Distribution Agreement

In presenting this thesis as a partial fulfillment of the requirements for a degree from Emory University, I hereby grant to Emory University and its agents the non-exclusive license to archive, make accessible, and display my thesis in whole or in part in all forms of media, now or hereafter now, including display on the World Wide Web. I understand that I may select some access restrictions as part of the online submission of this thesis. I retain all ownership rights to the copyright of the thesis. I also retain the right to use in future works (such as articles or books) all or part of this thesis.

Katelyn A. Norton April 1, 2020

Skepticism and Open-mindedness: A Large-Scale Investigation of Oberg's Dictum

by

Katelyn A. Norton

Scott O. Lilienfeld
Adviser

Department of Psychology

Scott O. Lilienfeld

Adviser

Jessica M. Barber

Committee Member

Tracy Scott

Committee Member

2020

Skepticism and Open-mindedness: A Large-Scale Investigation of Oberg's Dictum

By

Katelyn A. Norton

Scott O. Lilienfeld

Adviser

An abstract of
a thesis submitted to the Faculty of Emory College of Arts and Sciences
of Emory University in partial fulfillment
of the requirements of the degree of
Bachelor of Arts with Honors

Department of Psychology

2020

Abstract

Skepticism and Open-mindedness: A Large-Scale Investigation of Oberg's Dictum
By Katelyn A. Norton

Given the prevalence of misinformation in society, it is of great importance to identify who may fall prey to misinformation and why. Oberg's dictum is a saying that states that individuals should be moderately open, but that past a certain level, openness may predispose to irrationality. Oberg's dictum suggests a curvilinear relation between openness and unsupported beliefs, whereby high levels of openness are associated with much higher levels of endorsement. Nevertheless, this widely cited principle has never been put to an empirical test. In the present study, I sought to elucidate evidence for Oberg's dictum by examining associations between Openness to Experience and endorsement of unsubstantiated beliefs such as conspiracy theories, pseudoscience, paranormal beliefs, and susceptibility to pseudo-profound bullshit. Additionally, I conducted a factor analysis to examine the two facets of Openness, Imagination and Intellect, to determine whether either would have higher associations with the beliefs. A mixed-gender sample of individuals from North America, Australia, and New Zealand (*N*=565) was recruited via Prolific, an online crowdsourcing platform. I administered multiple self-report measures of openness and measures assessing the endorsement of beliefs.

Consistent with previous research, two factors of Openness were uncovered in a factor analysis. Results suggested that Imagination, but not Intellect, may be a risk factor for endorsement of pseudoscientific beliefs given significant correlations with said measures. Results also suggested that Intellect may be protective against conspiratorial beliefs.

Support for Oberg's dictum was not found, as significant curvilinear trends were not detected. However, future studies should still examine openness and misinformation, examining the theory within different populations and societies.

Skepticism and Open-mindedness: A Large-Scale Investigation of Oberg's Dictum

By

Katelyn A. Norton

Scott O. Lilienfeld

Adviser

A thesis submitted to the Faculty of Emory College of Arts and Sciences
of Emory University in partial fulfillment
of the requirements of the degree of
Bachelor of Arts with Honors

Department of Psychology

2020

Acknowledgements

Firstly, I'd like to thank my adviser, Scott Lilienfeld, for his unfailing support. His guidance and knowledge were paramount to the project.

Next, I'd like to acknowledge the support of my graduate students, Shauna Bowes and Tom Costello, as well as Adele Strother. They were constantly available for assistance and advice throughout the project, for which I am very grateful.

Finally, I'd like to thank my mom, Karen, and all of the friends who encouraged me from start to finish.

Table of Contents

Background

Introduction

The human mind has been dubbed a "belief engine," meaning that individuals tend to initially accept claims rather than dismiss them; the propensity to accept claims psychologically precedes the processes that lead to rejection. Therefore, humans tend to engage in and contribute to confirmation rather than disconfirmation when appraising new information. (Novella, 2018; Gilbert, 1991; Alcock, 1995). A proposed explanation for this tendency is that the mind operates with a Spinozan procedure, meaning that comprehension and acceptance arrive at the brain simultaneously (Gilbert, 1991). Once something is understood, it is quickly accepted, and only afterwards does the potential for disconfirmation arise (Gilbert, 1991). Corresponding with these propensities to readily and uncritically accept information, humans also tend to hold beliefs with high confidence even in the absence of compelling scientific evidence (Alcock, 1995). To battle these natural, yet potentially detrimental, human tendencies, a balance between skeptical scrutiny and openness to new ideas is needed (Sagan, 1987). Skepticism should be employed to protect the mind against erroneous acceptance of beliefs, whereas openness is required to allow new information into the mind.

Oberg's dictum, named after space engineer and historian James Oberg, is a maxim that states that we should keep an open mind, but not so open that our brains fall out (Lilienfeld, Lohr, & Morier, 2001). This principle suggests that there is a transition point at which openness to new ideas becomes dangerous. Moderate amounts of openness may be conducive to critical thinking, and openness is beneficial in order to allow new theories to be tested. If individuals are too open, however, they may fall prey to fake or false information, uncritically accepting

claims that have not been rigorously investigated or tested. This is of particular concern in the current sociopolitical climate, as information—and misinformation—may spread at a previously unmatched rate.

Misinformation is an umbrella term for a range of false, incorrect, or otherwise misleading information. Misinformation takes many forms, namely false or fake news, false sciences (e.g., aromatherapy), and conspiracy theories. All of these examples of misinformation could potentially have significant implications for public policy and education (Ecker, Lewandowsky, Chang, & Pillai, 2014; Kata, 2010). Research has demonstrated the significant ramifications that misinformation can have on memory and eyewitness reports, revealing that once misinformation is encoded in memory, it becomes accurate, truthful information in the mind of the consumer (Loftus, 2005; Rapp, 2016). This suggests that misinformation is not insignificant and that it affects what is true in the mind of an individual once it is recorded in memory. Previous research suggests that many of us are susceptible to misinformation to at least a certain degree. For example, Oliver and Wood (2014) found that over half of assessed Americans endorsed at least one conspiracy theory. Even Nobel Prize winners have endorsed unsubstantiated beliefs, suggesting that intelligence is not protective against these beliefs. Kary Mullis, a Nobel Prize-winning biochemist, argued that HIV does not cause AIDS and that astrology is a valid body of knowledge, and expressed disbelief at the notion of human-made global warming (Lilienfeld, Basterfield, Bowes, & Costello, 2019). Given the extent of varied kinds of misinformation and the wide range of those who may fall for it, Oberg's dictum is of paramount importance in our society; moreover, it has implications for many arenas of life, including academic research, science, and politics.

