Journal of Research in Personality 98 (2022) 104227

Contents lists available at ScienceDirect

Journal of Research in Personality

journal homepage: www.elsevier.com/locate/jrp

Inquisitive but not discerning: Deprivation curiosity is associated with excessive openness to inaccurate information

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ARTICLE INFO

Keywords:
Epistemic curiosity
Intellectual humility
Novelty detection
Overclaiming Questionnaire
Bullshit receptivity
Analytic thinking
Disinformation
Fake news
Beliefs

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, 2 & 4). They find meaning in "bullshit" (Studies 3 & 4), believe disinformation (Study 4), and lack intellectual humility (Studies 1, 3 and 4). We theorize that deprivation curiosity is characterized by an indiscriminate openness to information.

1. Introduction

Epistemic curiosity, or the desire for knowledge (Berlyne, 1954; Litman & Spielberger, 2003; Kashdan & Silvia, 2009; Loewenstein, 1994), is widely considered an important virtue (Baehr, 2011; Silvia & Kashdan, 2009), and 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 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 disinformation? 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 an intellectually beneficial facet and a "darker", disadvantageous side.

1.1. Facets of epistemic curiosity

Observing that the desire for knowledge can be motivated by different emotions and motivations, researchers identified two facets 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 deep into complex and unfamiliar topics. It is unspecific in that the primary motivation is exploring and learning *new things*, rather than pursuing a particular topic (e.g., Hidi, 2006).

Deprivation curiosity is more specific, and more emotionally ambivalent. It is motivated by the desire to reduce the unpleasant "itch" of uncertainty and frustration that arises when we are presented with an unanswered question (Litman, 2008; Litman & Spielberger, 2003; Litman & Silvia, 2006; see also Di Leo, Muis, Singh, & Psaradellis, 2019; Kruger & Evans, 2009; Noordewier & van Dijk, 2017; Shani, Tykocinski, & Zeelenberg, 2008).

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 correlated (around 0.40 – 0.50; e.g., Litman, 2005). Nonetheless, they are distinct constructs. 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 not (Litman, 2010). Interest curiosity has been

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https://doi.org/10.1016/j.jrp.2022.104227
Received 21 April 2021; Received in revised form 29 March 2022; Accepted 31 March 2022
Available online 4 April 2022

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 pertaining to learning. This is especially surprising since interest and deprivation curiosity are defined by the desire for 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 related to acquiring knowledge.

1.2. Curiosity and epistemic processes

Satisfying the thirst for knowledge is not as simple as quenching our literal thirst. To acquire knowledge, one needs to be discerning of the quality of information. One needs to be attentive to new (vs. old) information and evaluate critically which 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 outlined next.

1.2.1. 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, 2016). We often lack this recognition and engage in an impressive amount of mental gymnastics to inoculate our beliefs from new, potentially contradictory information (Kunda, 1990; Nickerson, 1998). Intellectually humble individuals are aware of the limits of their knowledge and willing to revise their beliefs in light of new evidence (Leary et al., 2017).

Research has found a positive correlation between curiosity and intellectual humility (using two different intellectual humility scales; 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 learn new things would make people open to revising their beliefs in light of new evidence. Curiosity motivated by the desire to reduce uncertainty might not. On the contrary: experiencing discomfort in the face of uncertainty might motivate people to avoid said discomfort by clinging to existing beliefs and ignoring new, potentially contradictory evidence.

1.2.2. Responsiveness to new information

To acquire new information, it is critical to discriminate between what is new and what is already known. This ability is often measured with recognition memory tasks (e.g., Tulving, & Kroll, 1995; Tulving, Markowitsch, Craik, Habib, & Houle, 1996), in which participants attempt to distinguish new from old (previously learned) items.

Interestingly, research has found that sensitivity to novelty is correlated with intellectual humility (Deffler et al., 2016). So far, no research has examined how it relates to curiosity. Since interest curiosity is focused on learning new information, we expected that individuals high in interest curiosity would be highly responsive to novelty. This is, after all, what they are seeking. It is not clear if the same applies to deprivation curious individuals, as they are not specifically focused on novelty.

In addition to actual novelty, we were interested in how curiosity relates to what we call *conceptual novelty*—when something familiar is viewed in a new light due to new contextual information. To explore this, we developed a new task in which we elicited conceptual novelty by providing surprising contextual information about a familiar piece of art. We expected that individuals high in interest curiosity would be responsive to this manipulation. The same might not apply to deprivation curiosity, since conceptual novelty does not help close a specific knowledge gap.

1.2.3. 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. There is indeed indirect evidence linking curiosity—in this case inferred from openness to experience—to general knowledge (Furnham, Christopher, Garwood, & Martin, 2007; Furnham, Swami, Arteche, & Chamorro-Premuzic, 2008).

But being knowledgeable is no antidote to making *false* claims of knowledge. Evidence for this comes from the overclaiming procedure. This procedure resembles a standard general knowledge test, which also contains made-up terms (Paulhus & John, 1998; Paulhus, Harms, Bruce, & Lysy, 2003). Thus, it measures both real knowledge and *overclaiming*, or the tendency to make false claims of knowledge.

Because distinguishing real from false information seems obviously important for acquiring knowledge, one might expect that curious individuals are good at distinguishing real and made-up concepts. However, there is reason to expect curiosity could also make people prone to overclaiming. Here it is important to understand why people overclaim. While overclaiming was initially interpreted as a sign of self-enhancement (Bing, Kluemper, Davison, Taylor, & Novicevic, 2011; Paulhus, 2012; Paulhus et al., 2003), it can also stem from confusion (Dunlop et al., 2017; Kam et al., 2015; Goecke, Weiss, Steger, Schroeders, & Wilhelm, 2020; Müller, & Moshagen, 2018; Williams, Paulhus, & Nathanson, 2002). Highly knowledgeable individuals and those high in openness to experience are prone to overclaiming (Dunlop et al., 2017). Dunlop et al. speculated that this is due to their inquisitive nature, which causes them to generate vivid associations between the words that describe made-up concepts and real concepts in their memory. The activation and retrieval of memories can create the illusion of familiarity. It *feels* as if the made-up concept was *retrieved* from memory, when it is merely semantically associated with real memories (see also Kelley, & Wixted, 2001). Given this link between inquisitiveness and confusion in the Overclaiming procedure, we wanted to examine if interest and deprivation curiosity relate to the ability to distinguish between real and made-up concepts.

1.2.4. Seeing through bullshit

"Bullshit" is a special category of information. It is neither true nor false but it lacks coherent meaning (Pennycook, Cheyne, Barr, Koehler, & Fugelsang, 2015). Consider this example: "We are being called to explore the totality itself as an interface between serenity and intuition" (Pennycook et al., 2015). Some people find meaning in this type of nonsense (e.g., Pennycook et al., 2015; Pennycook & Rand, 2018). Bullshit receptivity has been linked to conspiracy beliefs (Čavojová, Secară, Jurkovič, & Šrol, 2019; Pennycook et al., 2015) and political ideology (Evans, Sleegers, & Mlakar, 2020; Nilsson, Erlandsson, & Västfjäll, 2019; Sterling, Jost, & Pennycook, 2016). So far, nobody has looked at how curiosity relates to it. 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 may make them open to all kinds of information, perhaps even bullshit.

1.2.5. Skepticism towards Disinformation, or "Fake News"

Finally, we examined how interest and deprivation curiosity relate to the way people engage with disinformation or fake news—misinformation purposefully designed to deceive (Brady, Wills, Jost, Tucker, & Van Bavel, 2017; Zimdars, & McLeod, 2020). Critically

evaluating the truthfulness of information is important for learning. Therefore, one might expect highly curious individuals to be especially critical of disinformation. However, their hunger for information may make the open to entertaining a variety of information, in some cases perhaps even disinformation.

Thus far, belief in fake news has been linked to a lack of analytic thinking (Bago, Rand, & Pennycook, 2020; Bronstein, Pennycook, Bear, Rand, & Cannon, 2019; Pennycook & Rand, 2018, 2019a, 2019b). Pennycook and colleagues introduced the term "reflexive open-mindedness" to describe this tendency. "Open-mindedness" may sound charitable, but it fits with the notion we propose—that people can potentially entertain disinformation because of genuine curiosity. Here, we examine if interest and deprivation curiosity predict belief in disinformation.

