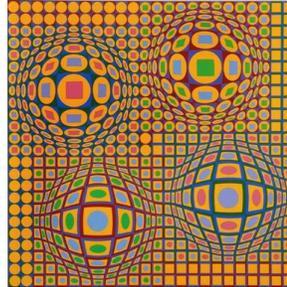


Finding meaning in the clouds: Illusory pattern perception predicts receptivity to pseudo-profound bullshit



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Abstract

Previous research has demonstrated a link between illusory pattern perception and various irrational beliefs. On this basis, we hypothesized that participants who displayed greater degrees of illusory pattern perception would also be more likely to rate pseudo-profound bullshit statements as profound. We find support for this prediction across three experiments ($N = 627$) and four distinct measures of pattern perception. We further demonstrate that this observed relation is restricted to illusory pattern perception, with participants displaying greater endorsement of non-illusory patterns being no more likely to rate pseudo-profound bullshit statements as profound. Additionally, this relation is not a product of a general proclivity to rate all statements as profound and is not accounted for by individual differences in analytic thinking. Overall, we demonstrate that individuals with a tendency to go beyond the available data such that they uncritically endorse patterns where no patterns exist are also more likely to create and endorse false-meaning in meaningless pseudo-profound statements. These findings are discussed in the context of a proposed framework that views individuals' receptivity to pseudo-profound bullshit as, in part, an unfortunate consequence of an otherwise adaptive process: that of pattern perception.

Keywords: pseudo-profound bullshit, bullshit receptivity, illusory pattern perception, irrational belief

1 Introduction

“Bullshit is everywhere.” – George Carlin

This statement may be truer today than ever before, as technological advances have allowed for information to spread faster and farther than ever before. Included in this expansion of information is likely an increase in peoples' exposure to bullshit. While many people may believe that they can reliably detect and resist bullshit, empirical findings suggest otherwise (Pennycook, Cheyne, Barr, Koehler & Fugelsang, 2015a; Pennycook & Rand, 2018; Pfatthe-

icher & Schindler, 2016; Sterling, Jost & Pennycook, 2016). For example, an initial investigation of people's receptivity to pseudo-profound bullshit by Pennycook and colleagues (2015a) demonstrated how people frequently rate these superficially impressive yet vacuous statements as profound. Furthermore, studies have reported initial evidence for how receptivity to pseudo-profound bullshit relates to real-world beliefs, such as beliefs about political ideologies and candidates (Pfattheicher & Schindler, 2016; Sterling, Jost & Pennycook, 2016), conspiracy and supernatural beliefs (Pennycook et al. 2015a), and beliefs about the accuracy of “fake news” (Pennycook & Rand, 2018). Despite bullshit representing a real, prevalent, and consequential phenomenon, little research has been conducted on the topic. The current article furthers the investigation of pseudo-profound bullshit in two ways: First, we propose that peoples' susceptibility to pseudo-profound bullshit arises in part as an unfortunate consequence of an otherwise adaptive behaviour, that of pattern perception; second, congruent with this proposal, we inves-

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tigate whether individuals susceptible to endorsing illusory patterns are more receptive to pseudo-profound bullshit.

1.1 Pseudo-profound bullshit

Initial investigations of bullshit, specifically of the pseudo-profound variety, have utilized Frankfurt's (2005) conception of bullshit as an absence of concern for the truth. That is, according to Frankfurt, bullshit is not about falsity but rather fakery; bullshit may be true, false, or meaningless, what makes a claim bullshit is an implied yet artificial attention to the truth. Consistent with this description of bullshit, Pennycook and colleagues (2015a) generated a list of superficially impressive statements that implied yet did not contain either truth or meaning by having a computer program randomly arrange a set of profound-sounding words in a way that maintained proper syntactic structure (see Dalton, 2016, for a comment, and Pennycook, Cheyne, Barr, Koehler & Fugelsang, 2016, for a response).

In addition to demonstrating peoples' receptiveness to meaningless pseudo-profound bullshit statements, Pennycook and colleagues (2015a) revealed how various individual differences were associated with bullshit receptivity. Specifically, it was found that those more receptive to bullshit were less analytic thinkers (e.g., scored lower on the Cognitive Reflection Test), scored lower in measures of cognitive ability (e.g., the Wordsum test and Raven's Advanced Progressive Matrices), and were more likely to hold religious, conspiratorial, and paranormal beliefs. Two mechanisms were proposed to explain participants' endorsement of pseudo-profound bullshit. First, some participants were shown to possess a general tendency to afford *any* and *all* statements some level of profundity (e.g., mundane statements such as "Some things have very distinct smells"). The results of Pennycook and colleagues suggest that this gullible tendency towards ascribing profundity to even the most mundane of statements is one component of bullshit receptivity. Second, individual differences in analytic thinking (as measured by the Cognitive Reflection Test and a "Heuristics and Biases" battery) were found to be associated with bullshit receptivity. Specifically, those with a propensity for analytic (as opposed to intuitive) thinking were found to be less receptive to pseudo-profound bullshit. Thus, another explanation put forth by Pennycook and colleagues is that individuals differ with regards to their ability to detect bullshit, with more analytic thinkers being more likely to detect and critically reflect on the presented pseudo-profound bullshit statements leading to lower ratings of profundity. The primary goal of this paper is to propose a third compatible mechanism to explain individual differences in receptivity to pseudo-profound bullshit: the illusory perception of patterns.