Astronomer and science writer Carl Sagan (1995) proposed that a judicious mix of openness and skepticism is needed in order to both be open to the advance of science and also to protect oneself against misinformation. A certain amount of openness may be adaptive, as it allows individuals to explore novel ideas and concepts; yet excessively high levels of openness may leave individuals vulnerable to pseudoscientific, fake, or false information. Recent studies have examined individual differences in susceptibility to misinformation, pseudoscience, and false and fake news, as well as systems that could possibly underlie such susceptibility. Given research concerning misinformation and skepticism and noting the seemingly large number of individuals who fall prey to misinformation, it appears prudent to directly examine skepticism and openness. Examining this relationship will lead to the investigation of which individuals are most likely to fall prey to misinformation, if openness as a personality trait may predispose to irrational beliefs, and which types of beliefs are most endorsed when openness levels become too high. Oberg's dictum implies a curvilinear relationship between openness and endorsement of pseudoscientific beliefs—meaning that as levels of openness increase, the endorsement of pseudoscientific and other alternative beliefs will increase exponentially, revealing a quadratic relationship—which the current study aims to examine systematically for the first time.

In the present study, I seek to elucidate the relationship between openness and beliefs in conspiratorial beliefs and beliefs in other largely unsubstantiated beliefs, such as empirically unsupported complementary and alternative medicines, which I examine in this study as they, like pseudosciences, are typically devoid of empirical support. This study intends to fill the gap

in literature concerning the nature of openness' relationship with skepticism and the endorsement of unsubstantiated claims.

Openness

Human personality is widely conceptualized in terms of the Five Factor Model (FFM), or the Big Five (John & Shrivastava, 1999), which is an empirically derived taxonomy of personality traits composed of five higher-order dimensions of personality: openness (e.g., imaginative, daring); conscientiousness (e.g., carefulness); extraversion (e.g., sociable, friendly); agreeableness (e.g., cooperative, polite); and neuroticism (e.g., insecure, self-conscious) (McCrae & Costa, 1987). This model was derived using a lexical analysis of descriptive adjectives relating to personality, which rests on the assumption that the adjectives we use to describe each other can be used to infer the underlying structure of personality (Ashton & Lee, 2005). In early studies concerning the characteristics of general personality traits, thousands of potential personality trait adjectives were examined (Allport & Odbert, 1936). In an attempt to whittle the list down to a more tractable size, Cattell (1943) narrowed this list, ultimately yielding a first approximation of the Five Factor Model. Cattell's variables were further simplified by Fiske (1949), who identified, among other variables, a factor that he called "Inquiring Intellect"—the factor that we now call "Openness".

Although there is no singular definition or agreement of Openness, Openness to Experience reflects "a general tendency toward complexity and flexibility in information processing", while the widely observed traits central to it are openness to experience, imagination, and intellect (DeYoung, 2014, p. 6). Importantly, researchers have hoped to clarify

what it means if an individual is either high or low in openness. Certain arguments posit that openness should not be used solely to infer that an individual is either "closed" or "open", but rather to observe that openness is a continuum of processing experience (McCrae & Costa, 1997). Openness is also generally understood to be a broad conceptualization of individual differences, with factors relating to specific areas in which individuals are relatively more closed or open (McCrae, 1993). Generally, individuals who are more open are "in a constant quest of unfamiliar situations characterized by a high degree of novelty" as opposed to being passive recipients of new experiences (Baer & Oldham, 2006, p. 964). They also seek out the unfamiliar and new (McCrae & Costa, 1997).

While these general conceptions of Openness provide a framework for understanding the aspect of personality, there has historically been difficulty in conceptualizing openness, partly due to its potential multifactorial nature and partly due to contention about the name of the factor. Tupes and Christal followed Cattell's and Fiske's research with eight analyses of Fiske's variables. This research revealed their "Factor V", which mirrored the Inquiring Intellect factor described by Fiske (Fiske, 1949; French, 1953; Tupes & Christal, 1961/1992). They found that Factor V was defined by the traits Socially Polished, Independent-Minded, Imaginative, Cultured, and Esthetically Fastidious (Tupes & Christal, 1961/1992). Although they acknowledged that Factor V was the least clear and most difficult to conceptualize of the five factors, it was a significant factor deserving of its own category. This fifth factor was termed *Intellect or Openness*.

Operationalizing Openness to Experience has historically been challenging, consistent with Tupes' and Christal's (1961/1992) assertion that it is the least clear of the five factors. The difficulty in conceptualizing the Openness dimension of the FFM has also led to the multifarious labels given to this dimension – it has variously been called Openness/Intellect, Openness, or Openness to Experience (DeYoung, 2014; Kaufman et al., 2016). The original labels for the variable, Culture and Inquiring Intellect, were deemed inadequate because although it was first implied that variations in the factor were due to education or upbringing, research disconfirmed this hypothesis (DeYoung, 2014). Instead, the current label and conceptualizations can be attributed in large part to Costa and McCrae, who discovered in their early research that emotional and aesthetic sensitivity, imagination, intelligence, and openness to change covaried (DeYoung, 2014; McCrae & Costa, 1997). They argued that the factor should be called Openness to Experience rather than Openness/Intellect. The possibility of using just "Intellect" as a label was rejected by Costa and McCrae, who argued that Openness was broader than the single underlying ability of intellect. Both openness and intellect share an important part in the conceptualization of this measure, with some of the most prominent measurements of personality such as the Big Five Aspect Scales and the IPIP-NEO containing subscales called Intellect (DeYoung & Quilty, 2007; Johnson, 2014). The two factors are importantly separable because though Openness and Intellect hang together, they do not measure the same aspects of Openness (DeYoung et al., 2014). Adjectives that describe Intellect, which reflects intellectual engagement and perceived intelligence, are *clever* and *philosophical*; on the other hand, Openness, which relates to engagement with aesthetic domains, is described by words such as *fantasy-prone* and *artistic* (DeYoung et al., 2014). These

notable differences between the two factors of Openness makes them distinguishable, but DeYoung et al. (2014) noted that certain words such as *imaginative* and *original* are related to both factors.