1.3. The current research

Four preregistered studies tested the effects of interest and deprivation curiosity on processes relevant to acquiring knowledge. All studies were conducted in the order in which they are reported. This was an iterative process, in which the results from each study informed the predictions for the next. The first study tested how interest and deprivation curiosity relate to (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 differences between the two facets. Study 1 is therefore the only study in which we departed from our preregistered 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), disinformation (Study 4) and conceptual novelty (Study 4). In addition, these studies rule out alternative explanations. Study 2 rules out that deprivation curious individuals' lack of discernment is explained by self-enhancement, and Study 4 rules out a lack of analytic thinking.

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 and 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 internal review board.

2. 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, 2020 and Leary et al., 2017) and greater sensitivity in distinguishing new vs. old information and real vs. made-up concepts. We then explored 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 measured other types of curiosity (spiritual and scientific), for purposes unrelated to the current studies. These measures were not included in Studies 2–4, and the results will be presented elsewhere.

2.1. Method

2.1.1. Participants

We sought to collect data from 500 participants. The sample size was based on the following. First, a previous study by Deffler et al. (2016) found a moderate correlation between novelty detection and intellectual humility. A power analysis determined we would need at least 154 participants to replicate this finding. To have more power to detect the unknown correlation between curiosity and novelty detection and other novel predictions, we aimed for a much larger sample.

We collected data from 622 respondents, anticipating exclusions for failing attention checks. All checks can be found in the preregistration and all exclusions were made blind with regard to the results. 79 respondents were excluded, resulting in a final sample of 543 (236 men, 304 women, 3 other or undisclosed). The average age was 32.65 years (SD = 11.23). Additional demographic data can be found in the supplemental materials.

2.1.2. Measures and procedure

2.1.2.1. Recognition Memory Task. Responsiveness to novelty was assessed in an old/new recognition memory task modeled after Deffler et al. (2016). In a learning phase, participants read statements about four controversial topics. They then performed a filler task (the Overclaiming Questionnaire described below) and the recognition phase. Because we wanted the task to be a *surprise* memory task, it was framed as being about attitudes. 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.

In the learning phase, participants read 40 statements in random order. These 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.

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.

2.1.2.2. Overclaiming Questionnaire. Participants were presented with terms from four domains: "historical events and people", "geographical and historical landmarks", "religion" and "politics". Participants indicated their familiarity with each term using a 1–5 scale with the 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.

2.1.2.3. General Intellectual Humility Scale. This 6-item scale (Leary et al., 2017) assesses the degree to which people recognize that their beliefs might be wrong and seek 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". McDonald's ω was 0.743.

2.1.2.4. Comprehensive Intellectual Humility Scale. Like the General Intellectual humility scale, the Comprehensive 22-item scale (Krumrei-Mancuso & Rouse, 2016) assesses openness to new information that contradicts one's existing beliefs (e.g., "I am open to revising my important beliefs in the face of new information"). Unlike the "General" scale, the "Comprehensive" scale is multi-dimensional (it can be divided

into sub-scales) and it includes items that emphasize the interpersonal aspects of intellectual humility, such as respecting other people's views, not feeling "above" others, and not feeling personally attacked when others question one's beliefs (e.g., "When someone contradicts my most important beliefs, it feels like a personal attack"), McDolald's ω was 0.838.

Despite the nuanced differences between the two scales, we treated them interchangeably, as both have been linked to epistemic curiosity (Krumrei-Mancuso, et al., 2020; Leary et al., 2017) and we had no reason to expect that they would function differently in the current context.

2.1.2.5. Epistemic Curiosity Scale. This 10-item scale consists of the two sub-scales interest curiosity (e.g., "I find it fascinating to learn new information"; ω = 0.820) and deprivation curiosity (e.g., "I can spend hours on a single problem because I just can't rest without knowing the answer"; ω = *0.*826; Litman, 2008). Participants respond on a 4-point scale from "almost never" to "almost always".

2.1.2.6. Spiritual Curiosity Scale. This newly constructed 9–item scale assesses curiosity for spiritual practices (e.g., "I would enjoy attending a church service from an unfamiliar religious tradition"). It was included for purposes unrelated to the present research (scale validation and exploring the relationship between different kinds of curiosity).

2.1.2.7. Science Curiosity Scale. This 9-item scale is a sub-scale from a 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"). This scale also was included for unrelated purposes.

Descriptive statistics and correlations between all dependent variables can be found in the supplemental materials.

2.2. Results

2.2.1. Intellectual humility

First, we replicated the previously found correlation between epistemic curiosity (as a whole) and intellectual humility, for both the General Intellectual Humility scale (r = 0.327, p <.001) and the Comprehensive Intellectual Humility scale (r = 0.571, p <.001).

To gain a more nuanced picture of the independent effects of interest and deprivation curiosity, we then conducted two regression analyses with interest and deprivation curiosity as separate predictors (see Table 1). For the General Intellectual Humility scale, only interest curiosity emerged as a significant predictor. For the Comprehensive Intellectual Humility scale, the effects of interest and deprivation curiosity diverged even more: Interest curiosity predicted increased intellectual humility, whereas deprivation curiosity predicted decreased humility.

2.2.2. Responsiveness to novelty

Next, we looked at novelty detection in the recognition memory task. We scored the task according to signal detection theory (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), then created a sensitivity index (d') by subtracting false alarms from the hits. (Hit and false alarm rates were first standardized).

We found that epistemic curiosity, as a whole, was not correlated with sensitivity (r = 0.035, p =.457). However, when we partialled out interest and deprivation curiosity in a regression model (Table 2), we found that interest curiosity was associated with increased sensitivity and deprivation curiosity with decreased sensitivity. Follow-up analyses revealed that interest curiosity was associated with an increased hit rate and fewer false alarms, whereas deprivation curiosity was associated with more false alarms (see Table 2).

2.2.3. Real and false claims of knowledge

Next, we examined real and false claims of knowledge in the overclaiming task. This task was scored using the same indices of sensitivity, hits and false alarms. One additional step involved dichotomizing responses to count hits (i.e., claims of familiarity with real items) and false alarms (i.e., claims of familiarity with foils). 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 as *familiar*.

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 hits and false alarms. Hits are indicative of real knowledge and false alarms are typically interpreted as overclaiming (i.e., claiming to know more than one actually does; Dunlop et al., 2017). However, people can of course falsely claim to know real existing concepts. Therefore, sensitivity, hits and false alarms are best interpreted in conjunction.

We initially examined the correlation between epistemic curiosity and sensitivity. This correlation was negative (r = -0.112, p =.013). However, when we partialled out interest and deprivation curiosity in a regression (Table 3), interest curiosity predicted increased sensitivity, whereas deprivation curiosity predicted decreased sensitivity. Moreover, interest curiosity was associated with an increased hit rate (i.e., greater knowledge) but not false alarms. Deprivation curiosity did not predict hits, but it did predict false alarms, or overclaiming.

2.3. Discussion

These results reveal a previously overlooked side of epistemic curiosity, which emerges when we separate interest and deprivation curiosity. Previous research had found a positive relationship between epistemic curiosity and intellectual humility, which we replicate. But when we partial out interest and deprivation curiosity, we find that this positive relationship is driven only by interest curiosity. Highly deprivation curious individuals are not humble. If anything, they are somewhat intellectually arrogant.

The findings differ slightly for the two intellectual humility scales. The General Intellectual Humility scale was uncorrelated with deprivation curiosity, whereas the Comprehensive Intellectual Humility scale showed a negative relationship with deprivation curiosity. These scale-specific differences could be due to the Comprehensive scale being longer and more reliable (i.e., less noisy), and/or to conceptual differences between the scales, even though we, a-priori, considered them conceptually interchangeable.

Table 1
Regression models for the intellectual humility scales in Study 1.

Model	Variable	B	SE	*t*	*p*	95% CI
General IH	Interest curiosity	0.405	0.044	9.18	0.000	(0.318, 0.491)
	Deprivation curiosity	0.013	0.038	0.35	0.728	(-0.062, 0.088)
	Constant	2.67	0.124	21.50	0.000	(2.425, 2.913)
Comprehensive IH	Interest curiosity	0.346	0.038	9.10	0.000	(0.272, 0.421)
	Deprivation curiosity	-0.149	0.033	−4.53	0.000	(-0.214, -0.084)
	Constant	2.903	0.107	27.08	0.000	(2.692, 3.113)

Note: IH = Intellectual Humility.

Table 2
Regression models predicting the recognition memory task indices in Study 1.

