2017; Kang et al., 2009; Kashdan & Fincham, 2002; Kaufman, 2017; Litman, 2005). Here, we reveal a surprising dark side to one of the two facets—deprivation curiosity. Previous studies have shown that interest and deprivation curiosity feel differently and are driven by different motivations. Here we show that the two types of curiosity are also associated with different ways of engaging with information that are directly relevant to

acquiring accurate new knowledge. (Table 7 summarizes the key findings across the four studies.)

Despite their conceptual differences, both types of curiosity are defined by the desire for knowledge. So it would seem reasonable to assume that both should drive learning and knowledge gain. To our surprise, we found evidence that only interest curiosity is associated with having a rich general knowledge. On the trivia task, for instance, greater interest curiosity was associated more correct answers—a sign of more general knowledge—whereas greater deprivation curiosity predicted *less* knowledge. The overclaiming task, also, can in some ways be thought of as a general knowledge test. We found that interest curiosity was consistently associated with more hits, mostly in the absence of an inflated false alarm rate. This, again, indicates greater general knowledge. In contrast, deprivation curiosity mostly did *not* predict hits, and in one study was even associated with fewer hits.

In addition to a decreased knowledge base, deprivation curiosity was also associated with errors in discerning the novelty and quality of information. In the recognition memory task, deprivation curiosity was associated with false or illusory claims of familiarity with information that was in fact new. In the overclaiming task, deprivation curiosity was associated with decreased sensitivity, or an inability to distinguish real from made-up information, as well as false claims of familiarity with made-up concepts.

Further evidence for a specific deficit in discernment for deprivation curiosity comes from the bullshit receptivity and fake news tasks. Here, deprivation curiosity was associated with a tendency to rate meaningless sentences as profound, and a willingness to entertain and share blatantly false news.

We tested the possibility that these deficits are explained by a general lack of analytical thinking. Past research suggests that receptivity to fake news and bullshit is associated with decreased analytical thinking (e.g., Pennycook & Rand, 2018, 2019a, 2019b). Despite replicating this relationship, we found no evidence of a relationship between analytical thinking and deprivation curiosity.

Being overly inclusive in the information one is willing to entertain might seem like a good default strategy when encountering new information. It might open up

learning opportunities and chances for unexpected discoveries; even if it has no immediate utility, new information may prove useful in the future. So rather than displaying a *deficit* in the ability to discern the quality of information, perhaps highly deprivation curious individuals are simply using a more open heuristic approach to novel information, thereby lowering the threshold for what information they endorse or entertain? Although this is possible, Study 4 strongly suggests that this is not the case. Here, individuals were explicitly warned about the likelihood of misinformation, yet the same lack of discernment was observed.

Ironically, highly deprivation curious individuals are not only burdened with a decreased knowledge base and errors in discernment, our results suggest they are also less likely to realize when they are wrong, since they lack intellectual humility. Indeed, we discovered a surprising opposing relationship between the two subtypes of epistemic curiosity and intellectual humility; interest curiosity was positively associated with intellectual humility, whereas deprivation curiosity was associated with a *lack* of humility. Although the evidence for this opposing relationship was less strong in Study 2 (likely due to normal sampling variation), the general pattern was robust, being observed across all four studies. These differences were more pronounced for the Comprehensive Intellectual Humility scale, which has a stronger emphasis on the interpersonal aspects of intellectual humility, such as feeling personally attacked when others contradict one's beliefs. Study 3 showed that the relationship between deprivation based curiosity and intellectual humility was mediated by need for closure. As mentioned, need for closure is a general (nonspecific) desire to close information gaps, thus making it similar to deprivation curiosity (note, however, that past research has observed relatively weak correlations between the two constructs, see Litman, 2010). However we did not find that need for closure mediated any of the discernment findings.

How can we reconcile what appears to be a paradoxical phenomenon in relation to deprivation curiosity; a promiscuous desire for information, even bullshit and fake news, but also a lack of humility, or openness to revising their beliefs in light of new evidence? Deprivation curiosity seems to be characterized by a pattern of cognitive “seizing and freezing” (Kruglanski, & Webster, 1996), a terminology originally introduced in the context of the need for closure, but offered here as a broader

metaphor to describe alternative ways of engaging with information. When new information is available, people may either embrace it (“seize”), or resist updating their current knowledge (“freeze”), depending on their base of prior information (Kruglanski, Webster, & Klem, 1993). When we are exposed to unfamiliar topics (i.e., about which we have no prior knowledge or beliefs), being open to the information helps reduce the void in our current state of understanding (Kruglanski, & Webster, 1996). However, when we have prior beliefs or knowledge on particular topics, we may be motivated to resist challenges to our knowledge so as to avoid aversive states of uncertainty. The promiscuous desire for information in individuals with high deprivation curiosity seems to express itself both in pronounced seizing as well as freezing. Highly deprivation curious individuals are overly receptive to new information—even bullshit and fake news. At the same time, they are resistant to questioning or updating their existing beliefs and opinions (i.e., low intellectual humility). Thus, even though need for closure was not found to mediate the relationship between deprivation curiosity and a lack of discernment, its related constructs of “seizing” and “freezing” may help to characterize how deprivation curiosity is associated both with an openness to new information and a reluctance to challenge existing knowledge.

Real World Implications, Limitations and Future Directions

The finding that individuals high in deprivation curiosity are more likely to believe—and share—fake news perhaps best illustrates the “dark side” of curiosity. Of course, the correlational nature of these findings is an important limitation. We don’t know if deprivation curiosity plays a *causal* role in making people vulnerable to disinformation, and we don’t know to what extent a momentary *state* of deprivation curiosity would lead to the same negative consequences as we have found for the personality trait. If curiosity indeed contributes to the spread of disinformation, this would be quite detrimental. The viral spread of fake news is a growing problem and a threat to democracies (e.g., Chen, 2020; Schwartz, 2021). Thus far, the potential role curiosity may play in exacerbating the problem has not been considered, but this is an important avenue for future research.

Aside from fake news, we are exposed to many sources of distraction that are specifically designed to capture our attention by creating a sense of information

deprivation. This is readily apparent in the “clickbait” phenomenon. Clickbait headlines (e.g., “You won’t believe who...” or “You won’t believe what happened next”; Scott, 2021) allude to something interesting, but withhold critical information. Such content may be uniquely able to “hijack” our deprivation curiosity and create a state Litman (2010) termed “irrational wanting”—irrational because we often aren’t really interested in the information. It is still an open question whether this type of hijacking or manipulation has any immediate impact on how information is subsequently processed. Our results suggest two things: that individuals high in deprivation curiosity may be more susceptible to sensationalized news, clickbait and the like, and also more likely to contribute to the spread of it.