1.2 Illusory pattern perception

The ability to perceive patterns and form meaningful connections between stimuli in our environment is clearly evolutionarily advantageous (Beck & Forstmeier, 2007; Mattson, 2014; Shermer, 2011). For example, Mattson (2014) claims that superior pattern processing capabilities are essential for a variety of higher cognitive functions (e.g., imagination and invention) and likewise, credits these capabilities as fundamental to the technological progress humans have enjoyed. Relatedly, he argues that evolved superior pattern processing abilities are a primary reason why human cognition greatly exceeds the capabilities of lower species. Due to the adaptive nature of pattern perception, it has been claimed that we are the descendants of those best able to detect patterns (Shermer, 2011).

Nevertheless, our proclivity for detecting patterns comes with a cost, as we often find it difficult to distinguish between real and illusory patterns. Therefore, the same adaptive processes that allow us to perceive patterns and identify *meaningful* connections between stimuli in our environment also leads us to sometimes perceive *illusory* patterns and consequently endorse false beliefs about reality. However, when comparing the consequences of failing to detect a real and informative pattern with those of endorsing an illusory pattern, one of these errors may frequently loom larger than the other. For example, failing to connect a rustling in the grass with the presence of a dangerous predator has more dire consequences than *mistakenly* attributing movement in the grass to a predator and misguidedly escaping from a gust of wind. Using an evolutionary model, Biologist Foster and Kokko (2009) demonstrated how natural selection can favour strategies that involve the frequent endorsement of illusory patterns in order to ensure successful detection of meaningful patterns that offer large reproductive and survival benefits. Additionally, beliefs based on illusory patterns can even be advantageous if they disrupt aversive feelings, such as overwhelming thoughts of lacking control in an unpredictable world (Hogg, Adelman & Blagg, 2010; Whitson & Galinsky, 2008). This asymmetry of consequences between missing a real pattern and endorsing an illusory one is one reason humans are said to have evolved a "believing-brain" with a proclivity for pattern perception and a susceptibility to being fooled by illusory patterns (Beck & Forstmeier, 2007; Foster & Kokko, 2009; Shermer, 2011). Thus, not unlike the adaptive heuristics that guide decision-making, yet predictably lead to certain biases, pattern perception may represent an adaptive function at the heart of both rational and irrational beliefs about how stimuli are connected in the environments that we inhabit.

Illusory pattern perception includes the perception of connections between unrelated stimuli as well as the perception of patterns within random stimuli. One reason for the occurrence of illusory pattern perception is the fact that individ-

uals often have difficulty accepting that ordered events can emerge from random processes. For example, when asked to produce random sequences, people often produce far more variation (and therefore fewer “runs”) than would be created by a truly random process (Falk & Konold, 1997). What follows, is that when people encounter random sequences that coincidentally maintain some order (e.g., symmetry in a series of coin tosses) they may ascribe a meaningful non-random process as its source (Gilovich, Vallone & Tversky, 1985).

People’s tendency to engage in illusory pattern perception has been shown to be associated with various irrational beliefs (Blackmore & Moore, 1994; Van Harreveld, Rutjens, Schneider, Nohlen & Keskinis, 2014; Van Prooijen, Douglas & Inocencio, 2018; Wiseman & Watt, 2006). For example, Van Prooijen, Douglas and Inocencio (2018), found that individuals who perceive more illusory patterns are also more likely to endorse conspiracy and supernatural beliefs. Related to this association between illusory pattern perception and irrational belief is the finding that lacking control increases illusory pattern perception (Van Harreveld et al., 2014; Whitson & Galinsky, 2008). Whitson and Galinsky (2008) demonstrate that those induced to feel a lack of control perceive more illusory patterns and engage in more conspiratorial and superstitious thinking. On the basis of this evidence they argue that feeling a lack of control in one’s environment is so aversive that individuals will often endorse illusory patterns and irrational beliefs in order to diminish feelings of lacking control and return to the more pleasant view that one’s environment is predictable. Consistent with this argument is additional evidence demonstrating that lacking control increases conspiracy (Sullivan, Landau & Rothschild, 2010; Van Prooijen & Acker, 2015) and supernatural beliefs (Kay, Gaucher, McGregor & Nash, 2010; Laurin, Kay & Moscovitch, 2008). Therefore, irrational beliefs may not only arise as the result of a believing-brain with a proclivity towards pattern perception, but also as a compensatory strategy that seeks to endorse patterns (illusory or not) in order to alleviate aversive states, such as feeling a lack of control in an unpredictable environment.