Types of Misinformation. This study focuses on three broad categories of misinformation, unwarranted beliefs and thinking styles: beliefs in conspiracy theory, belief in pseudosciences, and propensities toward patternicity and bullshit receptivity. Additionally, actively open-minded thinking, a thinking style characterized by the tendencies to consider outside opinions and examine new evidence, will be assessed, as it relates to Oberg's dictum in that the dictum implies a need to examine evidence and opinions before accepting new theories (Haran, Ritov & Mellers, 2013). Conspiracy theories, pseudoscientific beliefs, and paranormal beliefs, although distinct, are being examined together in this study because they share a defining feature: they are epistemically unwarranted (Lobato, Mendoza, Sims, & Chin, 2014). Preliminary investigations have revealed that participants who endorse one type of unwarranted belief will endorse others, just as individuals who endorse one conspiracy tend to endorse others as well, providing a further basis to examine all three types of misinformation together (Lobato, Mendoza, Sims, & Chin, 2014; Swami et al., 2011; Wood, Douglas, & Sutton, 2012). It was crucial that this study cast a broad net in terms of the types of misinformation and pseudoscience that are examined.

Conspiracy theories. Conspiracy theories are defined as proposed plots by powerful people working together in secret to accomplish a sinister goal (Douglas & Sutton, 2008). Additionally, there are three principles that encompass the nature of conspiratorial beliefs:

first, that nothing happens by accident; second, that appearances are deceiving and therefore things are not as they seem; and third, that everything is interconnected (Barkun, 2003). Conspiratorial events are perceived to be nonrandom; therefore, events perceived through a conspiratorial lens appear carefully designed and do not occur by accident.

Because the human mind is a belief engine, it is hardly surprising that fantastical theories can take hold of the minds of individuals and societies alike. As individuals believe first and may choose to refute new ideas later, and as conspiratorial beliefs are within closed belief systems designed to insulate themselves from refutation, conspiracy theories can easily spread throughout multiple cultures, societies and domains (Novella et al., 2018). Research has shown that individual differences in characteristics such as distrust in authority and powerlessness are associated with conspiracy beliefs (Bilewicz, Cichocka, & Soral, 2015). Given that individual differences of those who endorse these beliefs have been elucidated in previous research, it is reasonable to examine whether other individual differences, such as personality differences, may also be associated with these beliefs.

Research concerning the psychological correlates of conspiracy beliefs is timely and relevant given the high prevalence of conspiratorial ideation in the United States. It may be the inclination of many individuals to assume that only extreme persons and groups believe in conspiracies, yet past research suggests that over half of assessed adults in the United States endorse at least one conspiracy theory (Oliver & Wood, 2014). Conspiratorial ideation is not entirely new, nor is it dependent upon recent events, as studies from more than twenty years ago have also suggested that many studied participants endorsed conspiracy theories, such as

the theory that JFK was not assassinated only by Lee Harvey Oswald (McHoskey, 1995). Beliefs in conspiracy theories may appear benign, but certain conspiracy theories, like vaccine conspiracies, may pose a threat to public health and public policy. Conspiratorial beliefs surrounding vaccines and medicine impact the real-world decisions made by individuals concerning their health and the health of their children, as individuals who endorse vaccine conspiracy theories choose not to vaccinate themselves and members of their family at higher rates than do other individuals (Jolley & Douglas, 2014). Although conspiratorial beliefs often seeming harmless, these beliefs can have dire implications for the lives of individuals. These theories often have an emotional element and stem from circular reasoning; some postulate that conspiracy theories arise from thinking errors, such as the fundamental attribution error, which is the tendency to over-emphasize fringe explanations and neglect situational explanations when evaluating a scenario (Swami & Coles, 2010).

Goertzel (1994) described conspiratorial beliefs as monological belief systems, whereby individuals refer only to themselves for information and ignore context, thereby creating an environment where conspiracy theories are proven or built upon with other conspiracy theories, perpetuating a circular thinking pattern. Beliefs in fictitious conspiracies, conspiracies which are not currently known to be widely endorsed or stemming from a factual historical event, are significantly associated with beliefs in other real-world conspiracies (Swami et al., 2011). Individuals may also endorse mutually exclusive theories about the deaths of famous individuals (such as Princess Diana or Osama bin Laden), suggesting that there is a potential inclination to widely believe many varieties of conspiratorial ideation (Wood, Douglas, & Sutton, 2012). The results of these studies suggest that the best predictor for belief in

conspiracy theories is the endorsement of other theories, which implies that individuals may have the inclination to build a network of conspiracy theory beliefs. A network of conspiracy beliefs may include general theories, specific theories, and conspiracist ideation. Conspiracist ideation can be described as the belief in a vast and international conspiratorial network (Hofstadter, 1966; Swami et al., 2011). Individuals with such a thinking style are more inclined to think conspiratorially.