Understanding how and when deprivation curiosity can mislead us may allow us to be more intentional, critical consumers of information. If we are not intentional about choosing what drives our curiosity, then it may come at a cost. This may manifest in benign ways, such as wasted time clicking through tabloid or “junk news”. The literature points to other examples of individuals chasing information that is at best pointless and at worst costly. For instance, some people display a morbid curiosity for gory images or other types of aversive information (e.g., Niehoff, & Oosterwijk, 2020). People are often curious to learn things they might be better off not knowing (e.g., Kruger & Evans, 2009; Niehoff, & Oosterwijk, 2020). One study has even shown that people are willing to give themselves electric shocks out of sheer curiosity (Hsee & Ruan, 2016). Satisfying one’s curiosity about aversive outcomes may *feel* satisfying, but it seems unproductive. When it comes to entertaining fake news, the costs are even more directly apparent. And when people share fake news with others, the costs extend beyond the individual. All in all, these examples illustrate how curiosity, and specifically deprivation curiosity, can lead us down the wrong rabbit holes.

Understanding the costs of curiosity is especially relevant for educational contexts. Theoretical work (e.g., the situational interest hypothesis) currently assumes positive impacts from inducing deprivation type curiosity, suggesting that it can lead to “increased concentration, focused attention and a willingness to learn” (p. 3, Schmidt, Rotgans, & Yew, 2011) in pupils. However, it could be that making specific gaps in students’ knowledge salient may cause an aversive state of uncertainty. This in turn may

lead to effects like the ones we observed in the current study; namely, students may become more open to misinformation and less discerning of the quality of information. A way to avoid such consequences may be to elicit a more open-ended state of interest-curiosity in students. Classroom based research suggests that question formulation may be an effective way to cultivate curiosity in adolescents (Clark, Harbaugh, & Seider, 2019), and theorists have proposed that *different kinds of questions* can direct the learning process in different ways. “Wonderment” questions, which are more open-ended (e.g., “If dogs can be trained to detect cancer through smell, how could we use that to build a cancer-detecting robot?”), have been proposed to lead to greater conceptual learning (Chin & Osborne, 2008).

Alternatively, there may be methods for inducing a state of deprivation curiosity without the corresponding negative affect; in other words, inducing a specific interest in a close-ended question or problem while buffering against aversive reactions to uncertainty. Note, however, that current conceptualizations of deprivation curiosity define it by the presence of negative affect. Thus a state of specific curiosity with neutral or positive affect is a theoretically novel concept. This also points to another limitation of the current research. Since deprivation curiosity inherently contains negative affect associated with uncertainty, we cannot distinguish to what extent the need to close information gaps or the negative affect associated with information gaps drive the negative relationships with intellectual humility and the lack of discernment. Future research should examine the effects of curiosity-related negative affect, as well as the potential effects of a more enthusiastic type of deprivation curiosity, in so far as it exists.

Concluding remarks

If curiosity can be cultivated, the present research suggests we should strive to foster the joyful kind known as interest curiosity. We find that this general tendency to delight in the gaining of new information is associated with a host of virtues including: greater general knowledge, enhanced responsiveness to new information, superior ability in distinguishing between real and made-up concepts, all complimented with a penchant for intellectual humility. In contrast, interest curiosity’s “tortured” counterpart deprivation curiosity—driven by the desire to reduce the uncertainty of not knowing something—not only feels less pleasant, is also characterized by a host of errors and

intellectual confusion, such as a false sense of familiarity with new or made-up information and a failure to see through bullshit and deliberate disinformation. Those who excel in deprivation curiosity are eager to gain information, but they lack discernment in distinguishing fact from fiction, and the intellectual humility to recognize the limitations of their often-faulty knowledge. Such individuals may pose a particular risk to society, as they are also especially eager to share false facts with others. Further research is needed to explore the potential dangers of this type of curiosity, including: its causal role in undermining intellectual discernment and its capacity to drive us to pursue information that does not deeply interest us. By understanding the mechanisms and circumstances under which the negative effects of deprivation curiosity play out, we will be in a better position to buffer against these pitfalls and harness curiosity as a source of joyful discovery and learning opportunities.

References

- Adeboye, N. O., Fagoyinbo, I. S., & Olatayo, T. O. (2014). Estimation of the effect of multicollinearity on the standard error for regression coefficients. *Journal of Mathematics*, 10(4), 16-20.
- Akinwande, M. O., Dikko, H. G., & Samson, A. (2015). Variance inflation factor: as a condition for the inclusion of suppressor variable (s) in regression analysis. *Open Journal of Statistics*, 5(7), 754-767.
- Ames, D. R., Rose, P., & Anderson, C. P. (2006). The NPI-16 as a short measure of narcissism. *Journal of Research in Personality*, 40(4), 440-450.
- Anderson, C., Brion, S., Moore, D. A., & Kennedy, J. A. (2012). A status-enhancement account of overconfidence. *Journal of Personality and Social Psychology*, 103(4), 718-735.
- Bago, B., Rand, D. G., & Pennycook, G. (2020). Fake news, fast and slow: Deliberation reduces belief in false (but not true) news headlines. *Journal of Experimental Psychology: General*, 149(8), 1608–1613.
- Baehr, J. (2011). *The inquiring mind: On intellectual virtues and virtue epistemology*. New York, NY: Oxford University Press.
- Begg, I., Anas, A., & Farinacci, S. (1992). Dissociation of processes in belief: Source recollection, statement familiarity, and the illusion of truth. *Journal of Experimental Psychology: General*, 121(4), 446–458.
- Berliner, W. (2020, January). ‘Schools are killing curiosity’: why we need to stop telling children to shut up and learn. *The Guardian*. Retrieved from <https://www.theguardian.com/education/2020/jan/28/schools-killing-curiosity-learn>
- Berlyne, D. E. (1954). A theory of human curiosity. *British Journal of Psychology*, 45(3), 180–191.
- Berlyne, D. E. (1960). *Conflict, arousal, and curiosity*. New York: McGraw-Hill.
- Berlyne, D. E. (1966). Curiosity and exploration. *Science*, 153(3731), 25-33.
- Berlyne, D. E. (1978). Curiosity and learning. *Motivation and Emotion*, 2(2), 97–175.
- Bing, M. N., Kluemper, D., Davison, H. K., Taylor, S., & Novicevic, M. (2011). Overclaiming as a measure of faking. *Organizational Behavior and Human*