Model	Variable	B	SE	*t*	*p*	95% CI
Memory sensitivity	Interest curiosity	0.320	0.086	3.73	0.000	(0.151, 0.488)
	Deprivation curiosity	-0.235	0.076	−3.09	0.002	(-0.384, -0.086)
	Constant	1.668	0.248	6.72	0.000	(1.181, 2.156)
Memory Hits	Interest curiosity	0.043	0.011	3.80	0.000	(0.021, 0.065)
	Deprivation curiosity	-0.019	0.010	−1.93	0.055	(-0.038, 0.001)
	Constant	0.708	0.032	22.33	0.000	(0.645, 0.770)
Memory False Alarms	Interest curiosity	-0.040	0.016	-0.250	0.013	(-0.072, -0.009)
	Deprivation curiosity	0.049	0.014	3.51	0.000	(0.021, 0.076)
	Constant	0.146	0.045	3.22	0.001	(0.057, 0.235)

Table 3
Regression models for the Overclaiming Questionnaire measures in Study 1.

Model	Variable	B	SE	*t*	*p*	95% CI
OCQ sensitivity	Interest curiosity	0.085	0.043	1.99	0.047	(0.001, 0.170)
	Deprivation curiosity	-0.164	0.037	−4.48	0.000	(-0.235, -0.092)
	Constant	1.152	0.122	9.46	0.000	(0.913, 1.391)
OCQ Hits (i.e., knowledge)	Interest curiosity	0.055	0.017	3.32	0.001	(0.022, 0.088)
	Deprivation curiosity	-0.002	0.014	-0.11	0.912	(-0.030, 0.027)
	Constant	0.418	0.047	8.95	0.000	(0.326, 0.510)
OCQ False Alarms (i.e., overclaiming)	Interest curiosity	0.016	0.021	0.77	0.440	(-0.025, 0.057)
	Deprivation curiosity	0.057	0.018	3.17	0.002	(0.022, 0.092)
	Constant	0.069	0.058	1.19	0.235	(-0.045, 0.184)

Note: OCQ = Overclaiming Questionnaire.

Why would deprivation curiosity, when controlling for interest curiosity, not show the same positive relationship with intellectual humility? Both the interest and the deprivation curiosity scale measure a person's hunger for information. And, not surprisingly, they are correlated ($r = 0.515$, $p < .001$ in the current study). Highly curious individuals are often motivated to explore information broadly *and* to close specific knowledge gaps. However, the two don't always go together and, when holding all else constant, can have unique effects. To investigate the unique effects of deprivation curiosity, over and above being a generally curious person and over and above being broadly interested in exploring novel information, it makes sense to control for interest curiosity.

Unlike interest curiosity, deprivation curiosity is specifically motivated by uncertainty reduction (Litman, 2008; Litman & Spielberger, 2003; Litman & Silvia, 2006). This might explain its unique relationship with intellectual humility, when controlling for interest curiosity. Having your beliefs challenged can evoke uncertainty. Thus, the reason why highly deprivation curious individuals are less willing have their beliefs challenged may be that they like to avoid uncertainty.

Interest and deprivation curiosity, when partialled out in a regression analysis, also had unique, opposite relationships with novelty discrimination: Highly interest curious individuals are highly accurate at discriminating between new and old information. Deprivation curiosity, on the other hand, was associated with errors discriminating new and old items, driven by a tendency to ascribe familiarity to novel items.

A similar pattern occurred in the overclaiming task. Here, interest curiosity was associated with more 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 overclaimed.

Collectively these results suggest 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 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 of familiarity with items they have never seen before. For instance, fluent processing increases familiarity (e.g., Jacoby & Whitehouse, 1989; Kelley & Rhodes, 2002; Kelley, & Wixted, 2001; Kurilla, & Westerman, 2008; Olds, & Westerman, 2012; Unkelbach, 2006) and truth ratings (Begg, Anas, & Farinacci, 1992; Fazio, Brashier, Payne, & Marsh, 2015; Schwartz, 1982; Unkelbach, 2007). A similar process may be occurring 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 the self-enhancement account.

3. Study 2

A classic finding in the self-enhancement literature is that most people think they are better than average (Guenther & Alicke, 2010; Zell, Strickhouser, Sedikides, & Alicke, 2020). A related phenomenon is *overconfidence,* overestimating one's performance relative to one's true scores (Ehrlinger, Mitchum, & Dweck, 2016; Mayer, Panter, & Caruso, 2020). The better-than-average effect can only be interpreted at the population level, since some people *are* better than average. Overconfidence is problematic in its own way, because a person may overestimate their performance without feeling superior to others. Despite these complexities, a number of measures have been developed to assess self-enhancement.

One 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 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 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 time concerns, we did not include the recognition memory task here. However, we did in Study 3.) Our second prediction was that deprivation curiosity would be associated with self-enhancement. The preregistration can be found here https://osf.io/mn5uz and all data and supplemental materials here https://osf.io/ar3kx/.

3.1. Methods

3.1.1. Participants

We collected data from 550 respondents. 25 were excluded for failing attention or compliance checks. We were left with 525 participants (206 men, 313 women, 6 other or undisclosed). The average age was 33.73 (SD = 12.10). Other demographic data can be found in the supplemental materials.

3.1.2. Measures and procedure

3.1.2.1. Subjective Self-Enhancement. Participants read a list of 24 personality traits (e.g., boring, friendly) and rated each trait on a 5-point scale ("not at all" - "extremely") for the following prompts, presented in fully counterbalanced order: 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).

3.1.2.1. Overclaiming task. See Study 1.

3.1.2.2. Objective Self-Enhancement measure 1: Math task. (Adapted from Anderson et al., 2012). Participants were briefly (2 s) presented with six two-digit numbers and 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 (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. We then asked, in random order: "Out of the 10 questions, how many do you think you got right?", "Out of the 10 questions, how many do you think our study participants got right, on average?".

3.1.2.3. Objective Self-Enhancement measure 2: Trivia task. Participants answered 20 trivia questions. 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. After the last question, participants were asked to estimate their own and other people's scores as in the Math task.

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

3.1.2.4. General intellectual humility scale. See Study 1, $\omega = 0.797$.

3.1.2.5. Comprehensive intellectual humility scale. See Study 1, $\omega = 0.864$.

3.1.2.6. Epistemic curiosity scale. See Study 1. For interest curiosity, ω was 0.822. For deprivation ω was 0.837.

3.1.2.7. Breadth of categorization task. This task (see Isen & Daubman, 1984) was included for exploratory purposes. Participants were asked how well various exemplars (e.g., suit, purse) belong within a category (e.g., clothes).

3.1.2.8. Narcissistic personality inventory short form. This 16-item scale assesses sub-clinical 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 0.753.

3.1.2.9. Learning and performance goal orientation scale. This scale (Button, Mathieu, & Zajac, 1996) assesses the extent to which learning is motivated by the desire to learn (e.g., "The opportunity to do challenging work is important to me"; $\omega = 0.878$) and to perform better than others (e.g., "I feel smart when I can do something better than most other people"; $\omega = 0.809$).

Descriptive statistics and correlations between all dependent variables can be found in the supplemental materials.

3.2. Results

3.2.1. Intellectual humility

As in Study 1, we conducted two regression analyses on interest and deprivation curiosity (Table 4). For General Intellectual Humility, both interest and deprivation curiosity emerged as significant predictors this time, although the coefficient for interest curiosity was notably larger ($b = 0.402$) than for deprivation curiosity ($b = 0.132$). For the Comprehensive Intellectual Humility scale, only interest curiosity predicted humility.

3.2.2. Real and false claims of knowledge

Next, we replicated our analyses for the overclaiming task (Table 5). Interest curiosity again predicted increased sensitivity, while deprivation curiosity did not. Moreover, interest curiosity was again associated with more hits but not false alarms whereas deprivation curiosity once again predicted more false alarms, or overclaiming.

3.2.3. Subjective Self-Enhancement

To examine whether self-enhancement explains the differences between interest and deprivation curiosity, we first calculated subjective self-enhancement based on people's self- and other- evaluations. We regressed participants' self-ratings for each trait on their desirability ratings, then regressed their other-ratings on desirability, and subtracted the two coefficients from each other (i.e., b(self-evaluations, desirability) – b(other-evaluations, desirability). 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 self-enhancement, as shown in a positive differences score between the two coefficients (M = 0.168, SD = 0.259), which deviated significantly from zero, $t(524) = 14.857$, $p < .001$, 95 %CI (0.146, 190)). However, a regression analysis predicting self-enhancement from interest and deprivation curiosity (Table 6) showed that deprivation curiosity was unrelated to self-enhancement. Unexpectedly, though, interest curiosity was associated with greater self-enhancement. This speaks against the self-enhancement account.