1.3 The current study

The current study investigates how individual differences in pattern perception relate to differences in pseudo-profound bullshit receptivity. While previous studies have observed a positive relation between illusory pattern perception and various irrational beliefs (e.g., conspiracy and supernatural beliefs; Van Harreveld et al., 2014; Van Prooijen et al., 2018) no study has examined the relation between pattern perception and bullshit receptivity. Bullshit is distinct from other irrational beliefs on two dimensions. First, bullshit as conceived of by Frankfurt (2005) is disinterested in the specific truth or untruth of a given claim. That is, the primary goal

of a bullshitter is to be persuasive, without concern for the validity of their claims. In contrast, irrational beliefs involve individuals endorsing beliefs that *are* specifically concerned with making truth claims. For example, the belief that the United States government is covering up its own involvement in the 2001 Islamic terrorist attacks against the World Trade Centre. In this case, those with a belief in this conspiracy are insisting that there is a truth to be discovered that is merely being covered up by a government’s deception. This point leads into a second distinguishing feature of bullshit: specificity. Continuing with the example of the 911 attacks, endorsing this belief comes along with endorsing a specific set of rules for how the world and governments operate. Bullshit receptivity, however, requires only the vague perception that there is *something* meaningful being communicated by the bullshitter. Bullshit receptivity could be an early contributor to the eventual adoption of an irrational belief, but there is no reason a priori to assume that they are identical.

Despite being distinguished from other irrational beliefs, we expect that bullshit receptivity will relate to illusory pattern perception in a familiar way. Specifically, we hypothesize that individuals susceptible to endorsing illusory patterns will be more receptive to pseudo-profound bullshit. This hypothesis is consistent with our view of receptivity to pseudo-profound bullshit as arising in part as an unfortunate consequence of an otherwise adaptive process: the uncritical perception of patterns in our environment. Therefore, we believe that individuals with a greater tendency to go beyond the available data and uncritically endorse patterns where no patterns exist will also be more likely to create and endorse false-meaning in meaningless pseudo-profound statements.

Importantly, we expect this relation to remain after controlling for individual differences in analytic thinking. Controlling for analytic thinking is important as individual differences in analytic thinking have been shown to relate to a host of irrational beliefs, including conspiracy and supernatural thinking (Pennycook, Fugelsang & Koehler, 2015b; Shenav, Rand & Greene, 2012; Swami, Voracek, Stieger, Tran, & Furnham, 2014). Therefore, it is possible that previous positive associations observed between illusory pattern perception and various irrational beliefs are simply a result of those with an intuitive (as opposed to analytic) thinking style being more likely to endorse illusory patterns as well as irrational beliefs. Lastly, we expect illusory pattern perception to share an association with bullshit sensitivity, a measure of participants’ ability to distinguish between legitimately meaningful motivational quotations and pseudo-profound bullshit statements. That is, we believe that individual differences in illusory pattern perception will relate specifically to the endorsement of *meaningless* statements as profound as opposed to relating to an increase in profundity ratings in general.

In Experiments 1 and 2 we build on two experiments from Van Prooijen and colleagues (2018), which examined the

relation between participants' endorsements of illusory patterns and their level of conspiracy and supernatural belief. Importantly, we modified these experiments in order to assess the research questions at hand by replacing items assessing participants' conspiracy and supernatural beliefs with a profundity judgment task featuring both pseudo-profound bullshit statements and motivational quotations. Furthermore, we added in a measure of analytic thinking in order to assess and control for individual differences in thinking style. In Experiment 3 we improve upon these first two experiments by utilizing two new measures of pattern perception which more concretely and objectively feature both real and illusory patterns. These measures of pattern perception allow us to more convincingly distinguish between how individual differences in illusory, as opposed to non-illusory, pattern perception relate to differences in bullshit receptivity and bullshit sensitivity. Taken together, the current study utilizes four distinct measures of pattern perception to conduct an initial investigation of how individual differences in the endorsement of both illusory and non-illusory (Experiments 2 and 3) patterns predicts individuals' receptivity to pseudo-profound bullshit.

2 Study 1

2.1 Method

2.1.1 Participants

A sample of 201 participants were recruited from Amazon Mechanical Turk and received \$2.00 upon completion of a 15-minute online questionnaire. Across all three experiments, participants were recruited under the condition that they be U.S. residents and possess a Mechanical Turk HIT approval rate greater than or equal to 95%. All experiments reported in the current study were preregistered through Open Science Framework.¹

2.1.2 Measures

Pattern perception. To assess participants' degree of illusory pattern perception we employed a pattern perception measure used by Van Prooijen and colleagues (2018). Specifically, this measure indexes the degree to which participants find it difficult to accept that ordered or partially ordered sequences can arise from random processes. In this task, participants rated the extent to which they felt that

randomly generated coin flip sequences were random or predetermined on a 7-point scale (1 = completely random, 7 = completely determined). A total of 11 pattern perception items were presented to participants. The first ten items featured unique ten-flip coin sequences (e.g., HTHHTTT-THH), whereas the final item presented all previously seen sequences together and asked participants to rate the randomness of the 100 coin flip sequence. Overall, responses given to all 11 items were averaged to form an 11-item pattern perception score. A full list of items (for all measures reported in the current study) can be viewed in the supplementary materials.

Bullshit Receptivity Scale. The Bullshit Receptivity (BSR) scale, taken from Pennycook and colleagues (2015a), was administered to participants in Experiment 1. This scale consists of ten pseudo-profound bullshit statements originally obtained from two websites (<http://wisdomofchopra.com> and <http://sebpearce.com/bullshit/>) able to create meaningless statements by randomly arranging a list of profound-sounding words together in a way that retains syntactic structure. Participants rated the profundity of each statement using a 5-point scale (1 = Not at all profound, 5 = Very profound). A BSR score for each participant was calculated by averaging the profundity ratings given to the ten presented pseudo-profound bullshit statements.