- Decision Processes*, 116(1), 148-162.
- Brady, W. J., Wills, J. A., Jost, J. T., Tucker, J. A., & Van Bavel, J. J. (2017). Emotion shapes the diffusion of moralized content in social networks. *Proceedings of the National Academy of Sciences*, 114(28), 7313-7318.
- Bronstein, M. V., Pennycook, G., Bear, A., Rand, D. G., & Cannon, T. D. (2019). Belief in fake news is associated with delusionality, dogmatism, religious fundamentalism, and reduced analytic thinking. *Journal of Applied Research in Memory and Cognition*, 8(1), 108-117.
- Bornstein, R. (1989). Exposure and affect: Overview and meta-analysis of research, 1968–1987. *Psychological Bulletin*, 106, 265–289.
- Button, S. B., Mathieu, J. E., & Zajac, D. M. (1996). Goal orientation in organizational research: A conceptual and empirical foundation. *Organizational Behavior and Human Decision Processes*, 67(1), 26-48.
- Čavojová, V., Secară, E. C., Jurkovič, M., & Šrol, J. (2019). Reception and willingness to share pseudo-profound bullshit and their relation to other epistemically suspect beliefs and cognitive ability in Slovakia and Romania. *Applied Cognitive Psychology*, 33(2), 299-311.
- Chen, B. X. (2020, October). How to Deal With a Crisis of Misinformation. *New York Times*. Retrieved from <https://www.nytimes.com/2020/10/14/technology/personaltech/how-to-deal-with-a-crisis-of-misinformation.html?searchResultPosition=4>
- Chin, C., & Osborne, J. (2008). Students' questions: A potential resource for teaching and learning science. *Studies in Science Education*, 44(1), 1–39.
- Clark, S., Harbaugh, A. G., & Seider, S. (2019). Fostering adolescent curiosity through a question brainstorming intervention. *Journal of Adolescence*, 75, 98-112.
- Collins, R. P., Litman, J. A., & Spielberger, C. D. (2004). The measurement of perceptual curiosity. *Personality and Individual Differences*, 36(5), 1127-1141.
- Deffler, S. A., Leary, M. R., & Hoyle, R. H. (2016). Knowing what you know: Intellectual humility and judgments of recognition memory. *Personality and Individual Differences*, 96, 255-259.

- DeYoung, C. G. (2015). Openness/intellect: A dimension of personality reflecting cognitive exploration. In M. Mikulincer, P. R. Shaver, M. L. Cooper, & R. J. Larsen (Eds.). *APA handbook of personality and social psychology, Vol. 4. Personality processes and individual differences* (p. 369–399). American Psychological Association.
- DeYoung, C. G., Quilty, L. C., & Peterson, J. B. (2007). Between facets and domains: 10 aspects of the Big Five. *Journal of Personality and Social Psychology, 93*(5), 880-896.
- Di Leo, I., Muis, K. R., Singh, C. A., & Psaradellis, C. (2019). Curiosity... Confusion? Frustration! The role and sequencing of emotions during mathematics problem solving. *Contemporary Educational Psychology, 58*, 121-137.
- Dunlop, P. D., Bourdage, J. S., de Vries, R. E., Hilbig, B. E., Zettler, I., & Ludeke, S. G. (2017). Openness to (reporting) experiences that one never had: Overclaiming as an outcome of the knowledge accumulated through a proclivity for cognitive and aesthetic exploration. *Journal of Personality and Social Psychology, 113*(5), 810-834.
- Ehrlinger, J., Mitchum, A. L., & Dweck, C. S. (2016). Understanding overconfidence: Theories of intelligence, preferential attention, and distorted self-assessment. *Journal of Experimental Social Psychology, 63*, 94-100.
- Evans, A., Sleegers, W., & Mlakar, Ž. (2020). Individual differences in receptivity to scientific bullshit. *Judgment and Decision Making, 15*(3), 401-412.
- Fazio, L. K., Brashier, N. M., Payne, B. K., & Marsh, E. J. (2015). Knowledge does not protect against illusory truth. *Journal of Experimental Psychology: General, 144*(5), 993-1002.
- Furnham, A., Christopher, A. N., Garwood, J., & Martin, G. N. (2007). Approaches to learning and the acquisition of general knowledge. *Personality and Individual Differences, 43*(6), 1563-1571.
- Furnham, A., Swami, V., Arteche, A., & Chamorro-Premuzic, T. (2008). Cognitive ability, learning approaches and personality correlates of general knowledge. *Educational Psychology, 28*(4), 427-437.

- Frederick, S. (2005). Cognitive reflection and decision making. *Journal of Economic Perspectives*, 19, 25–42.
- Goecke, B., Weiss, S., Steger, D., Schroeders, U., & Wilhelm, O. (2020). Testing competing claims about overclaiming. *Intelligence*, 81, 101470.
- Grinberg, N., Joseph, K., Friedland, L., Swire-Thompson, B., & Lazer, D. (2019). Fake news on Twitter during the 2016 US presidential election. *Science*, 363(6425), 374-378.
- Gross, M. E., Zedelius, C. M., & Schooler, J. W. (2020). Cultivating an understanding of curiosity as a seed for creativity. *Current Opinion in Behavioral Sciences*, 35, 77-82.
- Gruber, M. J., Gelman, B. D., & Ranganath, C. (2014). States of curiosity modulate hippocampus-dependent learning via the dopaminergic circuit. *Neuron*, 84(2), 486-496.
- Guenther, C. L., & Alicke, M. D. (2010). Deconstructing the better-than-average effect. *Journal of Personality and Social Psychology*, 99(5), 755-770.
- Guess, A., Nagler, J., & Tucker, J. (2019). Less than you think: Prevalence and predictors of fake news dissemination on Facebook. *Science Advances*, 5(1), eaau4586.
- Hardy III, J. H., Ness, A. M., & Mecca, J. (2017). Outside the box: Epistemic curiosity as a predictor of creative problem solving and creative performance. *Personality and Individual Differences*, 104, 230-237.
- Hassan, M. M., Bashir, S., & Mussel, P. (2015). Personality, learning, and the mediating role of epistemic curiosity: A case of continuing education in medical physicians. *Learning and Individual Differences*, 42, 83–89.
- Heck, P. R., & Krueger, J. I. (2015). Self-enhancement diminished. *Journal of Experimental Psychology: General*, 144(5), 1003-1020.
- Hoyle, R. H., Davisson, E. K., Diebels, K. J., & Leary, M. R. (2016). Holding specific views with humility: Conceptualization and measurement of specific intellectual humility. *Personality and Individual Differences*, 97, 165-172.
- Hidi, S. (2006). Interest: A unique motivational variable. *Educational Research Review*, 1(2), 69-82.