3.2.4. Objective Self-Enhancement

Next, we analyzed our objective self-enhancement measures. Following Krueger, Heck, and Asendorpf, (2017), we defined self-

Table 4
Regression models for the intellectual humility scales in Study 2.

Model	Variable	B	SE	*t*	*p*	95% CI
General IH	Interest curiosity	0.402	0.040	10.13	0.000	(0.324, 0.480)
	Deprivation curiosity	0.132	0.035	3.77	0.000	(0.063, 0.201)
	Constant	2.418	0.121	20.01	0.000	(2.181, 2.656)
Comprehensive IH	Interest curiosity	0.320	0.033	9.63	0.000	(0.254, 0.385)
	Deprivation curiosity	-0.038	0.029	−1.29	0.199	(-0.095, 0.020)
	Constant	2.761	0.101	27.30	0.000	(2.562, 2.960)

Note: IH = Intellectual Humility.

Table 5
Regressions models for the Overclaiming Questionnaire measures in Study 2.

Model	Variable	B	SE	*t*	*p*	95% CI
OCQ sensitivity	Interest curiosity	0.147	0.052	2.83	0.005	(0.045, 0.249)
	Deprivation curiosity	-0.075	0.046	−1.62	0.106	(-0.166, 0.016)
	Constant	1.005	0.157	6.39	0.000	(0.696, 1.314)
OCQ Hits (i.e., knowledge)	Interest curiosity	0.057	0.014	4.17	0.000	(0.030, 0.084)
	Deprivation curiosity	-0.001	0.012	-0.01	0.991	(-0.024, 0.024)
	Constant	0.433	0.042	10.32	0.000	(0.350, 0.515)
OCQ False Alarms (i.e., overclaiming)	Interest curiosity	0.015	0.015	1.03	0.305	(-0.014, 0.044)
	Deprivation curiosity	0.028	0.013	2.14	0.033	(0.002, 0.053)
	Constant	0.105	0.045	2.36	0.018	(0.018, 0.193)

Note: OCQ = Overclaiming Questionnaire.

Table 6
Regression models for subjective self-enhancement and related self-report measures in Study 2.

Model	Variable	B	SE	*t*	*p*	95% CI
Subjective self-enhancement	Interest curiosity	0.098	0.026	3.74	0.000	(0.047, 0.150)
	Deprivation curiosity	-0.010	0.023	-0.42	0.672	(-0.055, 0.036)
	Constant	0.197	0.080	2.46	0.014	(0.040, 0.354)
Narcissism	Interest curiosity	0.006	0.013	0.50	0.617	(-0.019, 0.032)
	Deprivation curiosity	0.022	0.011	1.94	0.053	(-0.002, 0.044)
	Constant	0.162	0.039	4.12	0.000	(0.085, 0.239)
Learning orientation	Interest curiosity	0.608	0.054	11.33	0.000	(0.502, 0.713)
	Deprivation curiosity	0.269	0.047	5.69	0.000	(0.176, 0.362)
	Constant	3.111	0.163	19.04	0.000	(2.790, 3.432)
Performance orientation	Interest curiosity	-0.007	0.064	-0.11	0.909	(-0.133, 0.118)
	Deprivation curiosity	0.036	0.056	0.64	0.521	(-0.074, 0.147)
	Constant	5.430	0.194	27.92	0.000	(5.048, 5.812)

enhancement in the math and trivia tasks as a function of two factors: a) whether a person placed themselves above average, and b) whether their performance was in fact above average. 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 (the others were accurate). In the math task, 135 overplaced, and of those 37 were self-enhancers (the others were accurate).

To test if interest and deprivation curiosity predicted chances of falling in the self-enhancer category, we conducted two logistic regression analyses, one for the trivia task and one for the math task (see Table 7). Neither interest nor deprivation curiosity predicted self-enhancement on either task.

3.2.5. Trivia and math accuracy

Since we had participants' objective scores from the two tasks, we were interested in whether these scores were predicted by interest and deprivation curiosity. A linear regression for trivia scores showed that interest curiosity predicted increased accuracy (b = 0.033, t = 3.07, p =.002, 95 %CI (0.012, 0.053), whereas deprivation curiosity was predictive of poorer trivia performance (b = -0.025, t = -2.65, p =.008, 95 % CI (-0.043, -0.006), $F(2, 525) = 5.98$, p =.003. On the math task, there no effect of interest (b = 0.045, t = 1.95, p =.052, 95 %CI (-0.001, 0.091), or deprivation curiosity (b = 0.002, t = 0.14, p =.887, 95 %CI (-0.037, 0.043).

3.2.6. Narcissism

Next, we examined the narcissism scale. A regression (Table 6) analysis showed neither interest nor deprivation curiosity predicted narcissism.

Table 7
Regression models for the objective (task based) self-enhancement measures in Study 2.

Model	Variable	B	SE	*z*	*p*	95% CI
Math self-enhancement	Interest curiosity	-0.207	0.321	-0.64	0.519	(-0.837, 0.423)
	Deprivation curiosity	-0.135	0.291	-0.47	0.642	(-0.705, 0.434)
	Constant	−1.622	0.961	−1.69	0.091	(-3.506, 0.261)
Trivia self-enhancement	Interest curiosity	0.070	0.294	0.24	0.811	(-0.505), 0.646
	Deprivation curiosity	0.292	0.252	1.16	0.248	-0.203, 0.787)
	Constant	−3.275	0.908	−3.61	0.000	(-5.055, −1.495)

3.2.7. Goal orientation

Our final self-enhancement measure was the goal orientation scale. Two regression analyses (see Table 8) showed that, whereas learning goals were predicted by both interest and deprivation curiosity, performance goals were not predicted by either.

3.2.8. 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. A regression analysis indicated no effect of interest ($b = 1.344$, $t = 1.50$, $p = .135$, 95 %CI (-0.418, 0.3.106)) nor deprivation curiosity ($b = 0.084$, $t = 0.11$, $p = .916$, 95 %CI (-1.470, 0.1.638).

3.3. Discussion

These results 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.

We largely replicate the findings for the overclaiming task. Interest curiosity was 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. 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 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 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. 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 the math tasks, so there is some evidence for their objective superiority in some intellectual domains. However, seems unlikely that they would possess more positive traits and fewer negative traits across the board (including in many areas not related to intellectual pursuits), or that they objectively excel in exactly those traits they happen to personally value more.

Interestingly, we found correlations (albeit small) between behavior on the overclaiming task and our measures of self-enhancement. Sensitivity was negatively correlated with narcissism ($r = -0.225$, $p < .001$) and self-enhancement on the trivia task ($r = -0.115$, $p = .042$). Moreover, false alarms were correlated with narcissism ($r = 0.101$, $p = .020$) and subjective self-enhancement ($r = 0.098$, $p = .025$). 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 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 erroneous or useless information. In Study 3, we test this possibility by extending our investigation into the domain of "bullshit".

4. 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 forth by the promiscuous information bias account; that individuals high in deprivation curiosity are overly accepting of bullshit. To test this hypothesis, 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 need for closure. This served to clarify the theoretical constructs of interest and deprivation curiosity by confirming that deprivation 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, with weak results. We predicted that deprivation curiosity would be positively, and interest curiosity negatively related to need for closure. The preregistration for Study 3 can be found here https://osf.io/unh2p and all data and supplemental materials here https://osf.io/3mt5y/.

4.1. Method

4.1.1. Participants

We collected data from 510 respondents. 74 were excluded for failing attention checks, resulting in 436 participants (261 men, 154 women, 4 other, 17 undisclosed). The average age was 34.54 (SD = 11.55). Other demographic data can be found in the supplemental materials.

4.1.2. Measures and procedure

4.1.2.1. Recognition Memory Task. See Study 1.

4.1.2.2. Overclaiming Questionnaire. See Study 1.

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

4.1.2.3. Bullshit Receptivity Scale. This scale lists 20 pseudo-profound 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. McDonald's ω was 0.938.

4.1.2.4. 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), $\omega =$ was 0.877.

4.1.2.5. Epistemic curiosity Scale. See Study 1, $\omega = 0.841$ for interest curiosity and $\omega = 0.820$ for deprivation curiosity.