Although many conspiracy theories appear outlandish and make dubious assertions about the world, they cannot simply be dismissed as the thinking of unwell individuals. Furthermore, not all conspiracies are irrational, as some, like Watergate, turned out to be true (Fenster, 2008). Conspiracy-endorsing individuals are individuals who might be, more strongly than others, predisposed to certain styles of thinking, namely *patternicity* and *agenticity*. Conspiratorial thinkers engage in what Michael Shermer dubbed "agenticity", or the inclination to assume that an intentional, often malevolent, agent is responsible for causing naturally or randomly occurring events (Lilienfeld, 2017; Shermer, 2009). Patternicity, a closely related construct, is the tendency to find meaningful patterns, even when they do not exist (Shermer, 2009). For example, patternicity may be demonstrated by finding patterns in a series of coin flips when coin flips are in fact random; an example of agenticity is hearing a noise in the dark and believing it to be the work of a ghost. The connection between pattern perception and conspiracy theories has been demonstrated in relatively recent studies, where the desire for control, a desire believed to underlie beliefs in conspiracies, distorts objective reality and leads individuals to erroneously identify patterns in random noise (Whitson & Galinsky, 2008). A study more immediately relevant to conspiratorial thinking revealed similar findings: Illusory

pattern perception is a thinking style that accounted for beliefs in the supernatural and conspiracy theories (Van Prooijen, Douglas, & Inocencio, 2017). Given the support shown by these recent studies, it was crucial to measure both conspiratorial beliefs and patternicity in this study, as the potential to examine the tendency to engage in patternicity and agenticity in connection with conspiratorial beliefs.

Pseudoscience. Pseudoscience is distinguishable from true science by four criteria: first, it refers to entities and/or processes outside the domain of science and the falsifiable (e.g. the supernatural); second, it makes use of insufficient methodology; third, it is not supported by rigorous evidence; and finally, it is erroneously presented as scientific knowledge (Fasce & Picó, 2018). Researchers posit that any of the first three items in conjunction with the fourth renders a discipline as pseudoscientific. The precise demarcation line between science and pseudoscience is fuzzy, although there are a few differentiating features. First, science is constituted by methods of inquiry rather than by doctrines (Hansson, 2008). Second, science deals with the realm of the falsifiable, meaning that scientific theories can be refuted and rigorously tested; pseudoscience is often designed in such a way that it cannot be disconfirmed (Bunge, 1984).

Because pseudoscience poses as real science, it has the potential to dangerously misinform members of the public if individuals believe that the pseudosciences have been rigorously assessed and tested as real sciences are. For example, when individuals seek treatment through complementary and alternative medicines, they may forego rigorous and effective treatment that has been scientifically demonstrated to be effective (Allchin, 2004).

Rebirthing therapy, a pseudoscientific treatment that asks patients to reenact their birth to treat disorders, resulted in a child's death in the early 2000s (Josefson, 2001). The scope of pseudoscientific beliefs is widespread, with student samples revealing positive attitudes towards and beliefs in complementary and alternative medicines (Lie & Boker, 2004). By assessing acceptance of such beliefs with openness, Oberg's dictum will be applied to the endorsement of pseudoscientific beliefs to assess whether individuals accept pseudosciences at a higher rate at higher levels of openness.

Paranormal Beliefs. Paranormal events are phenomena that violate basic limiting principles of science. Indeed, the paranormal could be considered in the same realm as pseudoscience, as both lie outside the realm of the falsifiable (Broad, 1953). Paranormal phenomena include belief in spirits and ghosts and belief in witchcraft. Studies have revealed that students in accelerated academic programs demonstrated significantly fewer beliefs in certain paranormal phenomena compared with their peers; this suggests that endorsements of these beliefs may not have positive correlations with intelligence, which some have posited to be a key individual difference in those who endorse these beliefs (Tobacyk & Jones, 1984). Paranormal beliefs, while perhaps not as urgently pertinent as pseudosciences in the scope of what may have ramifications to individuals and the public, are nonetheless related to pseudosciences in that they are non-falsifiable and are not rigorously tested beliefs.

Pseudo-profound bullshit. Pseudo-profound bullshit is defined as communication designed to convey profound or important meaning but is, in fact, devoid of true meaning (Pennycook et al., 2015). An example of a pseudo-profound statement is, "We are in the midst

of a high-frequency blossoming of interconnectedness that will give us access to the quantum soup itself" (Pennycook et al., 2015). The statement may appear profound as it contains complex and lofty words, but upon closer inspection can be seen to be vacuous. Studies concerning this recently coined term have revealed that those susceptible to finding meaning within pseudo-profound bullshit are lower in cognitive ability and less reflective than other individuals (Pennycook et al., 2015). Though research has not yet examined the relation between bullshit receptivity and openness, the less-reflective nature of those who are susceptible to it suggests that it may be useful to examine them in conjunction, as those who score high on openness measure report themselves to be clever and reflective (McCrae, 1987).

Given the propensities of those high in openness to seek out the novel and potentially obscure or peculiar, and taking into account the unfounded and obscure nature of many false, fake and pseudoscientific theories, this study will examine the potential that those high in openness will endorse unwarranted beliefs at a high rate (Baer & Oldham, 2006; McCrae & Costa, 1997). The exact examination between Openness to Experience and the endorsement of unwarranted beliefs has been missing from literature—a gap that the current research seeks to fill.

Current Study

Pursuant to the potential non-linear relationship and the absence of research dedicated explicitly to Oberg's dictum, in this study I examined the relation between openness to experience and endorsement of pseudoscientific, conspiratorial, and pareidolic tendencies in a sample of community members from the United States, Canada, New Zealand, and Australia

(*N*=565). These participants were recruited via Prolific, an online crowdsourcing platform through which community members participate in research studies for monetary compensation. I drew upon multiple measures of both openness and susceptibility to misinformation to examine the robustness of the effects and buffer against mono-operation bias. My primary aim was to investigate the connection between trait openness and the endorsement of pseudoscientific and paranormal beliefs, beliefs in conspiracy theories, beliefs in unsubstantiated medical practices, and illusory pattern perception.

More specifically, in this study of Oberg's dictum, I hypothesize that there will be a curvilinear relation between open-mindedness and the endorsement of pseudoscience, the paranormal, conspiracy theories, belief in complementary and alternative medicines, and illusory pattern perceptions. I also wish to test for a curvilinear relation between openness and the endorsement of beliefs to determine whether extremely high levels of openness may predispose to irrationality. As a secondary aim, I intend to examine the two major facets of Openness, imagination and intellect, to determine if the proposed curvilinear relation is specific to one of the two factors or extends to both.