- Hsee, C. K., & Ruan, B. (2016). The Pandora effect: The power and peril of curiosity. *Psychological Science*, 27(5), 659-666.
- Jacoby, L. L., & Whitehouse, K. (1989). An illusion of memory: False recognition influenced by unconscious perception. *Journal of Experimental Psychology: General*, 118(2), 126-135.
- Jach, H. K., Smillie, L. D., & Fajkowska, M. (2020). Testing the information-seeking theory of openness/intellect. *European Journal of Personality*, 35(1) 103–119.
- Kam, C., Risavy, S. D., & Perunovic, W. Q. E. (2015). Using over-claiming technique to probe social desirability ratings of personality items: A validity examination. *Personality and Individual Differences*, 74, 177-181.
- Kang, M. J., Hsu, M., Krajbich, I. M., Loewenstein, G., McClure, S. M., Wang, J. T., & Camerer, C. F. (2009). The wick in the candle of learning. *Psychological Science*, 20(8), 963–974.
- Kashdan, T. B., & Fincham, F. D. (2002). Facilitating Creativity by Regulating Curiosity. *American Psychologist*, 55, 1105-1116.
- Kashdan, T. B., & Silvia, P. J. (2009). Curiosity and interest: The benefits of thriving on novelty and challenge. *Oxford handbook of positive psychology*, 2, 367-374.
- Kashdan, T. B., Stikma, M. C., Disabato, D. J., McKnight, P. E., Bekier, J., Kaji, J., & Lazarus, R. (2018). The five-dimensional curiosity scale: Capturing the bandwidth of curiosity and identifying four unique subgroups of curious people. *Journal of Research in Personality*, 73, 130-149.
- Kaufman, S. B. (2017, July). Schools Are Missing What Matters About Learning. Curiosity is underemphasized in the classroom, but research shows that it is one of the strongest markers of academic success. *The Atlantic*. Retrieved from <https://www.theatlantic.com/education/archive/2017/07/the-underrated-gift-of-curiosity/534573/>
- Kaufman, S. B., Yaden, D. B., Hyde, E., & Tsukayama, E. (2019). The light vs. dark triad of personality: Contrasting two very different profiles of human nature. *Frontiers in Psychology*, 10, 467.

- Kelley, C. M., & Rhodes, M. G. (2002). Making sense and nonsense of experience: Attributions in memory and judgment. *Psychology of Learning and Motivation, 41*, 293-320.
- Kelley, R., & Wixted, J. T. (2001). On the nature of associative information in recognition memory. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 27*(3), 701-722.
- Klosterman, C. (2017). *But what If We're Wrong? Thinking about the Present as If it Were the Past*. Penguin.
- Krueger, J. I. (1998). Enhancement bias in the description of self and others. *Personality and Social Psychology Bulletin, 24*(5), 505-516.
- Krueger, J. I., Heck, P. R., & Asendorpf, J. B. (2017). Self-enhancement: Conceptualization and assessment. *Collabra: Psychology, 3*(1), 1-11.
- Kruger, J., & Evans, M. (2009). The paradox of Aplytus and the pursuit of unwanted information. *Journal of Experimental Social Psychology, 45*, 1173-1179.
- Kruglanski, A. W., Webster, D. M., & Klem, A. (1993). Motivated resistance and openness to persuasion in the presence or absence of prior information. *Journal of Personality and Social Psychology, 65*(5), 861-876.
- Kruglanski, A. W., & Webster, D. M. (1996). Motivated closing of the mind: "Seizing" and "freezing." *Psychological Review, 103*(2), 263-283.
- Krumrei-Mancuso, E. J., Haggard, M. C., LaBouff, J. P., & Rowatt, W. C. (2020). Links between intellectual humility and acquiring knowledge. *The Journal of Positive Psychology, 15*(2), 155-170.
- Krumrei-Mancuso, E. J., & Rouse, S. V. (2016). The development and validation of the comprehensive intellectual humility scale. *Journal of Personality Assessment, 98*(2), 209-221.
- Kunda, Z. (1990). The case for motivated reasoning. *Psychological Bulletin, 108*(3), 480-498.
- Kurilla, B. P., & Westerman, D. L. (2008). Processing fluency affects subjective claims of recollection. *Memory & Cognition, 36*(1), 82-92.

- Lamnina, M., & Chase, C. C. (2019). Developing a thirst for knowledge: How uncertainty in the classroom influences curiosity, affect, learning, and transfer. *Contemporary Educational Psychology*, 59, 101785.
- Landrum, A. R., Hilgard, J., Akin, H., Li, N., & Kahan, D. M. (2016). Measuring interest in science: The science curiosity scale. *CogSci 2016*.
- Leary, M. R., Diebels, K. J., Davisson, E. K., Jongman-Sereno, K. P., Isherwood, J. C., Raimi, K. T., Deffler, S. A., & Hoyle, R. H. (2017). Cognitive and interpersonal features of intellectual humility. *Personality and Social Psychology Bulletin*, 43(6), 793-813.
- Leventhal, A. M., Martin, R. L., Seals, R. W., Tapia, E., & Rehm, L. P. (2007). Investigating the dynamics of affect: Psychological mechanisms of affective habituation to pleasurable stimuli. *Motivation and Emotion*, 31(2), 145-157.
- Litman, J. A. (2005). Curiosity and the pleasures of learning: Wanting and liking new information. *Cognition & Emotion*, 19(6), 793–814.
- Litman, J. A. (2008). Interest and deprivation factors of epistemic curiosity. *Personality and Individual Differences*, 44(7), 1585–1595.
- Litman, J. A. (2010). Relationships between measures of I-and D-type curiosity, ambiguity tolerance, and need for closure: An initial test of the wanting-liking model of information-seeking. *Personality and Individual Differences*, 48(4), 397-402.
- Litman, J., Hutchins, T., & Russon, R. (2005). Epistemic curiosity, feeling-of-knowing, and exploratory behaviour. *Cognition & Emotion*, 19(4), 559-582.
- Litman, J. A., & Jimerson, T. L. (2004). The measurement of curiosity as a feeling of deprivation. *Journal of Personality Assessment*, 82(2), 147–157.
- Litman, J. A., & Silvia, P. J. (2006). The latent structure of trait curiosity: Evidence for interest and deprivation curiosity dimensions. *Journal of Personality Assessment*, 86(3), 318-328.
- Litman, J. A., & Spielberg, C. D. (2003). Measuring epistemic curiosity and its diversive and specific components. *Journal of Personality Assessment*, 80(1), 75-86.
- Litman, L., Robinson, J., & Abberbock, T. (2016). TurkPrime.com: A versatile