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

4.1.2.6. General Intellectual Humility scale. See Study 1, $\omega = 0.815$.

4.1.2.7. Comprehensive Intellectual Humility Scale. See Study 1, $\omega =$

Table 8
Regression models for the intellectual humility scales in Study 3.

Model	Variable	B	SE	*t*	*p*	95% CI
General IH	Interest curiosity	0.373	0.050	7.49	0.000	(0.275, 0.471)
	Deprivation curiosity	0.005	0.044	0.11	0.913	(-0.082, 0.092)
	Constant	2.836	0.143	19.80	0.000	(2.554, 3.117)
Comprehensive IH	Interest curiosity	0.241	0.040	6.01	0.000	(0.162, 0.320)
	Deprivation curiosity	-0.072	0.036	−2.04	0.042	(-0.142, -0.003)
	Constant	3.066	0.116	26.51	0.000	(2.839, 3.293)

Note: IH = Intellectual Humility.

0.858.

4.1.2.8. 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"), $\omega = 0.894$.

Descriptive statistics and correlations between all dependent variables can be found in the supplemental materials.

4.2. Results

4.2.1. Intellectual humility

We first replicated our previous analyses for the intellectual humility scales (see Table 8). For the General Intellectual Humility scale, only interest curiosity emerged as a significant predictor. For the Comprehensive Intellectual Humility scale, interest curiosity again predicted increased humility and deprivation curiosity decreased humility.

4.2.2. Responsiveness to novelty

Replicating our previous analyses for responsiveness to novelty, interest curiosity is associated with increased sensitivity and deprivation curiosity with decreased sensitivity. And once again, this was driven by interest curiosity being associated with more hits and fewer false alarms, while deprivation curiosity was associated with more false alarms (see Table 9).

4.2.3. Real and false claims of knowledge

Replicating our previous analyses, we found that deprivation curiosity again predicted reduced sensitivity (as in Study 1), but this time interest curiosity did not predict sensitivity. Moreover, deprivation curiosity predicted neither hits nor false alarms, while interest curiosity was associated with more hits but also slightly more false alarms (see Table 10).

Table 9
Regression models for the recognition memory task indices in Study 3.

Model	Variable	B	SE	*t*	*p*	95% CI
Memory sensitivity	Interest curiosity	0.371	0.075	4.94	0.000	(0.223, 0.518)
	Deprivation curiosity	-0.224	0.066	−3.40	0.001	(-0.354, -0.095)
	Constant	1.638	0.215	7.61	0.000	(1.215, 2.061)
Memory Hits	Interest curiosity	0.043	0.012	3.74	0.000	(0.020, 0.066)
	Deprivation curiosity	-0.007	0.010	-0.71	0.479	(-0.027, 0.013)
	Constant	0.685	0.033	10.59	0.000	(0.620, 0.750)
Memory False Alarms	Interest curiosity	-0.038	0.013	−3.02	0.003	(-0.063, -0.013)
	Deprivation curiosity	0.050	0.011	4.44	0.000	(0.028, 0.072)
	Constant	0.103	0.037	2.82	0.005	(0.031, 0.175)

4.2.4. Bullshit receptivity

Our new prediction was that deprivation but not interest curiosity would be associated with greater receptivity to bullshit. We performed two regression analyses, one for the Bullshit Receptivity Scale and one for the Scientific Bullshit Receptivity Scale (Table 11). As expected, deprivation curiosity predicted greater receptivity to pseudo-profound and scientific bullshit, whereas interest curiosity did not.

4.2.5. Need for closure

Finally, we tested how interest and deprivation curiosity relate to the need for closure. Regressing need for closure scores on both types of curiosity (see Table 11) confirmed that deprivation curiosity was associated with more and interest curiosity with less need for closure.[1]

4.3. Discussion

The results replicate key findings from Studies 1 and 2. For 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. (These results were not as strong in Study 2. Since sampling variation may account for such differences, we replicate these analyses again in Study 4.).

We directly replicate our findings from Study 1 with regard to novelty discrimination. 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. Individuals higher in deprivation curiosity show the opposite pattern; they are less sensitive to novelty and more prone to illusions of familiarity. We also partly replicate our findings on the overclaiming task. We again find that deprivation curiosity is associated with being *less* sensitive to the differences between real and made-up concepts, though this time this did not express itself in more overclaiming.

Responses on these tasks were uncorrelated with need for closure. Thus, need for closure cannot explain why deprivation curiosity is associated with a general lack of discernment in these tasks.

To explain why individuals higher in deprivation curiosity are less discerning, we had previously evoked the idea of a promiscuous 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. We tested this idea here in the context of bullshit. As

[1] 1) 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, ($b = 0.204$, $t = 4.52$, $p < .001$, 95%CI (0.115, 0.293)), and interest curiosity was with less need for closure ($b = -0.241$, $t = -4.74$, $p < .001$, 95%CI (-0.342, -0.141), $F(2, 420) = 14.55$, $p < .001$). We also wanted to test if need for closure mediates the negative relationship between deprivation curiosity and intellectual humility. This preregistered analysis is not reported here due to space constraints, and because the number of alternative interpretations of this mediation model render it not very insightful.

Table 10
Regression models for the Overclaiming Questionnaire measures in Study 3.

Model	Variable	B	SE	*t*	*p*	95% CI
OCQ sensitivity	Interest curiosity	0.008	0.049	0.16	0.876	(-0.089, 0.104)
	Deprivation curiosity	-0.113	0.044	−2.58	0.010	(-0.198, -0.027)
	Constant	1.413	0.143	9.87	0.000	(1.132, 1.695)
OCQ Hits (i.e., knowledge)	Interest curiosity	0.070	0.017	4.17	0.000	(0.037, 0.102)
	Deprivation curiosity	-0.026	0.015	−1.78	0.076	(-0.055, 0.003)
	Constant	0.456	0.048	9.50	0.000	(0.361, 0.550)
OCQ False Alarms (i.e., overclaiming)	Interest curiosity	0.049	0.020	2.46	0.014	(0.010, 0.089)
	Deprivation curiosity	0.017	0.018	0.94	0.349	(-0.018, 0.051)
	Constant	0.042	0.058	0.74	0.461	(-0.071, 0.156)

Note: OCQ = Overclaiming Questionnaire.

Table 11
Regression models for the Bullshit Sensitivity scales and Need for Closure in Study 3.

Model	Variable	B	SE	*t*	*p*	95% CI
Bullshit Receptivity Scale	Interest curiosity	0.016	0.075	0.21	0.835	(-0.132, 0.164)
	Deprivation curiosity	0.354	0.067	5.32	0.000	(0.223, 0.485)
	Constant	1.839	0.217	8.49	0.000	1.413, 2.265)
Scientific Bullshit Receptivity Scale	Interest curiosity	0.070	0.066	1.05	0.293	(-0.061, 0.200)
	Deprivation curiosity	0.220	0.059	3.57	0.000	(0.105, 0.336)
	Constant	1.987	0.191	10.40	0.000	(1.611, 2.362)
Need for Closure	Interest curiosity	-0.237	0.048	−4.62	0.000	(-0.331, -0.142)
	Deprivation curiosity	0.196	0.042	4.62	0.000	(0.112, 0.280)
	Constant	4.142	0.138	30.04	0.000	(3.871, 4.413)

expected, deprivation curiosity predicted receptivity to both spiritual- and scientific bullshit.

Defaulting on accepting information may not be a bad thing most of the time. We may often be surrounded by more good (i.e., true and useful) than bad information, and 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 a disadvantage. In the next study, we extend our investigation to the domain of disinformation, where defaulting to accepting is a more obvious disadvantage.

We also wanted to extend our understanding of the connection between curiosity and responsiveness to novelty. Specifically, we wanted to explore how interest and deprivation curiosity relate to responsiveness to *conceptual* novelty.

5. Study 4

To test if deprivation curiosity is associated with believing disinformation, we used a news discernment task (from Pennycook & Rand, 2019b), in which participants evaluate the truthfulness of real and false news headlines. We also asked how likely participants would be to share the news on social media. Willingness to share serves as an additional measure for the tendency to 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 further wanted to replicate our findings from Study 3 with regard to bullshit receptivity, and add an element of discernment to that measure. To do so, we added truly meaningful sentences to the bullshit sentences. This allowed us to test whether individuals high in deprivation curiosity are less discerning about the difference between meaningful information and bullshit, or whether they find all information more meaningful.