Motivational Quotation Scale. To contrast the meaningless statements featured in the BSR, the motivational quotation scale, originating from Pennycook and colleagues (2015a), was administered to participants. This scale consisted of ten motivational quotations originally obtained via an internet search. Importantly, unlike the statements featured in the BSR, these ten statements were constructed with a clear intention of meaning. Thus, unlike the presented BSR statements, these statements were intended to represent "truly" meaningful statements for which the majority of people could reasonably endorse as profound. Participants rated the profundity of each motivational statement using the same 5-point scale used to assess BSR items. Likewise, participants' profundity ratings to the ten presented motivational quotations were averaged to create a motivational quotation scale score for each participant.

Bullshit sensitivity. Bullshit sensitivity is a measure of a participant's ability to distinguish pseudo-profound bullshit from meaningfully profound motivational quotations (Pennycook et al., 2015a). Bullshit sensitivity was computed by subtracting participants' mean profundity ratings given to motivational quotations from their mean profundity ratings given to pseudo-profound bullshit statements. Higher scores indicate less sensitivity in detecting bullshit.

¹We preregistered all methods, hypotheses, and analyses for each of our three experiments through Open Science Framework: Registration forms for all three reported experiments can be viewed by following the links below (Experiment 1: https://osf.io/rxtn9/?view_only=a1a69426948e4df8b67f7ce48fe21e36, Experiment 2: https://osf.io/fpr32/?view_only=8f1a964fa76e4a8ca574d71292ae5ca0, Experiment 3: https://osf.io/x9vue/?view_only=36854c9508d3428ab31d816a7fd5ce92).

TABLE 1: Experiment 1 Correlations. (Cronbach's alphas in parentheses.)

	M	SD	1	2	3	4	5
1. Pattern Perception	3.20	1.16	(.86)				
2. BSR	2.31	0.97	.35***	(.93)			
3. Motivational quotations	3.13	0.83	.17*	.49***	(.87)		
4. CRT	1.84	1.47	-.23**	-.37***	-.18*	(.72)	
5. BS Sensitivity (Var2–Var3)	-0.82	0.91	.21**	.61***	-.39***	-.22**	–

Note. Pearson correlations (Experiment 1; $N = 201$). *BSR* = Bullshit Receptivity scale; *CRT* = Cognitive Reflection Test. *BS Sensitivity* = Participants' mean BSR profundity ratings minus their mean motivational quotation profundity ratings. *** $p < .001$, ** $p < .01$, * $p < .05$.

Cognitive Reflection Test. The Cognitive Reflection Test (CRT; Frederick, 2005) was designed to evaluate individuals' ability to suppress an intuitive incorrect response in favour of a deliberative correct answer. Participants were presented with four CRT items taken from Toplak, West and Stanovich, (2014) and Primi, Morsanyi, Chiesi, Donati and Hamilton (2016). The number of correct responses was summed for each participant, giving each participant a CRT score that ranged from zero to four.

2.1.3 Procedure

Participants completed an online questionnaire in which they completed all four measures described above. Specifically, participants began by completing eleven pattern perception items. Next, participants were asked to rate the profundity of twenty statements (BSR and motivational quotations) that were presented in a randomized order. Finally, participants completed a nine-item belief in existing conspiracy theories scale² and responded to four CRT items.

2.2 Results and discussion

The results of Experiment 1 are shown in Table 1. As expected, illusory pattern perception was positively correlated with participants' BSR scores ($r(191) = .35, p < .001$). That is, participants who rated randomly generated coin toss sequences as more determined were also more likely to rate BSR items as profound. A weaker relation was observed between illusory pattern perception and motivational quotations ($r(189) = .17, p = .020$), demonstrating that illusory pattern perception also shared a positive association with profundity ratings for meaningful statements. Nevertheless, a positive relation was observed between bullshit sensitivity (the difference between BSR and motivational quotations)

²This scale, presented exclusively in Experiment 1, was included for reasons peripheral to the main objective of the current study and therefore will not be discussed further in the main body of this manuscript. However, see our supplementary materials for a set of analyses featuring this scale.

and illusory pattern perception ($r(187) = .21, p < .001$), indicating that illusory pattern perception did not simply relate to a tendency to find profundity in all things unselectively. Rather, illusory pattern perception was associated with participants' ability to distinguish between meaningful motivational quotations and pseudo-profound bullshit statements. Furthermore, replicating the results of past research (Pennycook et al., 2015a; Pennycook & Rand, 2018), participant's CRT scores correlated negatively with BSR scores ($r(197) = -.37, p < .001$). Notably, a partial correlation showed that the relation between illusory pattern perception and bullshit receptivity was largely unaffected after including participant's CRT performance as a covariate ($r(190) = .30, p = .004$, vs. $r = .35$ without the covariate), indicating that individual differences in CRT performance did not account for the association between illusory pattern perception and bullshit receptivity. This was also true of the relation between bullshit sensitivity and illusory pattern perception ($r(186) = .17, p = .020$, vs. $r = .21$ without the covariate), when including CRT performance as a covariate.