- crowdsourcing data acquisition platform for the behavioral sciences. *Behavior Research Methods*, 49(2), 433-442.
- Loewenstein, G. (1994). The psychology of curiosity: A review and reinterpretation. *Psychological Bulletin*, 116(1), 75-98.
- Logg, J. M., Haran, U., & Moore, D. A. (2018). Is overconfidence a motivated bias? Experimental evidence. *Journal of Experimental Psychology: General*, 147(10), 1445-1456.
- Lynam, D. R., Hoyle, R. H., & Newman, J. P. (2006). The perils of partialling: Cautionary tales from aggression and psychopathy. *Assessment*, 13(3), 328-341.
- Marcoulides, K. M., & Raykov, T. (2019). Evaluation of variance inflation factors in regression models using latent variable modeling methods. *Educational and Psychological Measurement*, 79(5), 874-882.
- Marvin, C. B., & Shohamy, D. (2016). Curiosity and reward: Valence predicts choice and information prediction errors enhance learning. *Journal of Experimental Psychology: General*, 145(3), 266-272.
- Mayer, J. D., Panter, A. T., & Caruso, D. R. (2020). When people estimate their personal intelligence who is overconfident? Who is accurate? *Journal of Personality*, 88(6), 1129-1144.
- McCrae, R. R., & Costa Jr, P. T. (1997). Conceptions and correlates of openness to experience. In *Handbook of personality psychology* (pp. 825-847). Academic Press.
- Mesmer-Magnus, J., Viswesvaran, C., Deshpande, S., & Joseph, J. (2006). Social desirability: The role of over-claiming, self-esteem, and emotional intelligence. *Psychology Science*, 48(3), 336-356.
- Mullaney, K. M., Carpenter, S. K., Grotenhuis, C., & Burianek, S. (2014). Waiting for feedback helps if you want to know the answer: the role of curiosity in the delay-of-feedback benefit. *Memory & Cognition*, 42(8), 1273-1284.
- Müller, S., & Moshagen, M. (2018). Overclaiming shares processes with the hindsight bias. *Personality and Individual Differences*, 134, 298-300.
- Mussel, P. (2010). Epistemic curiosity and related constructs: Lacking evidence of discriminant validity. *Personality and Individual Differences*, 49(5), 506-510.

- Mussel, P. (2013). Introducing the construct curiosity for predicting job performance. *Journal of Organizational Behavior*, 34(4), 453-472.
- Nickerson, R. S. (1998). Confirmation bias: A ubiquitous phenomenon in many guises. *Review of General Psychology*, 2(2), 175-220.
- Niehoff, E., & Oosterwijk, S. (2020). To know, to feel, to share? Exploring the motives that drive curiosity for negative content. *Current Opinion in Behavioral Sciences*, 35, 56-61.
- Nilsson, A., Erlandsson, A., & Västfjäll, D. (2019). The complex relation between receptivity to pseudo-profound bullshit and political ideology. *Personality and Social Psychology Bulletin*, 45(10), 1440-1454.
- Noordewier, M. K., & van Dijk, E. (2017). Curiosity and time: From not knowing to almost knowing. *Cognition and Emotion*, 31(3), 411-421.
- Nusbaum, E. C., & Silvia, P. J. (2011). Are openness and intellect distinct aspects of openness to experience? A test of the O/I model. *Personality and Individual Differences*, 51(5), 571-574.
- O'Brien, E. (2019). Enjoy it again: Repeat experiences are less repetitive than people think. *Journal of Personality and Social Psychology*, 116(4), 519-540.
- Olds, J. M., & Westerman, D. L. (2012). Can fluency be interpreted as novelty? Retraining the interpretation of fluency in recognition memory. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 38(3), 653-664.
- Oosterwijk, S. (2017). Choosing the negative: A behavioral demonstration of morbid curiosity. *PloS one*, 12(7), e0178399.
- Paulhus, D. L. (2012). *Overclaiming on personality questionnaires*. In M. Ziegler, C. MacCann, & R. D. Roberts (Eds.), *New perspectives on faking in personality assessment* (p. 151–164). Oxford University Press.
- Paulhus, D. L., Harms, P., Bruce, M., & Lysy, D. C. (2003). The over-claiming technique: Measuring self-enhancement independent of ability. *Journal of Personality and Social Psychology*, 84(4), 890-904.
- Paulhus, D. L., & John, O. P. (1998). Egoistic and moralistic biases in self-perception: The interplay of self-deceptive styles with basic traits and motives. *Journal of Personality*, 66(6), 1025-1060.

- Pennycook, G., Binnendyk, J., Newton, C., & Rand, D. (2020). A practical guide to doing behavioural research on fake news and misinformation. PsyArxiv
<https://psyarxiv.com/g69ha/>
- Pennycook, G., Cheyne, J. A., Barr, N., Koehler, D. J., & Fugelsang, J. A. (2015). On the reception and detection of pseudo-profound bullshit. *Judgment and Decision Making*, 10(6), 549-563.
- Pennycook, G., Epstein, Z., Mosleh, M., Arechar, A. A., Eckles, D., & Rand, D. G. (2021). Shifting attention to accuracy can reduce misinformation online. *Nature*.
<https://doi.org/10.1038/s41586-021-03344-2>
- Pennycook, G., & Rand, D. G. (2019a). Lazy, not biased: Susceptibility to partisan fake news is better explained by lack of reasoning than by motivated reasoning. *Cognition*, 188, 39-50.
- Pennycook, G., & Rand, D. G. (2019b). Who falls for fake news? The roles of bullshit receptivity, overclaiming, familiarity, and analytic thinking. *Journal of Personality*, 88(2), 185-200.
- Powell, C., & Nettelbeck, T. (2014). Intellectual curiosity may not incrementally predict academic success. *Personality and Individual Differences*, 64, 7-11.
- Primi, C., Morsanyi, K., Chiesi, F., Donati, M. A., & Hamilton, J. (2016). The development and testing of a new version of the cognitive reflection test applying item response theory (IRT). *Journal of Behavioral Decision Making*, 29(5), 453-469.
- Schmidt, H. G., Rotgans, J. I., & Yew, E. H. (2011). The process of problem-based learning: What works and why. *Medical Education*, 45(8), 792-806.
- Schwartz, J. (2021, January). The Capitol Riot and Climate Disinformation. *New York Times*. Retrieved from <https://www.nytimes.com/2021/01/13/climate/the-capitol-riot-and-climate-disinformation.html?searchResultPosition=1>
- Schwartz, M. (1982). Repetition and rated truth value of statements. *The American Journal of Psychology*, 94(3), 393-407.
- Scott, K. (2021). You won't believe what's in this paper! Clickbait, relevance and the curiosity gap. *Journal of Pragmatics*, 175, 53-66.