Since 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 the Cognitive Reflection Test (Frederick, 2005). This test consists of a 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 and belief in false news.

We included another new measure of responsiveness to novelty. Studies 1 and 3 showed that interest curiosity is associated with greater sensitivity to actual novelty. We wanted to extend this to the realm of conceptual novelty. When we become more familiar with something, we typically 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 murderer, this might awaken your fascination. This new appreciation resulting from new information is what we are referring to as conceptual novelty.

To measure manipulate conceptual novelty, we developed an art viewing task adapted from an affective habituation task, in which participants are shown the same image repeatedly. Repeated exposure usually leads to reduced pleasure (e.g., Bornstein, 1989; Leventhal, Martin, Seals, Tapia, & Rehm, 2007). In our new version of the task, we repeatedly exposed participants to a photograph by an artist and then presented them with new information about the artwork to elicit conceptual novelty. 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 over the habituation period and a greater increase in pleasure after learning new information.

The preregistration for this study can be found here https://osf.io/xt28e and additional materials, pilot data and additional data addressing the overlap between epistemic curiosity and Openness to Experience can be found here https://osf.io/mjubg/.

5.1. Methods

5.1.1. Participants

We collected data from 623 respondents. 107 were excluded for failing checks (see preregistration). We were left with 516 participants (215 men, 290 women, 6 other, 5 undisclosed). The average age was 32.81 (SD = 11.11). Other demographic data can be found in the supplemental materials.

5.1.2. Measures and procedure

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

5.1.2.1. Media Truth Discernment Task. See Pennycook and Rand (2020; also see Pennycook, Binnendyk, Newton, & Rand, 2020). Participants were shown true and false news headlines presented in the style of social media posts. Headlines were gathered from the internet, and were fact-checked by fact checking organizations. 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 (anxiety, anger, humor). Based on the pilot, we selected 16 headlines (8 true, 8 false), which were rated as relatively unfamiliar by most participants and could be reasonably accurately identified as true or false, while still varying between individuals. (Pilot results can be found here: https://osf.io/mjubg/.).

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".

5.1.2.2. 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 (from Pennycook et al., 2015), $\omega = 0.944$.

5.1.2.3. Overclaiming Questionnaire. See Study 1.

5.1.2.4. Art Viewing Task. This task served to measure responsiveness to conceptual novelty. In the first phase—the habituation phase (adapted from Leventhal et al., 2007)—participants were repeatedly shown the same image; a color photograph by the artist Gordon Matta-Clark depicting a desolate house with a cut through the middle. The image was shown 14 times, for 5 s each, with an intra-trial interval of 5 s. After each 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 repeat the same rating 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.".

After 15 exposures, participants were given background information about the artwork (see preregistration). Here is an excerpt: "The [picture] 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 1970 s 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 pilled 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.".

After reading the text, participants were shown the image one more time. Then, participants were asked once more asked to rate how pleasurable they found the viewing experience.

5.1.2.5. Cognitive Reflection Test. Since this test is frequently used in social science research, a proportion of participants in some samples are familiar with the classic problems. New problems have recently been designed to address this problem. We included the three original items and seven newer problems (Thomson & Oppenheimer, 2016; Primi, Morsanyi, Chiesi, Donati, & Hamilton, 2016; Toplak, West, and Stanovich 2014; see preregistration.) Cronbach's alpha was 0.783.

5.1.2.6. Epistemic curiosity Scale. See Study 1. Cronbach's alpha was 0.821 for interest curiosity and 0.814 for deprivation curiosity.

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

5.1.2.7. General Intellectual Humility Scale. See Study 1, $\omega = 0.786$.

5.1.2.8. Comprehensive Intellectual Humility Scale. See Study 1, $\omega = 0.795$.

5.1.2.9. Openness to Experience. This scale (by DeYoung, Quilty, & Peterson, 2007) was included to test if there is overlap between interest and deprivation curiosity and the two facets that make up Openness to Experience. Due to space constraints, for further details and results see supplemental materials.

*5.1.2.10. **Mindful attention and awareness Scale.** (Brown & Ryan, 2003).* This scale was included for purposes of an unrelated investigation.

5.1.2.11. Political Identity. Following demographic questions, we asked several questions to assess participants' political views (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 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 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' political identity as: "democrat", "republican", "libertarian", "independent", or "other".

Descriptive statistics and correlations between all dependent variables can be found in the supplemental materials.

5.2. Results

5.2.1. Intellectual humility

First, we replicate our previous analyses for intellectual humility (Table 12). Once again, for the General Intellectual Humility scale, only interest curiosity was a significant predictor, and for the Comprehensive Intellectual Humility scale, interest curiosity predicted increased humility and deprivation curiosity decreased humility.

5.2.2. Real and false claims of knowledge

For the overclaiming task (Table 13), interest curiosity was not predictive of sensitivity, whereas deprivation curiosity once again predicted reduced sensitivity. Moreover, replicating Studies 1 and 2, interest curiosity was associated with more hits but no more false alarms, whereas deprivation curiosity was again associated with more false alarms.

5.2.3. Bullshit receptivity

For bullshit receptivity, we first repeated our analysis from Study 3 by regressing participants' evaluations of the bullshit sentences on interest and deprivation curiosity (see Table 14). As before, deprivation but not interest curiosity was associated with greater receptivity to bullshit.

Next, we tested if individuals high in deprivation curiosity have a

Table 12
Regression models for the intellectual humility scales in Study 4.

	Variable	B	SE	*t*	*p*	95% CI
General IH	Interest curiosity	0.360	0.044	8.26	0.000	(0.275, 0.446)
	Deprivation curiosity	0.004	0.040	0.10	0.921	(-0.075, 0.083)
	Constant	2.878	0.123	23.39	0.000	(2.636, 3.120)
Comprehensive IH	Interest curiosity	0.234	0.033	7.06	0.000	(0.169, 0.299)
	Deprivation curiosity	-0.132	0.031	−4.31	0.000	(-0.192, -0.072)
	Constant	3.226	0.094	34.44	0.000	(3.042, 3.410)

Note: IH = Intellectual Humility.

Table 13
Regression models for the Overclaiming Questionnaire measures in Study 4.

Model	Variable	B	SE	*t*	*p*	95% CI
OCQ sensitivity	Interest curiosity	0.040	0.047	0.85	0.394	(-0.052, 0.132)
	Deprivation curiosity	-0.109	0.043	−2.56	0.011	(-0.194, -0.025)
	Constant	1.269	0.131	9.66	0.000	(1.011, 1.527)
OCQ Hits (i.e., knowledge)	Interest curiosity	0.041	0.015	2.72	0.007	(0.011, 0.071)
	Deprivation curiosity	0.006	0.014	0.41	0.680	(-0.022, 0.033)
	Constant	0.487	0.043	11.44	0.000	(0.403, 0.571)
OCQ False Alarms (i.e., overclaiming)	Interest curiosity	0.023	0.019	1.22	0.224	(-0.014, 0.061)
	Deprivation curiosity	0.044	0.018	2.47	0.014	(0.009, 0.079)
	Constant	0.085	0.054	1.56	0.120	(-0.022, 0.192)

Note: OCQ = Overclaiming Questionnaire.

Table 14
Regression models for bullshit receptivity and evaluations of profound items on the Bullshit Receptivity Scale in Study 4.

Model	Variable	B	SE	*t*	*p*	95% CI
Bullshit Receptivity	Interest curiosity	0.077	0.071	1.09	0.275	(-0.062, 0.216)
	Deprivation curiosity	0.215	0.065	3.29	0.001	(0.087, 0.343)
	Constant	1.835	0.200	9.19	0.000	(1.443, 2.228)
Evaluations of Profound items	Interest curiosity	0.097	0.064	1.51	0.131	(-0.029, 0.224)
	Deprivation curiosity	0.172	0.059	2.19	0.004	(0.056, 0.289)
	Constant	2.502	0.182	13.77	0.000	(2.145, 2.859)

particular receptivity to nonsense or rate *all* information as more meaningful. To this end, we repeated the previous analysis, this time with ratings for profound items as the dependent variable (Table 18). In this model, again only deprivation curiosity emerged as a significant predictor.

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 rule this out, we performed a final regression analysis (Table 15) predicting evaluations of bullshit sentences from interest and deprivation curiosity, this time including evaluations of profound sentences as a covariate (following Pennycook & Rand, 2019b). Even when controlling for evaluations of profound sentences, deprivation curiosity still predicted higher profundity ratings for bullshit sentences.