3 Study 2

The results of Experiment 1 support our hypothesis that illusory pattern perception is positively associated with bullshit receptivity. The primary goal of Experiment 2 was to build on this finding by discriminating between two accounts for this association. First, a positive association between illusory pattern perception and bullshit receptivity may be a result of a general tendency towards perceiving patterns, whether real or illusory, being predictive of greater bullshit receptivity. In contrast, it may be exclusively a tendency towards *illusory* pattern perception that predicts greater bullshit receptivity. Previous research investigating the relation between non-illusory pattern perception and conspiracy and supernatural beliefs demonstrated that non-illusory pattern perception was uncorrelated with conspiracy beliefs and *negatively* correlated with supernatural beliefs (Van Prooijen, et al., 2018). In order to discriminate between these two accounts, Ex-

TABLE 2: Experiment 2 Correlations. (Cronbach's alphas in parentheses.)

	M	SD	1	2	3	4	5	6
1. Chaotic Art Pattern Perception	2.74	1.27	(.90)					
2. Structured Art Pattern Perception	6.09	0.85	–	(.89)				
3. BSR	2.33	0.90	.30**	–.23*	(.91)			
4. Motivational quotations	3.22	0.78	.14	.02	.43***	(.84)		
5. CRT	1.59	1.33	–.08	.16	–.26***	–.17*	(.62)	
6. BS Sensitivity (Var3–Var4)	–0.89	0.90	.17	–.24*	.62***	–.44***	–.11	–

Note. Pearson correlations (Experiment 2; $N = 200$). *BSR* = Bullshit Receptivity scale; *CRT* = Cognitive Reflection Test. *BS Sensitivity* = Participants' mean BSR profundity ratings minus their mean motivational quotation profundity ratings. *** $p < .001$, ** $p < .01$, * $p < .05$.

periment 2 had participants randomly assigned to evaluate paintings in which the appearance of a meaningful pattern was either present (structured paintings) or absent (chaotic paintings). On the basis of past findings, we hypothesized that perceiving patterns in chaotic, but not structured paintings, would be positively associated with bullshit receptivity.

3.1 Method

3.1.1 Participants

A sample of 220 participants were recruited from Amazon Mechanical Turk and received \$2.00 upon completion of a 15-minute online questionnaire. Those who participated in Experiment 1 were not recruited for Experiment 2.

3.1.2 Measures and Procedure

In order to assess pattern perception in Experiment 2, we employed items used by Van Prooijen and colleagues (2018) which had participants rate the extent to which they saw a pattern in various modern art paintings. Participants randomly assigned to the chaotic art condition were asked to evaluate nine paintings by US artist Jackson Pollock whereas those assigned to the structured art condition evaluated nine paintings by Hungarian artist Victor Vasarely (see supplementary materials; examples are also shown under the title). Although participants were not informed of the artist's name in either condition, they were informed that the paintings they would be evaluating all came from the same artist. Furthermore, in the chaotic art condition, participants were informed that they would be presented with paintings from an artist "well known for his random brush strokes and irregular figures." Similarly, in the structured art condition, participants were informed that the artist whose paintings they would be evaluating was "well-known for his regular design and alignment of figures." Each painting was presented along with three questions regarding beauty, familiarity, and pattern perception. Most notably, pattern perception was as-

sessed by asking participants "To what extent do you see a pattern in this painting?" for which they responded using a 7-point scale ranging from 1 (not at all) to 7 (very much). Following this initial portion of the experiment participants rated the profundity of 20 statements and completed the four CRT items used in Experiment 1.

3.2 Results and discussion

3.2.1 Participants

In Experiment 2 we removed all participants whose responses contained missing data. This intention was registered prior to data collection and analysis. Following this rule, we removed 20 participants thus leaving us with our target sample size of 200 participants.

3.2.2 Main findings

The results of Experiment 2 are shown in Table 2. As expected, perceiving patterns in chaotic art was positively associated with bullshit receptivity ($r(95) = .30$, $p = .003$). No such association was found between chaotic art pattern perception and profundity ratings for motivational quotations ($r(95) = .14$, $p = .182$), suggesting a dissociation between how individual differences in illusory pattern perception relate to profundity judgments given to meaningful and pseudo-profound statements. However, no significant relation was observed between bullshit sensitivity and the perception of patterns in chaotic art ($r(95) = .17$, $p = .089$), indicating that the tendency to perceive patterns in chaotic art may not relate to peoples' ability to distinguish between meaningful and pseudo-profound statements. Nevertheless, it should be noted that the direction and magnitude of these two non-significant correlations were almost identical to those observed in Experiment 1 with a distinct pattern perception measure. Thus, it is entirely plausible that the aforementioned correlations represent real, albeit weak, as-

sociations that the present analyses did not have the power to detect.