- Shani, Y., Tykocinski, O., & Zeelenberg, M. (2008). When ignorance is not bliss: How distressing uncertainty drives the search of negative information. *Journal of Economic Psychology*, 29, 643–653.
- Silvia, P. J., & Christensen, A. P. (2020). Looking up at the curious personality: Individual differences in curiosity and Openness to Experience. *Current Opinion in Behavioral Sciences*, 35, 1-6.
- Silvia, P. J., & Kashdan, T. B. (2009). Interesting things and curious people: Exploration and engagement as transient states and enduring strengths. *Social and Personality Psychology Compass*, 3(5), 785-797.
- Stanislaw, H., & Todorov, N. (1999). Calculation of signal detection theory measures. *Behavior Research Methods, Instruments, & Computers*, 31, 137–149.
- Sterling, J., Jost, J. T., & Pennycook, G. (2016). Are neoliberals more susceptible to bullshit? *Judgment & Decision Making*, 11(4), 352–360.
- Taylor, S. E., Lerner, J. S., Sherman, D. K., Sage, R. M., & McDowell, N. K. (2003). Portrait of the self-enhancer: Well adjusted and well liked or maladjusted and friendless? *Journal of Personality and Social Psychology*, 84(1), 165-176.
- Thomson, K. S., & Oppenheimer, D. M. (2016). Investigating an alternate form of the cognitive reflection test. *Judgment and Decision making*, 11(1), 99-113.
- Toplak, M. E., West, R. F., & Stanovich, K. E. (2014). Assessing miserly information processing: An expansion of the Cognitive Reflection Test. *Thinking & Reasoning*, 20(2), 147-168.
- Tulving, E., & Kroll, N. (1995). Novelty assessment in the brain and long-term memory encoding. *Psychonomic Bulletin & Review*, 2(3), 387-390.
- Tulving, E., Markowitsch, H. J., Craik, F. I., Habib, R., & Houle, S. (1996). Novelty and familiarity activations in PET studies of memory encoding and retrieval. *Cerebral Cortex*, 6(1), 71-79.
- Unkelbach, C. (2006). The learned interpretation of cognitive fluency. *Psychological Science*, 17(4), 339-345.
- Unkelbach, C. (2007). Reversing the truth effect: Learning the interpretation of processing fluency in judgments of truth. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 33(1), 219-230.

- Van Bavel, J. J., Harris, E. A., Pärnamets, P., Rathje, S., Doell, K. C., & Tucker, J. A. (2021). Political psychology in the digital (mis)information age: A model of news belief and sharing. *Social Issues and Policy Review*, 15(1), 84-113.
- Von Stumm, S., Hell, B., & Chamorro-Premuzic, T. (2011). The hungry mind: Intellectual curiosity is the third pillar of academic performance. *Perspectives on Psychological Science*, 6(6), 574-588.
- Williams, K. M., Paulhus, D. L., & Nathanson, C. (2002). The nature of over-claiming: Personality and cognitive factors. *Paper presented at the Annual Meeting of the American Psychological Association, Chicago, IL.*
- Zell, E., Strickhouser, J. E., Sedikides, C., & Alicke, M. D. (2020). The better-than-average effect in comparative self-evaluation: A comprehensive review and meta-analysis. *Psychological Bulletin*, 146(2), 118-149.
- Zimdars, M., & McLeod, K. (Eds.). (2020). *Fake news: understanding media and misinformation in the digital age*. Cambridge, MA: MIT Press.

Footnotes

1) Other types or facets of curiosity have been identified, for instance perceptual curiosity (e.g., Collins, Litman, & Spielberger, 2004), morbid curiosity (Oosterwijk, S. (2017), social curiosity and thrill seeking (e.g., Kashdan, Stikma, Disabato, McKnight, Bekier, Kaji, & Lazarus, 2018). However, the fundamental distinction between interest and deprivation curiosity is generally acknowledged in the field and often incorporated into measures with these other facets (e.g., Kashdan et al., 2018).

2) Studies have linked curiosity to better memory, in that people are better at remembering information they are more curious about (e.g., see Kang et al. 2009; Litman, Hutchins, & Russon, 2005; Marvin & Shohamy, 2016; Mullaney, Carpenter, Grotenhuis, & Burianek, 2014). However, committing information to memory does not require distinguishing between new and old information.

3) Aside from these findings relevant to curiosity, we also replicate the finding from Deffler et al., (2016) showing scores on the Comprehensive Intellectual Humility scale predict recognition memory sensitivity ($b = .406$, $t = 5.43$, $p < .001$, 95%CI (.259, .553, $F(1, 463) = 29.49$, $p < .001$) but not bias ($b = .017$, $t = .53$, $p = .595$, 95%CI (-.045, .078, $F(1, 463) = .28$, $p = .59$).

4) Another procedure for scoring the overclaiming questionnaire is to repeat this dichotomization at *every possible cut-off value* (i.e., at 2, 3, and 4) and then averaging the results (e.g., see Deffler et al., 2016; Dunlop et al., 2017; Paulhus et al., 2003; Williams & Zumbo, 2003). Since there is no empirically established standard for dichotomizing responses on the overclaiming questionnaire, and we did not see a clear advantage or theoretical rationale for the averaging method, we preregistered the somewhat stricter scoring with 1 as the cut-off value. Our reasoning was that the next highest response, “heard of it before, but can’t describe it exactly”, already conveys a sense of familiarity.

5) We also replicate the finding from Deffler et al., (2016) showing that scores on the General Intellectual Humility scale predicted sensitivity on the overclaiming task ($b = .088$, $t = 2.27$, $p = .023$, 95%CI (.012, .165)) but not bias ($b = .009$, $t = .21$, $p = .83$, 95%CI (-.080, .101)). This was one of our preregistered hypotheses, though it is less relevant to the current investigation.

6) This most common way of calculating the self-enhancement effect was preregistered as our default approach. As mentioned in our preregistration, we also explored a slightly different method to calculate self-enhancement, which is outlined in Heck & Krueger (2015). The results were virtually identical.

7) We also repeated the same analyses on the coefficient for self-evaluations and the coefficient for other evaluations separately, to better understand if the self-enhancement result is driven more strongly by positive self-views or other derogation. Interest curiosity predicted self-positivity ($b = .078, t = 3.67, p < .001, 95\%CI (.036, .119)$) but not other-evaluations ($b = -.021, t = -.96, p = .340, 95\%CI (-.063, .022)$). Deprivation curiosity predicted neither self-evaluations ($b = -.025, t = -1.37, p = .172, 95\%CI (-.062, .011)$) nor other evaluations ($b = -.016, t = -.82, p = .414, 95\%CI (-.053, .022)$).

8) 17 participants did not complete the Intellectual humility scales, leading to missing data in some of the analyses for Study 3.