Methods

Participants and Procedure

Participants were recruited from the community—specifically recruited from the United States of America, Canada, Australia, and New Zealand—via Prolific. Prolific is an online crowdsourcing platform on which community members complete research-related tasks for monetary compensation (*N* = 565). Prolific was chosen as the crowdsourcing platform for this

study over other platforms, such as Amazon's Mechanical Turk, due to a study comparing the naiveté of participants across multiple crowdsourcing platforms, where Prolific participants were more naïve to measures than participants on other platforms (Peer et al., 2017). Because of this potential loss of naiveté, seasoned participants from other platforms could potentially bias the dataset with practice effects (Chandler et al., 2014). The participants completed a wide array of questionnaires that were administered in an electronic format via Qualtrics and were compensated $10 USD for their participation.

Given the length of the survey, I undertook intentional efforts to ensure the quality of the data in the survey. To handle missing data, I excluded participants on a pairwise basis by measure; participant responses missing more than 10% of a given survey were excluded from analyses involving those surveys.

Participants were predominantly female (51.7%). Participants were predominantly white (74.9%), followed by Asian (11.0%) and African American (7.4%). The average age of participants was 34.6 years of age, with participants between the ages of 18 and 72 years old (SD = 11.63). Regarding education level, 36.3% had bachelor's degrees, followed by having completed some college (23.7%) and having a high school education (13.6%). Participants were mainly Christian (37.3%), agnostic (26.4%), and atheist (21.2%). The participants identified as Democrats (43.5%), Independents (20.4%), and Republican (14.7%), with an average political belief strength of 66.3 on a scale from 0-100, with 0 being no political belief and 100 being the strongest political beliefs.

Measures

All participants completed an online battery of self-report questionnaires lasting approximately 90 minutes on average. Internal consistencies (e.g., Cronbach's alpha coefficients) of the openness measures are reported in Table 2.

Openness. Participants completed three self-report measures of openness: the *HEXACO Personality Inventory-Revised* (HEXACO-PI-R; Ashton & Lee, 2009; Lee & Ashton, 2004), the *Big Five Aspect Scales* (BFAS; DeYoung, Quilty, & Peterson, 2007), and the *IPIP-NEO Personality Inventory* (IPIP-NEO; Johnson, 2014). These three measures contain a wider battery of assessments than needed—each of these measures assess other aspects of personality. For the purposes of this study, I only administered the openness subscales. Additionally, participants completed the *Actively Openminded Thinking Scale* (AOT; Haran, Ritov & Mellers, 2013).

The HEXACO-PI-R is a self-report measure of broadband personality that yields scores on six broad personality domains: Honesty-Humility, Emotionality, Extraversion, Agreeableness, Conscientiousness, and Openness to Experience. Given that openness was the facet of interest, only that section of the measure was administered. The HEXACO-PI-R facets of openness include aesthetic appreciation, inquisitiveness, creativity, unconventionality, and altruism (Ashton & Lee, 2009; Lee & Ashton, 2004). Given this study's emphasis on openness rather than an entire personality assessment, only the 32 openness items of the measure were administered. Participants rated their agreement of the statements on a scale from 1 to 5, with 1 being "strongly disagree" and 5 being "strongly agree".

The BFAS is a self-report measure of personality, with its Openness/Intellect subset containing statements relating to two "equally important" aspects of the domain: openness and intellect (DeYoung et al., 2007). As with the HEXACO, only the 20 openness questions of the BFAS were administered; the participants rated their agreement of the statements on the same 1 to 5 scale as the HEXACO.

The IPIP-NEO is a third self-report measure of personality. It contains 24 openness questions rated on a scale from 1 to 5, with 1 being "very inaccurate [as it pertains to me]" and 5 being "very accurate [as it pertains to me]". High ratings on each of the subsections, which include imagination, artistic interests, emotionality, adventurousness, intellect and liberalism, indicate that an individual displays strong or high levels of said category (e.g., if an individual scores highly in the "imagination" category, they have a vivid imagination) (Johnson, 2014).

The AOT is a self-report measure of individual differences in actively open-minded thinking (Haran, Ritov & Mellers, 2013; Baron, 1985). The measure contains 7 questions rated on a 1 to 7 scale of agreement, where 1 is "strongly disagree" and 7 is "completely agree." Actively open-minded thinking is "the disposition to be fair towards different conclusions even if they go against one's initially favored or pet conclusion" (Baron, year unknown). This measure is relevant to the hypotheses because, as Baron describes AOT, "they [individuals] should follow the bumper-sticker maxim: "Don't believe everything you think"" (Baron, 2019 p. 3). Concerning scores on the AOT measure, "high scores… indicate openness to belief change and cognitive flexibility, whereas low scores indicate cognitive rigidity and resistance to belief change" (Stanovich & West, 1997. pp. 347). Given the measure and its relevance to thinking

styles that predispose against misinformation, AOT may be protective against the outcome measures of particularly high beliefs in conspiracies, alternative medicines, and patternicity.

Factor analysis across measures of openness. Given the variance in facets of openness across the measures, I first conducted a factor analysis to examine whether the openness measures are underpinned by two or more dimensions. There is a preexisting basis for this analysis, as researchers previously conducted a factor analysis of 15 facets from the Openness domain (DeYoung, 2014). I conducted a factor analysis of the openness measures in SPSS using a principal axis factor analysis with Promax (oblique) rotation and Kaiser normalization. The scree plot strongly suggested 2 factors. The eigenvalues of these factors were 5.39 and 1.37, respectively, which together accounted for 52% of the total variance (see Table 1 and Appendix 1 for factor pattern matrix and scree plot). Variables with coefficients greater than .500 were used to identify and name the factors. Based on an inspection of their content, the factors were termed *Imagination* and *Intellect.* The first factor was called Imagination because the items that loaded highly onto it were the Big Five Aspect Scales Openness facet, the HEXACO Aesthetic Appreciation facet, the NEO Artistic Appreciation facet, the NEO Imagination facet, and the NEO Emotionality facet. The Big Five Aspect Scales Intellect facet, the HEXACO Inquisitiveness facet, the NEO Adventurousness facet, the NEO Intellect facet, and Actively-Openminded Thinking scale loaded highly onto the second factor, which is why it was called Intellect. Factor scores were saved using a regression-based approach.