Additionally, we expected that, unlike chaotic art pattern perception, perceiving patterns in structured art would not be positively associated with bullshit receptivity. In support of this hypothesis, a negative association between structured art pattern perception and bullshit receptivity was observed ($r(101) = -.23, p = .021$). A similar negative association was also observed between structured art pattern perception and bullshit sensitivity ($r(101) = -.24, p = .017$). In further support of the dissociation between illusory and non-illusory pattern perception, a difference test on the correlations between bullshit sensitivity and chaotic art pattern perception and bullshit sensitivity and structured art pattern perception revealed that these correlations significantly differed ($z = 2.89, p = .004$). Relatedly, there was no relation observed between structured art pattern perception and profundity ratings for motivational quotations ($r(101) = .02, p = .812$). Finally, we observed a significant negative correlation between CRT performance and bullshit receptivity, ($r(198) = -.26, p < .001$) but not bullshit sensitivity ($r(198) = -.11, p = .134$). Notably, partial correlations between chaotic and structured pattern perception and bullshit receptivity were unaffected by the addition of CRT performance as a covariate, ($r(94) = .29, p = .005$, vs. $r = .30$ without the covariate, and $r(100) = -.20, p = .049$, vs. $r = -.23$ without the covariate, respectively). The relation between structured art pattern perception and bullshit sensitivity was also unaffected by the inclusion of CRT performance as a covariate ($r(100) = -.22, p = .030$, vs. $r = -.24$ without the covariate).

4 Study 3

The results of Experiment 2 were consistent with our hypothesis that only illusory pattern perception would be positively associated with bullshit receptivity. Nevertheless, one could argue that chaotic art stimuli did in fact have meaningful patterns present and therefore that our measure of illusory pattern perception was flawed. The primary goal of Experiment 3 was to address this potential criticism by employing two new measures of pattern perception where the presence or absence of a pattern within stimuli was more objective and concrete. For both measures of pattern perception, we predicted that illusory pattern perception would be positively correlated with bullshit receptivity and that this positive correlation would disappear when examining non-illusory pattern perception.

4.1 Method

4.1.1 Participants

A sample of 206 participants was recruited from Amazon Mechanical Turk and received \$2.75 upon completion of a

20-minute online questionnaire. Those who participated in Experiments 1 or 2 were not recruited for Experiment 3.

4.1.2 Measures and procedure

Two new measures of pattern perception were employed in Experiment 3 (order counterbalanced). The first was a modified version of the snowy pictures task (Whitson & Galinsky, 2008). This task consisted of the presentation of 24 pictures, 12 of which contained an embedded object which was difficult to perceive and 12 of which contained only visual noise. For each image, participants were asked whether the image contained an object and responded with either a “yes” or “no” response.

Additionally, participants’ real and illusory pattern perception was also measured using a co-variation task, similar to that used by White (2003). For each item on this task, participants were presented with a single table which contained information regarding twenty fictional patients. For each patient, participants were informed whether the patient ate a meal containing a specific food additive (i.e., Additive A, B, C, or D) and whether or not the patient suffered from a specified disease (i.e., Disease Y). Below the presentation of each table was an item asking participants to what extent they felt that the specified food additive caused an increase, decrease, or had no effect on the occurrence of Disease Y. Participants responded on a -100 (causes great decrease) to 100 (causes great increase) scale using a slider which was anchored at 0 (no effect). This task consisted of four items, one for each food additive, which were presented on separate pages in a randomized order. The true association between the various food additives and Disease Y was such that two food additives shared no association with Disease Y, one food additive shared a positive association with Disease Y ($\Delta P = 0.5$), and one food additive shared a negative association with Disease Y ($\Delta P = -0.5$). As in Experiment 2, following the completion of both pattern perception measures, participants rated the profundity of 20 statements and responded to four CRT items. All instructions, stimuli, and items presented to participants in Experiment 3 can be viewed in the supplementary materials.

4.2 Results and Discussion

4.2.1 Participants

In Experiment 3 we once again removed all participants who had missing data. This intention was registered prior to data collection and analysis. Following this rule, we removed six participants, leaving us with our target sample size of 200 participants.

TABLE 3: Experiment 3 Correlations. (Cronbach's alphas in parentheses).

	M	SD	1	2	3	4	5	6	7	8
1. SPT (Object Absent)	2.32	2.95	(.87)							
2. SPT (Object Present)	9.25	2.28	.46***	(.70)						
3. Error (No Association)	30.93	33.02	.26***	-.02	.					
4. Error (Association)	69.24	36.54	.28***	.12	.43***	.				
5. BSR	2.41	0.92	.26***	.02	.42***	.27***	(.91)			
6. Motivational quotations	3.17	0.80	.15*	.07	.25***	.18*	.59***	(.85)		
7. CRT	1.58	1.31	-.17*	-.02	-.27***	-.14	-.37***	-.22**	(.59)	
8. BS Sensitivity (Var5-Var6)	-0.76	0.79	.15*	-.04	.23**	.13	.57***	-.33***	-.21**	.

Note. Pearson correlations (Experiment 3; $N = 200$). *SPT (Object Absent)* = Responses endorsing the presence of an object in Modified Snowy Picture Task items which did not contain an object; *SPT (Object Present)* = Responses endorsing the presence of an object in Modified Snowy Picture Task items which contained an object; *Error (No-Association)* = Error scores for Covariation items with no association between factors; *Error (Association)* = Error scores for Covariation items with an association between factors; *BSR* = Bullshit Receptivity scale; *CRT* = Cognitive Reflection Test; *BS Sensitivity* = Participants' mean BSR profundity ratings minus their mean motivational quotation profundity ratings. *** $p < .001$, ** $p < .01$, * $p < .05$.