9) We expected that the different associations between interest and deprivation curiosity and need for closure might be especially pronounced on the subscales *decisiveness*, *ambiguity*, and *close-mindedness* of the Need for Closure scale. This was not the case. Compounding scores for these three subscales yielded highly similar results as our analysis of the full scale: Deprivation curiosity was associated with increased need for closure, ($b = .204, t = 4.52, p < .001, 95\%CI (.115, .293)$), and interest curiosity was with less need for closure ($b = -.241, t = -4.74, p < .001, 95\%CI (-.342, -.141), F(2, 420) = 14.55, p < .001$).

10) Liking can also increase as a result of repeated exposure (the “mere exposure effect”), however, this seems to apply only to very brief exposure. Longer exposure times and more repetitions (even with brief exposure times) typically lead to decreased liking (e.g., Bornstein, 1989).

11) Interestingly, and in line with previous research (e.g., Evans et al., 2020), being more trusting of a republican-led government positively predicted bullshit receptivity ($b = .157, t = 5.76, p < .001$), as well as belief in false news ($b = .121, t = 4.80, p < .001$) and willingness to share false news ($b = .156, t = 4.94, p < .001$).

Tables

Table 1

Correlations between self-enhancement measures and responses in the overclaiming task in Study 2

	Subjective self- enhancement	Math self- enhancement	Trivia self- enhancement	Narcissism	Performance goals	Overclaiming sensitivity	Overclaiming hits
Math self- enhancement	$r = .080$ $p = .067$						
Trivia self- enhancement	$r = .031$ $p = .479$	$r = .044$ $p = .314$					
Narcissism	$r = .126$ $p = .004$	$r = .021$ $p = .624$	$r = .063$ $p = .152$				
Performance goals	$r = -.090$ $p = .039$	$r = .008$ $p = .853$	$r = -.012$ $p = .783$	$r = -.016$ $p = .719$			
Overclaiming sensitivity	$r = -.056$ $p = .324$	$r = -.106$ $p = .060$	$r = -.115$ $p = .042$	$r = -.225$ $p < .001$	$r = .016$ $p = .780$		
Overclaiming hits	$r = .004$ $p = .937$	$r = -.056$ $p = .205$	$r = -.017$ $p = .699$	$r = .017$ $p = .699$	$r = -.064$ $p = .145$	$r = .303$ $p < .001$	
Overclaiming false alarms	$r = .098$ $p = .025$	$r = .045$ $p = .273$	$r = .023$ $p = .597$	$r = .101$ $p = .020$	$r = -.042$ $p = .341$	$r = -.373$ $p < .001$	$r = .603$ $p < .001$

Table 2***Reliabilities and correlations between dependent measures in Study 3***

	General intellectual humility	Comprehensive intellectual humility	Novelty sensitivity	Overclaiming sensitivity	Spiritual bullshit receptivity	Scientific bullshit receptivity
Comprehensive intellectual humility	$r = .498$ $p < .001$					
Novelty sensitivity	$r = .173$ $p = .001$	$r = .335$ $p < .001$				
Overclaiming sensitivity	$r = .073$ $p = .146$	$r = .105$ $p = .037$	$r = .298$ $p < .001$			
Spiritual bullshit receptivity	$r = .020$ $p = .679$	$r = -.147$ $p = .003$	$r = -.198$ $p < .001$	$r = -.389$ $p < .001$		
Scientific bullshit receptivity	$r = -.022$ $p = .652$	$r = -.165$ $p = .007$	$r = -.143$ $p = .007$	$r = -.184$ $p < .001$	$r = .457$ $p < .001$	
Need for closure	$r = -.096$ $p = .049$	$r = -.327$ $p < .001$	$r = -.049$ $p = .360$	$r = -.012$ $p = .809$	$r = .053$ $p = .281$	$r = .075$ $p = .125$

Table 3***Correlations between dependent measures in Study 4***

	GIH	CIH	Over- claiming sensitivity	Bullshit receptivity	Belief in false news	Willing- ness to share false news	CRT score	Pleasure from conceptual novelty
GIH	$r = .543$ $p < .001$							
Overclaiming sensitivity	$r = .011$ $p = .811$	$r = .139$ $p = .002$						
Bullshit receptivity	$r = .088$ $p = .045$	$r = -.132$ $p = .003$	$r = -.371$ $p < .001$					
Belief in false news	$r = -.055$ $p = .214$	$r = -.234$ $p < .001$	$r = -.335$ $p < .001$	$r = -.336$ $p < .001$				
Willingness to share false news	$r = -.060$ $p = .175$	$r = -.244$ $p < .001$	$r = -.347$ $p < .001$	$r = -.308$ $p < .001$	$r = .608$ $p < .001$			
CRT score	$r = .094$ $p = .033$	$r = .150$ $p < .001$	$r = .244$ $p < .001$	$r = -.289$ $p < .001$	$r = -.216$ $p < .001$	$r = -.209$ $p < .001$		
Pleasure from conceptual novelty	$r = .135$ $p = .002$	$r = .079$ $p = .072$	$r = -.008$ $p = .861$	$r = -.020$ $p = .655$	$r = -.045$ $p = .310$	$r = -.012$ $p = .787$	$r = .106$ $p = .016$	
Openness to Experience	$r = .325$ $p < .001$	$r = .309$ $p < .001$	$r = .044$ $p = .335$	$r = .027$ $p = .539$	$r = -.080$ $p = .072$	$r = -.069$ $p = .120$	$r = .081$ $p = .065$	$r = .193$ $p < .001$

GIH = General Intellectual Humility scale, CIH = Comprehensive Intellectual Humility scale,
 CRT = Cognitive Reflection Test

Table 4

Correlations between Epistemic curiosity and Openness to Experience subscales in Study 4

	Interest curiosity	Deprivation curiosity	Openness
Deprivation curiosity	$r = .510$ $p < .001$		
Openness	$r = .411$ $p < .001$	$r = .172$ $p < .001$	
Intellect	$r = .480$ $p < .001$	$r = .283$ $p < .001$	$r = .231$ $p < .001$

Table 5

Regression results showing independent effects of Openness and Intellect on key dependent variables in Study 4

Dependent measure	Predictor	<i>b</i>	<i>t</i>	<i>p</i>	95% CI
General Intellectual Humility scale					
	Openness	.249	6.24	< .001	(.171, .327)
	Intellect	.154	3.27	< .001	(.061, .246)
Comprehensive Intellectual Humility scale					
	Openness	.120	4.08	< .001	(.062, .178)
	Intellect	.178	5.10	< .001	(.109, .246)
Overclaiming sensitivity					
	Openness	.067	1.61	.107	(-.014, .148)
	Intellect	-.026	-.53	.595	(-.123, .071)
Bullshit Receptivity Scale					
	Openness	-.012	-.19	.085	(-.139, .114)
	Intellect	.077	1.02	.309	(-.072, .227)
Belief in false news					
	Openness	-.167	-2.75	.006	(-.285, -.047)
	Intellect	.048	.68	.498	(-.092, .188)
Responsiveness to conceptual novelty					
	Openness	11.702	5.25	< .001	(7.321, 16.083)
	Intellect	-.059	-.02	.982	(-5.226, 5.109)