Table 15
Regression model predicting evaluations of bullshit items controlling for evaluations of profound items on the BRS.

Variable	B	SE	*t*	*p*	95% CI
Interest curiosity	0.020	0.060	0.34	0.735	(-0.098, 0.138)
Deprivation curiosity	0.114	0.056	2.04	0.042	(0.004, 0.223)
Evaluations of Profound items	0.585	0.041	14.23	0.000	(0.504, 0.666)
Constant	0.371	0.198	1.88	0.061	(-0.018, 0.760)

5.2.4. *Belief in fake news*

Next, we tested our new hypothesis that deprivation curiosity is associated with greater belief in false news. We first conducted a regression analysis predicting truth ratings for false news headlines from interest and deprivation curiosity (Table 16). As hypothesized, deprivation but not interest curiosity predicted a greater belief in false news.

To test if this effect is specific to false news, we repeated the analysis but this time on true headlines (Table 16). Here, neither deprivation nor interest curiosity were significant predictors.

There was a small to moderate correlation between believing false news and true news, $r = .278 p < .001$. To control for that, we conducted one more analysis regressing belief in false news on interest and deprivation curiosity, this time including belief in true headlines as a covariate (Table 17). Deprivation curiosity still predicted belief in false news.

5.2.5. *Willingness to share fake news*

We conducted the same set of analyses for willingness to share true and false news (Table 18). Mirroring the findings for belief, deprivation but not interest curiosity was associated with a greater willingness to share disinformation. When including willingness to share true headlines as a covariate (Table 19), deprivation curiosity still predicted

Table 16
Regression models predicting belief in false news and belief in true news.

Model	Variable	B	SE	*t*	*p*	95% CI
Belief in false news	Interest curiosity	0.011	0.067	-0.17	0.868	(-0.143, 0.121)
	Deprivation curiosity	0.179	0.062	2.88	0.004	(0.057, 0.300)
	Constant	1.820	0.190	9.58	0.000	(1.447, 2.193)
Belief in true news	Interest curiosity	0.027	0.065	0.42	0.675	(-0.101, 0.156)
	Deprivation curiosity	0.044	0.060	0.73	0.467	(-0.075, 0.162)
	Constant	3.954	0.185	21.42	0.000	(3.592, 4.318)

Table 17
Regression model predicting belief in false news controlling for belief in true news.

Variable	B	SE	*t*	*p*	95% CI
Interest curiosity	-0.019	0.065	-0.29	0.770	(-0.146, 0.108)
Deprivation curiosity	0.166	0.059	2.79	0.006	(0.049, 0.284)
Belief in true news	0.283	0.044	6.47	0.000	(0.197, 0.368)
Constant	0.802	0.252	2.79	0.005	(0.208, 1.196)

Table 18
Regression models predicting willingness to share false and true news.

Model	Variable	B	SE	*t*	*p*	95% CI
Share false news	Interest curiosity	-0.020	0.083	-0.24	0.809	(-0.184, 0.144)
	Deprivation curiosity	0.288	0.077	3.76	0.000	(0.138, 0.439)
	Constant	1.258	0.235	5.35	0.000	(0.796, 1.720)
Share true news	Interest curiosity	0.125	0.094	1.33	0.184	(-0.059, 0.309)
	Deprivation curiosity	0.268	0.086	3.11	0.002	(0.099, 0.438)
	Constant	1.263	0.265	4.77	0.000	(0.742, 1.783)

Table 19
Regression model predicting willingness to share false news controlling for willingness to share true news.

Variable	B	SE	*t*	*p*	95% CI
Interest curiosity	-0.096	0.061	−1.56	0.119	(-0.216, 0.025)
Deprivation curiosity	0.126	0.057	2.22	0.027	(0.015, 0.238)
Share true news	0.604	0.029	21.00	0.000	(0.547, 0.660)
Constant	0.496	0.176	2.81	0.005	(0.149, 0.842)

willingness to share false news, while interest curiosity did not.

Because belief and willingness to share are correlated (r = 0.608, p <.001), we wanted to test if deprivation curiosity predicts willingness to share false news when belief is included as a covariate (Table 20). Deprivation curiosity still predicted willingness to share false news, independent from belief.

5.2.6. Cognitive Reflection test

A regression model predicting Cognitive Reflection Test scores from interest and deprivation curiosity (Table 21) yielded no effect of interest nor deprivation curiosity.

We replicate previous findings by showing that Cognitive Reflection scores correlate negatively with bullshit receptivity (r = -0.289, p <.001), belief in false news (r = -0.216, p <.001), and willingness to share false news (r = -0.209, p <.001). But since we did not find a relationship between Cognitive Reflection scores and deprivation curiosity, a lack of analytic thinking cannot explain why deprivation curiosity is associated with a lack of discernment.

5.2.7. Political identity

A multinomial logistic regression with interest and deprivation curiosity predicting responses to lean democrat, republican, libertarian, independent or other was not significant, Chi^2 = 4.47, p =.812. Aside from a non-significant trend for "independent" (p =.073), all p values were far from significant (>0.48). Moreover, no type of curiosity predicted the degree to which participants trusted democrat-led and republican-led governments (p's > 0.151), further indicating no relationship between curiosity and political views.

Table 20
Regression model predicting willingness to share false news controlling for belief in false news.

Variable	B	SE	*t*	*p*	95% CI
Interest curiosity	-0.012	0.067	-0.18	0.860	(-0.143, 0.119)
Deprivation curiosity	0.156	0.062	2.52	0.012	(0.034, 0.278)
Belief	0.740	0.044	16.89	0.000	(0.654, 0.826)
Constant	-0.089	0.205	-0.44	0.663	(-0.491, 0.313)

Table 21
Regression model predicting Cognitive Reflection Test scores.

Variable	B	SE	*t*	*p*	95% CI
Interest curiosity	0.415	0.230	1.80	0.072	(-0.037, 0.866)
Deprivation curiosity	0.005	0.212	0.02	0.980	(-0.410, 0.421)
Constant	3.629	0.648	5.58	0.000	(2.346, 4.893)

5.2.8. Responsiveness to conceptual novelty

Next, we tested our novel hypotheses with regard 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 in the art viewing task. As can be seen in Fig. 1, 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 time on pleasure. As predicted in our preregistration, the average slope was negative (Mean slope = -0.875, 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 (Table 22). Neither interest nor deprivation curiosity were significant.

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 seen in Fig. 1, participants experienced a stark increase in pleasure from seeing the familiar image again after learning new information. A regression model predicting the pleasure increase (Table 22) showed that interest but not deprivation curiosity was associated with a greater jump in pleasure.

Finally, we performed an exploratory analysis examining how long participants viewed the final image as a function of curiosity. Neither interest nor deprivation curiosity predicted viewing time (Table 22).

5.3. Discussion

The current results once again replicate our key findings with regard to intellectual humility and overclaiming. We also replicate our finding that deprivation, but not interest curiosity, is associated with receptivity to bullshit. This remains the case when controlling for truly profound information. This fits with the notion that deprivation curiosity is associated with a lack of discernment.

Our new findings with regard to disinformation fit with that pattern as well. Deprivation, but not interest curiosity, was associated with a greater tendency to believe false news and to share it with others. These findings is interesting in two respects. One, they illustrates that there can be 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. Second, these findings suggests that individuals high in deprivation curiosity not only default to accepting false information when doing so is inconsequential or potentially even beneficial for them. They are also prone to accepting disinformation when they are specifically warned that they may be deceived.