4.2.2 Main findings

The results of Experiment 3 are shown in Table 3. First, as expected, perceiving objects in visual noise during the modified snowy pictures task was positively related with bullshit receptivity, ($r(198) = .26, p < .001$). This association was largely unaffected after adding participants' performance on the CRT as a covariate ($r(197) = .21, p = .003$). Furthermore, correctly perceiving objects in object present items was not related to bullshit receptivity ($r(198) = .02, p = .790$), once again demonstrating a distinction between real and illusory pattern perception as they relate to bullshit receptivity. Similarly, participants' pattern perception judgments were associated with their degree of bullshit sensitivity for object-absent trials, ($r(198) = .15, p = .034$), but not object-present trials ($r(198) = -.04, p = .537$).

Next, for the covariation task, an error score was calculated for each participant for each item type (i.e., association-present and association-absent items). This score was the summation of the differences (transformed to absolute values) between an item's true association and participants' responses. Therefore, higher error scores represented greater illusory pattern perception for association-absent items and a failure to correctly perceive true associations for association-present items. In line with our preregistration, we removed all error score data that diverged from the mean by more than three standard deviations, resulting in the removal of four participants. Consistent with expectations, error scores for association-absent items were positively correlated with bullshit receptivity, $r(194) = .42, p < .001$ and bullshit sensitivity $r(194) = .23, p = .001$. That is, the more participants endorsed an association between two factors when no asso-

ciation was present the more likely they were to rate BSR statements as profound and the less likely they were to distinguish between meaningfully profound and pseudo-profound statements. These relations were largely unaffected by the addition of CRT performance as a covariate ($r(193) = .36, p < .001$, and $r(193) = .19, p = .009$, respectively). Consistent with the results of Experiment 2, we found that error scores for association-present items were also positively correlated with bullshit receptivity ($r(194) = .27, p < .001$). This was not true of bullshit sensitivity, which failed to show a statistically significant relation with error scores for association-present items ($r(194) = .13, p = .070$). Additionally, the relation between error scores for association-present items and bullshit receptivity was shown to be largely unaffected by the inclusion of CRT performance as a covariate in a partial correlation ($r(193) = .23, p = .001$, vs. $r = .27$ without the covariate). Overall, the aforementioned findings support the claim that both perceiving illusory patterns and failing to correctly perceive patterns when they are present is predictive of greater receptivity to bullshit.

5 General discussion

Across three experiments and four distinct measures of pattern perception, our findings provide support for our hypothesis that individuals susceptible to endorsing illusory patterns would be more receptive to pseudo-profound bullshit. Notably, this association was observed for both conceptual and perceptual pattern perception tasks, suggesting that pattern perception may be a useful construct for connecting across conceptual and perceptual illusions. Additionally,

this finding was not merely a consequence of illusory pattern perception being related to a general tendency to rate statements as profound as bullshit sensitivity was found to generally be positively associated with illusory pattern perception. That is, participants who endorsed more illusory patterns tended to judge pseudo-profound bullshit statements as equally (or more) profound than meaningful motivational quotations. Although it should be noted that individual differences in illusory pattern perception may also help explain why some individuals seemingly afford some level of profundity to any and all statements (including those that are pseudo-profound). This is evidenced by our finding that profundity ratings for even “truly profound” motivational quotes also share a positive relation with illusory pattern perception (albeit weaker than pseudo-profound bullshit). Therefore, illusory pattern perception may not represent a mechanism entirely distinct from one put forth by Pennycook and colleagues (2015a) suggesting that a gullible tendency towards ascribing profundity to even the most mundane of statements is one component of bullshit receptivity.

Previous research has found that individuals less likely to engage in analytic thinking are more receptive to pseudo-profound bullshit (Pennycook et al., 2015a; Pennycook & Rand, 2018). We replicate these findings in the current study consistently observing a negative relation between bullshit receptivity and CRT performance. One possibility is that the relation between bullshit receptivity and illusory pattern perception arises simply as a result of intuitive thinkers being more prone to both bullshit receptivity and illusory pattern perception. However, the relation between bullshit receptivity and illusory pattern perception was largely unaffected by the inclusion of CRT performance as a covariate, suggesting that illusory pattern perception may represent a distinct mechanism for explaining individual differences in bullshit receptivity. Nevertheless, the results of the current study do suggest a modest negative relation between CRT performance and illusory pattern perception, such that individuals with a greater tendency to engage in analytical thinking appear less likely to endorse illusory patterns. This finding suggests that the tendency to engage analytic thinking as well as the tendency to perceive illusory patterns may interact in predicting who adopts irrational beliefs. That is, being less likely to engage analytic thinking may make individuals more likely to perceive patterns in random noise while simultaneously leaving them less able to correct for this intuitive perception. This speculation could have interesting implications for research on irrational beliefs that future studies should explore.

Lastly, the results of Experiments 2 and 3 demonstrate that increases in *non-illusory* pattern perception are *not* predictive of increases in bullshit receptivity. In fact, results obtained from two of our three measures of non-illusory pattern perception suggest that participants who perceived more non-illusory patterns were less receptive to bullshit.

Therefore, bullshit receptivity does not appear to be positively associated with a proclivity for endorsing patterns in general. Rather, it is specifically a proclivity for endorsing *illusory* patterns that was shown to share a positive association with bullshit receptivity.