Table 6

Regression results showing independent effects of Openness, Intellect and interest and deprivation curiosity on key dependent variables in Study 4

Dependent measure	Predictor	<i>b</i>	<i>t</i>	<i>p</i>	95% CI
General Intellectual Humility scale					
	Openness	.155	3.79	< .001	(.075, .236)
	Intellect	.011	.21	.832	(-.088, .110)
	Interest curiosity	.289	5.77	< .001	(.191, .387)
	Deprivation curiosity	.011	.27	.786	(-.068, .089)
Comprehensive Intellectual Humility scale					
	Openness	.094	3.04	.002	(.033, .155)
	Intellect	.157	4.15	< .001	(.083, .232)
	Interest curiosity	.134	3.55	< .001	(.060, .208)
	Deprivation curiosity	-.134	-4.46	< .001	(-.193, -.075)
Overclaiming sensitivity					
	Openness	.078	1.78	.075	(-.008, .164)
	Intellect	.009	.17	.864	(-.098, .116)
	Interest curiosity	.003	.05	.959	(-.104, .109)
	Deprivation curiosity	-.105	-2.45	.015	(-.190, -.021)
Bullshit Receptivity Scale					
	Openness	-.081	-1.20	.232	(-.214, .052)
	Intellect	-.058	-.70	.486	(-.221, .105)
	Interest curiosity	.131	1.59	.112	(-.031, .294)
	Deprivation curiosity	.217	3.30	.001	(.088, .346)
Belief in false news					
	Openness	-.222	-3.48	.001	(-.347, -.097)
	Intellect	-.061	-.78	.433	(-.214, .092)
	Interest curiosity	.106	1.37	.171	(-.046, .259)
	Deprivation curiosity	.175	2.84	.005	(.054, .297)
Responsiveness to conceptual novelty					
	Openness	10.067	4.23	< .001	(5.390, 14.744)
	Intellect	-2.349	-.80	.421	(-8.082, 3.384)
	Interest curiosity	5.605	1.93	.054	(-.104, 11.314)
	Deprivation curiosity	-1.260	-.54	.586	(-5.805, 3.286)

Table 7*Snapshot overview of key results from Studies 1-4*

	Study 1	Study 2	Study 3	Study 4
Dependent measure				
General Intellectual Humility scale	Interest curiosity ↗ Deprivation curiosity n.s.	Interest curiosity ↗ Deprivation curiosity ↗	Interest curiosity ↗ Deprivation curiosity n.s.	Interest curiosity ↗ Deprivation curiosity n.s.
Comprehensive Intellectual Humility scale	Interest curiosity ↗ Deprivation curiosity ↘	Interest curiosity ↗ Deprivation curiosity n.s.	Interest curiosity ↗ Deprivation curiosity ↘	Interest curiosity ↗ Deprivation curiosity ↘
Sensitivity in the recognition memory task	Interest curiosity ↗ (more hits, fewer false alarms) Deprivation curiosity ↘ (more false alarms)		Interest curiosity ↗ (more hits, fewer false alarms) Deprivation curiosity ↘ (more false alarms)	
Responsiveness to conceptual novelty in the affective habituation (art viewing) task				Interest curiosity ↗ Deprivation curiosity n.s.
Sensitivity in the overclaiming procedure	Interest curiosity ↗ (more hits) Deprivation curiosity ↘ (more false alarms)	Interest curiosity ↗ (more hits) Deprivation curiosity n.s. (more false alarms)	Interest curiosity n.s. (more hits, more false alarms) Deprivation curiosity ↘ (fewer hits)	Interest curiosity n.s. (more hits) Deprivation curiosity ↘ (more false alarms)
Receptivity to pseudo-scientific bullshit			Interest curiosity n.s. Deprivation curiosity ↗	
Receptivity to pseudo-profound bullshit			Interest curiosity n.s. Deprivation curiosity ↗	Interest curiosity n.s. Deprivation curiosity ↗
Belief in fake news				Interest curiosity n.s. Deprivation curiosity ↗
Willingness to share fake news				Interest curiosity n.s. Deprivation curiosity ↗

Figures**Figure 1**

Slopes showing deprivation curiosity predicts decreased sensitivity and interest curiosity predicts increased sensitivity in the recognition memory task (Study 1).

The shaded area represents 95% Confidence intervals.

Figure 2

Slopes showing deprivation curiosity predicts decreased sensitivity and interest curiosity predicts increased sensitivity in the overclaiming task (Study 1).

The shaded area represents 95% Confidence intervals.

Figure 3

Slopes showing interest curiosity predicts increased sensitivity in the overclaiming task and deprivation curiosity does not predict sensitivity (Study 2).

The shaded area represents 95% Confidence intervals.

Figure 4

Mediation model estimating the path from deprivation curiosity to overclaiming through narcissism (Study 2).

Confidence intervals were estimated from 1000 bootstrap samples. The indirect effect is not significant, indicating that the relationship between deprivation curiosity and overclaiming was not mediated by narcissism.

Figure 5

Slopes showing deprivation curiosity predicts decreased sensitivity and interest curiosity predicts increased sensitivity in the recognition memory task (Study 3).

The shaded area represents 95% Confidence intervals.

Figure 6

Slopes showing deprivation curiosity predicts decreased sensitivity in the overclaiming task and interest curiosity does not predict sensitivity (Study 3).

The shaded area represents 95% Confidence intervals.

Figure 7

Mediation model estimating the paths from interest and deprivation curiosity to intellectual humility (Comprehensive Intellectual Humility scale) through need for closure (Study 3).

Confidence intervals were estimated from 1000 bootstrap samples. The significant indirect effect indicates need for closure mediates the negative relationships between deprivation curiosity and intellectual humility. For interest curiosity, there is a significant direct effect and an indirect effect through need for closure.

Figure 8

Slopes showing deprivation curiosity predicts decreased sensitivity in the overclaiming task and interest curiosity does not predict sensitivity (Study 4).

The shaded area represents 95% Confidence intervals.

Figure 9

Mean pleasure ratings over 16 exposures to the same image in the affective habituation task (Study 4).

After 15 exposures, participants read contextual information meant to evoke a sense of conceptual novelty.