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, we also find that the relationship between deprivation curiosity and susceptibility to bullshit and fake news is not accounted for by a lack of

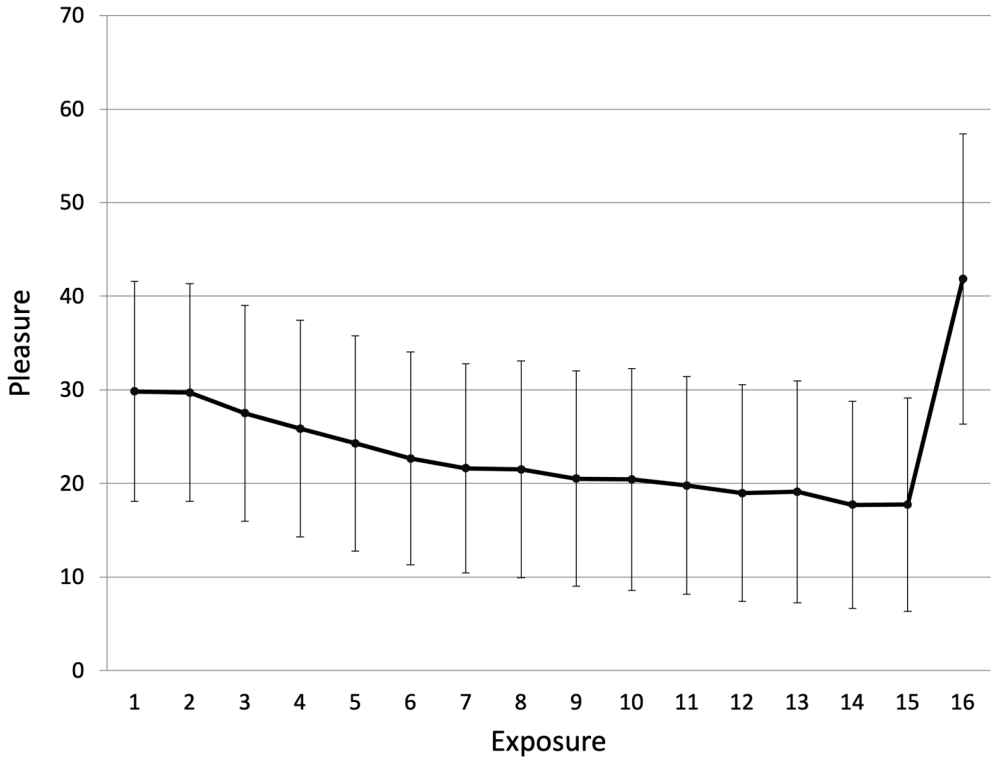

Fig. 1. Mean pleasure ratings over 16 exposures to the same image in the affective habituation task (Study 4). After 15 exposures, participants read contextual information meant to evoke a sense of conceptual novelty.

Table 22
Regression models predicting initial habituation and pleasure increase after learning new information in the art viewing task.

Model	Variable	B	SE	*t*	*p*	95% CI
Habituation	Interest curiosity	-0.109	0.155	-0.70	0.482	(-0.413, 0.195)
	Deprivation curiosity	0.101	0.142	0.71	0.477	(-0.178, 0.381)
	Constant	-0.792	0.436	−1.81	0.070	(-1.649, 0.066)
Pleasure increase	Interest curiosity	8.894	2.537	3.51	0.000	(3.910, 0.13.878)
	Deprivation curiosity	−1.880	2.335	-0.80	0.421	(-6.468, 0.2.708)
	Constant	1.147	7.148	0.16	0.873	(-12.915, 15.210)

analytic thinking. The two represent independent paths to believing disinformation. 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 supplemental materials), this does not seem to play any role in explaining our findings regarding deprivation curiosity.

Finally, the current study tested a new hypothesis focused more on interest curiosity. We had previously found that interest curiosity is associated with responsiveness to novelty, and here we extended this to conceptual novelty. Contrary to our expectation, we did not find that individuals high in interest curiosity are more easily bored by repetition. However, participants high in interest curiosity gain more pleasure from seeing something familiar after learning new contextual information about it. This is noteworthy. People often avoid revisiting the same aesthetic experience, such as going to the same art exhibition twice. Yet, when they do, they get more pleasure from it than they expected, because they discover new aspects of it (O'Brien, 2019). Our data suggest that individuals high in interest curiosity should be especially likely to enjoy such experiences. Being sensitive to conceptual novelty can also be beneficial for learning. Discovering new contextual information can sometimes alter the meaning or importance of previously learned facts. Being sensitive to this type of novelty means constantly updating one's understanding of the world.

6. 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. (Table 23 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 that both should drive learning and knowledge gain. To our surprise, we found evidence that only interest curiosity is associated with a rich general knowledge base. On the trivia task, for instance, greater interest curiosity was associated more correct answers, whereas greater deprivation curiosity predicted *less* knowledge. The overclaiming task, also, can be thought of as a general knowledge test. We found that interest curiosity was consistently associated with more hits, mostly in the absence of inflated false alarms. 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 associated with notable errors of discernment; participants high in deprivation curiosity claimed familiarity with new information in the memory task and were bad at distinguishing real from made-up concepts in the overclaiming task. They further showed a tendency to find meaning in nonsense and a willingness to entertain and share blatantly false news.

We ruled out the possibility that these deficits are explained by a lack

Table 23
Snapshot overview of key results from Studies 1–4.

Dependent measure	Study 1	Study 2	Study 3	Study 4
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 ↘
Novelty detection (i.e., recognition memory sensitivity)	Interest curiosity ↗ Deprivation curiosity ↘		Interest curiosity ↗ Deprivation curiosity ↘	
Responsiveness to conceptual novelty in the affective habituation (art viewing) task				Interest curiosity ↗ Deprivation curiosity **n. s.**
Distinguishing real from made-up concepts (i.e., sensitivity in the overclaiming procedure)	Interest curiosity ↗ Deprivation curiosity ↘	Interest curiosity ↗ Deprivation curiosity **n. s.**	Interest curiosity **n. s.** Deprivation curiosity ↘	Interest curiosity **n. s.** Deprivation curiosity ↘
Overclaiming (i.e., false alarms)	Interest curiosity **n. s.** Deprivation curiosity ↗	Interest curiosity **n. s.** Deprivation curiosity ↗	Interest curiosity ↗ Deprivation curiosity **n. s.**	Interest curiosity **n. s.** Deprivation curiosity ↗
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 ↗

Note. Arrows indicate the direction of significant relationships between dependent and independent variables. Arrows pointing up indicate a positive relationship, arrow pointing down a negative relationship, n.s. indicates that the relationship is not significant.

of analytical thinking. Past research linked receptivity to fake news and bullshit to decreased analytical thinking (e.g., Pennycook & Rand, 2018, 2019a, 2019b). We replicated this finding, but found no relationship between analytical thinking and deprivation curiosity.

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, as evidenced by a lack of intellectual humility. Although the evidence for this was less strong in Study 2, the general pattern that interest and deprivation relate differently to intellectual humility was robust, being observed across all four studies. The differences were more pronounced for the Comprehensive Intellectual Humility scale, which is longer and has a stronger emphasis on the interpersonal aspects of intellectual humility.

How can we reconcile what appears to be a paradoxical phenomenon in relation to those evidencing deprivation curiosity; a promiscuous desire for information, 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", Kruglanski, Webster, & Klem, 1993). When we are exposed to unfamiliar topics, being open to new information helps reduce the void in our current state of understanding (Kruglanski, & Webster, 1996). However, when we have prior beliefs or knowledge of particular topics, we may be motivated to resist challenges to our knowledge 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 disinformation—.

but they are resistant to questioning their existing beliefs.

6.1. 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. It also illustrates a real cost to deprivation curiosity, not only for the individual, but also their social environment, since highly deprivation curious individuals may inadvertently expose their friends and family to disinformation. 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. Given the threat of disinformation to democracies (e.g., Chen, 2020; Schwartz, 2021), this is an important avenue for future research.

Aside from fake news, we are exposed to many types of information specifically designed to capture our attention by creating a sense of information deprivation. "Clickbait" is a good example (Scott, 2021). Clickbait headlines 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). Understanding how and when deprivation curiosity can make us vulnerable to fake news, bullshit, clickbait and other such types of deceptive information may allow us to be more intentional, critical consumers of information.

Understanding the costs of curiosity is also relevant for educational contexts. Theoretical work (e.g., the situational interest hypothesis) 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). However, our results suggest that making specific gaps in students' knowledge salient might have a cost. It may cause an aversive state of uncertainty, which 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. Again, since our findings are correlational, experimental research is needed to test if deprivation curiosity causes a lack of discernment.

6.2. 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: 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 not only feels less pleasant, is also characterized by errors and intellectual confusion. 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.

Declarations

Transparency and availability of data and materials

All studies reported in this manuscript were preregistered on the Open Science Framework. Preregistration protocols and all materials (instructions, scales, tasks, stimulus materials) and data can be downloaded from https://osf.io/tzs9r/.

Funding

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

Author contributions

Claire M. Zedelius was involved in designing and preregistering the studies, data collection, data analysis and manuscript writing. Madeleine E. Gross and Jonathan W. Schooler were involved in study design and manuscript writing.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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