Beliefs in Conspiracy Theories. Participants completed three self-report measures assessing beliefs in conspiracy theories, These three measures are the *Vaccine Conspiracy Belief*

Scale (Shapiro et al., 2016), the *Generic Conspiracist Beliefs Scale* (Brotherton, French, & Pickering, 2013), and the *Dead or Alive Contradictory Beliefs* scale (Wood, Douglas, & Sutton, 2012).

The Vaccine Conspiracy Belief Scale is a brief, well-validated measure that asks participants to rate their agreement or disagreement with various statements concerning the safety and efficacy of vaccines (e.g. *Vaccine safety data is often fabricated; People are deceived about vaccine safety)*. The scale is composed of seven statements; participants indicated how much they agreed or disagreed with each statement on a scale from 1 to 7, with 1 being "strongly disagree" and 7 being "strongly agree."

The Generic Conspiracist Beliefs Scale is a 15-item measure that assesses beliefs in broader and, as the name suggests, more generic conspiracy theories. Participants were asked to rate their belief in the truth of the statements on a scale from 1 to 5, with 1 being "definitely not true" and 5 being "definitely true." This measure was constructed to assess individual differences in generic conspiracist ideation (Brotherton, French, & Pickering, 2013). The questions within the measure are general in nature and do not refer to any concrete theory or particular event (e.g. *Groups of scientists manipulate, fabricate, or suppress evidence in order to deceive the public).*

Finally, the Dead or Alive Contradictory Beliefs scale is a 15-item measure assessing contradictory beliefs concerning the deaths of famous figures, namely Princess Diana and Osama bin Laden. Given concerns that the Prolific community sample would have a low average age and would potentially not recall in great detail the deaths of both Diana and bin

Laden, we modified the measure by adding contradictory conspiratorial beliefs surrounding the recent death of Jeffrey Epstein, an American sex offender who died under potentially suspicious circumstances in his jail cell (See Appendix 3 for added Epstein statements). Five conspiracies concerning Epstein were added (e.g. *Jeffrey Epstein faked his own death so that he and Ghislaine Maxwell (his partner) could flee the country together; Jeffrey Epstein was murdered by his former business associates so that they could protect themselves from the criminal justice system).* The participants rated how true they believed each conspiracy to be on a scale from 1 to 10, with 1 being "not at all true" and 10 being "definitely true".

Beliefs in pseudoscience and the paranormal. To assess beliefs in pseudoscience and the paranormal, participants completed three self-report measures: the *Pseudoscientific Belief Scale* (PSEUDO; Fasce & Picó, 2018), the *Complementary and Alternative Medicine Health Belief Questionnaire* (CHBQ; Lie & Boker, 2004), and the *Revised Paranormal Belief Scale* (RPBS; Tobacyk, 2004).

The PSEUDO is a 30-item questionnaire that seeks to determine the level of endorsement of different pseudoscientific theories and treatments, such as neuro-linguistic programming and extra-sensory perception. The scale, created recently, attempts to use only well-founded and well-studied cases of pseudoscience, that is, claims that have been confirmed as pseudoscience (Fasce & Picó, 2018). Participants rated levels of agreement with each statement on a 1 to 4 scale, with 1 being "strongly disagree" and 4 being "strongly agree". Given concerns that some participants may not comprehend all of the statements and theories presented, such as "quantum mechanics," I added a "Do Not Know" option.

The CHBQ is a brief 10-item questionnaire assessing levels of agreement concerning complementary therapies, where participants rate agreement or disagreement with each statement on a scale from 1 (absolutely disagree) to 7 (absolutely agree). Specific therapies, like acupuncture, are not explicitly mentioned in the subset of questions used for this study; rather, the statements are general and refer to complementary theories as a whole (e.g. *Complementary therapies are a threat to public health; most complementary therapies stimulate the body's natural therapeutic powers).*

The RPBS is a 26-item scale that assesses the level of agreement concerning statements about witchcraft, spiritualism, traditional religious belief, psi, superstition, extraordinary life forms, and precognition. Participants rated their level of agreement with each statement on a scale from 1 (strongly disagree) to 8 (strongly agree). A single item (*Mind reading is not possible)* is reverse scored; high agreement with all other statements would indicate beliefs in paranormal phenomena.

Measures of patternicity and bullshit receptivity. I administered four measures that assessed patternicity and bullshit receptivity. They are the *Coin Toss Pattern Perception* measure (Coin Toss; Van Prooijen, Douglas, & Inocencio, 2017), the *Snowy Picture Task* (Snowy Picture; Whiston & Galinsky, 2008), the *Bullshit Receptivity Scale* (BSR; Pennycook et al., 2015), and the *Art Evaluation Task* (ArtEval; Lilienfeld et al., 2019).

The Coin Toss measure provides participants with 10 examples of the results of a coin being flipped ten times in a row. The coin landed either on heads (H) or tails (T). For each series of 10 flips, participants rated the extent to which they saw a pattern. If they believed the

flips to be entirely random, they would indicate a low score (0) and if they believed the flip results were determined, rigged or biased, they would indicate a higher score (6). All coin flips were randomly generated utilizing a randomization website, and therefore there were no predetermined patterns within the sequences (Van Prooijen, Douglas, & Inocencio, 2017). Higher ratings on the measure indicate illusory pattern perception.

The Snowy Picture task contains 24 grainy black and white pictures, twelve of which contained a grainy image which is difficult, but not impossible, to perceive (Whitson & Galinsky, 2008). The other 12 pictures were similarly grainy but did not contain any image. The images were randomized within the original study and participants were asked to indicate whether or not they perceived an image in the pictures, and the level to which they perceived an image on a scale from 1 (not at all) to 6 (very much). This task was included in the study because it demonstrates illusory pattern perception, for participants who indicate the presence of images in pictures which contained only random noise display patternicity. In the current study, I presented the images to participants in the same order that they were presented in the original study to ensure that there was no pattern in the order of pictures that contained or did not contain an embedded image.