Accounts of various irrational beliefs, including conspiracy, supernatural, and superstitious beliefs, have explained these beliefs in part as arising due to peoples’ natural tendency to uncritically perceive patterns (Kay, Moscovitch & Laurin, 2010; Shermer, 2011; Van Prooijen et al., 2018; Whitson & Galinsky, 2008; Zhao, Hahn & Osherson, 2014). Congruent with these accounts are findings showing that a tendency to endorse illusory patterns is positively associated with various irrational beliefs (Blackmore & Moore, 1994; Van Prooijen et al., 2018; Whitson & Galinsky, 2008; Wiseman & Watt, 2006; although see Blackmore, 1997 and Bressan, 2002). In the current article, we propose a similar account in attempt to elucidate why people are frequently receptive to pseudo-profound bullshit. Specifically, we propose that bullshit receptivity arises in part as an unfortunate side-effect of an otherwise adaptive pattern perception process. Such a perspective is important as, compared to initial accounts of bullshit receptivity which focus on receptivity to bullshit as arising from errors in reasoning (e.g., failing to engage in reflective thinking when encountering bullshit), this account emphasizes distinct ways to potentially reduce peoples’ susceptibility to bullshit. For example, it has been documented that aversive feelings, such as feelings related to a lack of control, increase peoples’ endorsement of illusory patterns. Thus, to the extent that greater illusory pattern perception leads to the creation of meaning where no meaning exists, manipulations that allow people to regain a sense of control should also reduce their susceptibility to bullshit. Congruent with this claim, enhancing people’s sense of control has been demonstrated to lower conspiracy beliefs (Van Prooijen & Acker, 2015; Whitson & Galinsky, 2008).

Finally, related to the concepts examined here (i.e., pattern perception, engagement of analytic thinking, and bullshit receptivity) is the construct of liberal acceptance. Liberal acceptance, or the tendency to collect little evidence and have lower decision-thresholds for making strong judgments, has been discussed as a risk factor for the emergence of various delusions and irrational beliefs, specifically for those suffering from psychosis (Moritz, Woodward, Jelinek & Klinge, 2008). For example, Moritz and colleagues, examining a liberal acceptance account of psychosis, found that patients suffering from schizophrenia were more likely to strongly endorse a false memory on a recognition memory test compared to healthy controls, specifically for weakly or moderately related distractors (as opposed to strongly related distractors for which no differences between patients and controls were observed). One might expect that liberal acceptance would be associated with greater illusory pattern perception, lower levels of analytic thinking, and a tendency

to endorse pseudo-profound bullshit statements as profound. The relation between illusory pattern perception and bullshit receptivity (perhaps compounded by low levels of analytic thinking) could be explained by this concept of liberal acceptance. That is, a person with low decision-thresholds for judging the relevance of infrequent or unrelated events may also be more likely to endorse illusory patterns as well as find meaning in meaningless pseudo-profound statements.

5.1 Future directions and limitations

One limitation of the current study was that, across all three experiments, our pattern perception tasks preceded our profundity judgment task, resulting in potential order effects. However, while one can imagine how profundity judgments may be influenced by first having participants complete a pattern perception task, it is not clear how the predictive validity of our individual difference measures would be affected. Furthermore, a clear limitation of the current study is its strictly correlational nature which prevents support of any causal claims. Thus, while increases in illusory pattern perception may lead to greater bullshit receptivity, it is also possible that the endorsement of pseudo-profound bullshit leads to greater illusory pattern perception or that both of these variables are associated with some unmeasured third variable (e.g., liberal acceptance). Nevertheless, we believe that the more parsimonious model is one suggesting a low-level perceptual process contributing to a higher level conceptual process as opposed to a model suggesting the reverse (i.e., bullshit receptivity influencing pattern perception). This may give some weight to our suggested account however, ideally, a future study would address this limitation by directly manipulating illusory pattern perception in order to investigate the potential causal link between illusory pattern perception and bullshit receptivity. However, successfully manipulating individuals' propensities towards illusory pattern perception in a way that remains influential during individuals' subsequent profundity ratings of pseudo-profound bullshit statements may prove difficult. One potential way to accomplish this goal is through a loss of control manipulation, such that aversive feelings of lacking control have been shown to lead to increases in illusory pattern perception and conspiratorial and superstitious beliefs (Whitson & Galinsky, 2008). Therefore, future research could investigate whether those randomly assigned a task that induces a lack of control more readily endorse pseudo-profound bullshit as profound.

5.2 Conclusion

Like other irrational beliefs, bullshit is a real, prevalent, and consequential phenomenon. Due to this prevalence and potential for harm, the ability to recognize and avoid bullshit is an essential skill to have in today's world. Unfortunately,

initial investigations of peoples' susceptibilities to pseudo-profound bullshit paint a grim picture, with people frequently endorsing profundity in meaningless pseudo-profound statements (Pennycook et al., 2015a; Pennycook & Rand, 2018; Pfattheicher & Schindler, 2016; Sterling et al., 2016). In the current study we propose that, like many other irrational beliefs, people's susceptibilities to bullshit results from an overall adaptive tendency to perceive patterns in the world. We demonstrate that individuals with a proclivity towards endorsing *illusory* patterns are more likely to rate meaningless pseudo-profound bullshit statements as profound. In conclusion, the tendency to go beyond the available data and infuse the world with illusory patterns is positively associated with the tendency to create and endorse meaning in superficially impressive, yet ultimately meaningless, pseudo-profound statements.

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