The BSR is a 30-item scale that contains statements (e.g. *Hidden meaning transforms unparalleled abstract beauty)* designed to appear profoundly meaningful but which are devoid of any true meaning (Pennycook et al., 2015). Although the statements are devoid of any true meaning, they are syntactically coherent, meaning that they are not nonsensical (Pennycook et al., 2015). The statements, taken directly from the original study, were constructed utilizing

website which constructed meaningless statements with appropriately profound-seeming buzzwords such as "*intrinsic experiences", "living cosmos",* and *"dreamscape".* Participants rated the level of profundity for each statement on a scale from 1 to 5, with 1 being "not at all profound" and 5 being "very profound".

Finally, for the purposes of this study we created the Art Evaluation Task, which is intended to mirror the pseudo-profundity of the BSR. We sourced five images of artwork from the internet and wrote a caption for each work of art (See Appendix 2). These captions were written as pseudo-profound bullshit similar to the statements within the BSR: they contained complex buzzwords but were written without direct or meaningful reference to the actual art images they were "describing" (e.g., *The artistic experience is reduced to the difficult but universal choice between order and chaos*). As with the BSR, participants were asked to rate the profoundness of the captions on a scale from 0 to 4, with 0 being "not at all profound" and 4 being "very profound."

Results

The factor analysis and factor pattern matrix (which displays the partial correlations between each measure and the latent factor) of the Openness measures are displayed in Table 1. The scree plot from the factor analysis can be found in Figure 1, while the eigenvalues and total variance can be found in Table 2. The Big Five Aspect Scales Openness facet, the HEXACO Artistic Appreciation facet, the IPIP-NEO Artistic Interests facet, the IPIP-NEO Imagination facet, and the IPIP-NEO Emotionality facet loaded highly onto Imagination. The Big Five Aspect Scales Intellect facet, the HEXACO Inquisitiveness facet, the IPIP-NEO Adventurousness facet, the IPIP-

NEO Intellect facet, and the Actively Openminded Thinking scale loaded significantly onto Intellect.

The two factors, Imagination and Intellect, were highly intercorrelated (.791), as seen in Table 4. Intercorrelations and Cronbach's alpha values for facets of the openness scales are displayed in Table 3. Each of the openness measures displayed high internal consistency (αs from .73 to .86). Almost every measure was significantly correlated with the others, save for HEXACO Inquisitiveness and NEO Adventurousness, and NEO Emotionality and NEO Adventurousness. All effect sizes for Tables 5, 6, and 7 were interpreted using benchmarks from Gignac and Szodorai (2016), which recommend that correlations of 0.10 be considered small, correlations of 0.20 be considered moderate, and correlations of above 0.30 be considered large in the context of individual differences research.

The zero-order correlations between the Imagination and Intellect factors and the conspiracy measures are shown in Table 5. Imagination was not significantly correlated with any of the conspiracy measures; unexpectedly, the correlations were negative for the Vaccine Conspiracy Scale and the Dead or Alive Contradictory Beliefs scale. The correlation between the Imagination factor and the Generic Conspiracist Beliefs Scale was positive, although not significant. Intellect, in contrast, exhibited small, significant negative correlations with the Vaccine Conspiracy Scale and the Dead or Alive Contradictory Beliefs scale. The significant negative correlations suggest that Intellect may be protective against conspiratorial beliefs, whereas Imagination is not protective against conspiratorial beliefs or conspiratorial thinking styles. To say whether one is protective with certainty, however, a test of the significance of the

difference between dependent correlations between Intellect and Imagination will need to be conducted.

The zero-order correlations between the Imagination and Intellect factors, on the one hand, and the pseudoscientific and paranormal measures, on the other, are displayed in Table 6. Imagination exhibited small positive correlations with the Pseudoscientific Belief Scale and moderate positive correlations with the Complementary and Alternative Health Belief Questionnaire; it was positively, though not significantly, correlated with the Revised Paranormal Belief Scale. Intellect was not significantly correlated with any of the measures; the correlations with the PSEUDO were negative.

Relations between the two factors and patternicity and bullshit receptivity measures are displayed in Table 7. Intellect displayed small negative correlations with the Coin Toss measure, and significant, moderate positive correlations with the Art Evaluation task. Intellect was not significantly correlated with the Bullshit Receptivity Scale, and was negatively, though not significantly, correlated with the Snowy Pictures task, which measures illusory pattern perception. Imagination, in contrast, was not significantly correlated with the Coin Toss and Snowy Pictures tasks. Imagination had small positive correlations with the Bullshit Receptivity Scale and moderate positive correlations Art Evaluation task.

Curvilinearity of factors and measures. In accord with Oberg's dictum, I predicted that there would be a curvilinear relation between openness and the endorsement of pseudoscience, the paranormal, conspiracy theories, belief in complementary and alternative medicines, and illusory pattern perceptions, such that the relation between openness facets and these

outcomes would be especially marked at high levels of openness. The results of curvilinear regression analyses with the two factors, Imagination and Intellect, and the outcome variables are displayed in Table 8. The changes in the squared terms were not statistically significant, meaning that there was little or no evidence of curvilinearity (ΔR^2 values from .000 to .008), hence providing no clear support for Oberg's dictum. There was one finding which indicated significance (the Coin Toss Pattern Perception and Intellect); however, due to the large number of analyses, the finding should be interpreted with caution as it may be due to chance.

Discussion

The primary aim of this study was to examine the relation between openness to experience and the endorsement of unsubstantiated beliefs. More specifically, I sought to examine Oberg's dictum, the hypothesis that openness is an epistemic virtue if present at moderate but not extremely high levels. I did so by examining multiple measures of Openness and measures assessing unsubstantiated beliefs, such as beliefs in pseudoscience, complementary and alternative medicines, and bullshit receptivity (Lilienfeld, Lohr, & Morier, 2001). Actively open-minded thinking, a thinking style, was also assessed, as were pareidolic tendencies. The relations between openness and the outcome measures were examined in a sizeable mixed-gender community sample. To avoid mono-operation bias, I included four measures of openness and multiple measures of endorsement of unsubstantiated beliefs.

Key Findings

Contrary to predictions, the study did not detect the presence of curvilinearity between openness and the endorsements of pseudoscientific beliefs, conspiratorial beliefs, and bullshit

receptivity and pareidolic tendencies. In the absence of curvilinearity, the findings do not offer support for Oberg's dictum, as the dictum implies that extremely high levels of openness would predispose individuals to high endorsement of such beliefs.

The small positive correlations between Imagination and the Pseudoscientific Belief Scale and Complementary and Alternative Health Belief Questionnaire suggest that the Imagination factor, in contrast to Intellect, may be somewhat of a risk factor for pseudoscientific beliefs given that Intellect was not significantly correlated with the measures. Additionally, the finding that the Art Evaluation task, created with the intent of mirroring the Bullshit Receptivity Scale, was significantly positively correlated with both factors whereas the Bullshit Receptivity Scale was only significantly positively correlated with Imagination, suggests that the Art Evaluation measure is somewhat different in its correlates as the BSR.

The study reinforced the presence of two distinct factors within Openness, Imagination and Intellect, consistent with previous research (DeYoung, 2014). Not only was the presence of the two distinct facets of Openness emphasized, but key differences between correlations of Imagination and Intellect were noted. Imagination was significantly correlated with pseudoscientific measures, suggesting that high levels of Imagination may be a risk factor for endorsing certain pseudoscientific beliefs. Additionally, given negative correlations between Intellect and the conspiracy measures, Intellect, not Imagination, may be protective against these beliefs.

Limitations

There were several limitations to this study. First, the participants were recruited solely via Prolific, an online crowdsourcing platform. Although this method of data collection allows for a varied sample, there are limitations to online crowdsourcing platforms, including the potential for participants to devote limited attention to the study given the lack of control over the testing environment (Palan & Schitter, 2018). However, in spite of the general lack of control over the environment, the benefits of amassing such a large and diverse population outweighed the drawbacks of such a platform.

Second, although the sample size was moderately large (*N*=565), a larger sample size would have been ideal to detect potential curvilinear relationships (Grant & Schwartz, 2011). Future studies on this topic that attempt to detect curvilinearity will benefit from a larger sample size.

Future Directions

Research concerning the endorsement of unsubstantiated beliefs remains pertinent given the current sociopolitical climate, especially given that at least one type of misinformation, namely fake news, permeates everyday discussion in the United States (Pennycook & Rand, 2019). Should the fake news trend, as well as conspiracy theories and the creation of new pseudosciences, continue to grow as they have the past years, examining individual differences in those who are susceptible will remain an appropriate topic of study. Findings indicate that those who fall for one type of misinformation are also susceptible to others, suggesting that epistemically unwarranted beliefs may be widespread, at least in certain population subgroups. Studies have also suggested that the tendency to be reflexively open-

minded—accepting of claims without adequate investigation—is a potential individual difference variable that predisposes to such beliefs (Pennycook & Rand, 2019).

The continued pertinence of misinformation in society leads once again to Oberg's dictum, which posits that although Openness is a beneficial trait, too much of it can predispose to irrationality (Lilienfeld, Lohr, & Morier, 2001). Although this study did not find evidence for the curvilinearity suggested in Oberg's dictum, future research should continue to examine Openness, skepticism, and the endorsement of unsubstantiated beliefs to further ascertain who is most susceptible to misinformation and why. A fruitful future endeavor might be to intentionally amass a sample with those who are high in beliefs in unsubstantiated claims and those who have high skepticism concerning unsubstantiated claims. Intentionally sampling those at either "end" of the spectrum—those who very much endorse the beliefs assessed in this study and those who very much oppose the beliefs assessed in this study—may provide a more rigorous test for Oberg's dictum.

Another future endeavor may be to develop more specific measures of open-mindedness, as it is potentially different from openness. Open-mindedness may be more specific to novel ideas and more of a cognitive style rather than a personality dimension, like Openness to Experience. In order to further elucidate the differences between open-mindedness and openness to experience, a future study could separate measures of open-mindedness, such as Actively Open-Minded Thinking, from measures of Openness to Experience, to examine the differences in correlates.

Figures 4 through 17 display the distributions of responses on the measures in the study. The distributions of the conspiracy measures and patternicity and bullshit receptivity measures are positively skewed, particularly the Vaccine Conspiracy Belief Scale and the Coin Toss Pattern Perception measure. In future analyses, it would be useful to utilize more advanced techniques to account for the skewness of these variables.

It should also be noted that the findings from this study are not generalizable to all cultures and societies. Many theories that are considered pseudoscientific in Western cultures, such as complementary and alternative medicines, are widely accepted in countries like China and Taiwan and have been a staple in medical practice for centuries (Lee et al., 2008). The findings of this study are therefore limited to and tempered by the cultures of the participants, who were all located in Western countries. Future expansions into this line of research may take cultural beliefs into consideration when utilizing measures that assume a technique or practice to be pseudoscientific, irrational or unsubstantiated.

References

Alcock, J. (1995). The belief engine. *Skeptical Inquirer, 19,* 14-18.

Allchin, D. (2004). Pseudohistory and pseudoscience. *Science & Education, 13,* 179-195.

Allport, G. W., & Odbert, H. S. (1936). Trait-names: A psycho-lexical study. *Psychological Monographs, 47,* No. 211.

Ashton, M., & Lee, K. (2005). The lexical approach to the study of personality structure: towards the identification of cross-culturally replicable dimensions of personality variation. *Journal of Personality Disorders, 19(3),* 303-308.

Ashton, M. C., & Lee, K. (2009). The HEXACO-60: A short measure of the major dimensions of personality. *Journal of Personality Assessment, 91,* 340-345.

Barkun, Michael. 2003. *A Culture of Conspiracy: Apocalyptic Visions in Contemporary America*. Berkeley: University of California Press.

Baron, J. (1985). *Rationality and intelligence*. New York: Cambridge University Press.

Baron, J. (2019). Actively open-minded thinking in politics. *Cognition, 188,* 8-18.

Baron, J. (year unknown). Assessment of actively open-minded thinking. https://www.sas.upenn.edu/~baron/papers/aotwrefs.pdf

Baer, M., & Oldham, G. R. (2006). The curvilinear relation between experienced creative time

pressure and creativity: Moderating effects of openness to experience and support for creativity. *Journal of Applied Psychology, 91(4),* 963-970.

Berlin, Benjamin. (mid-to-late 1920s). *Figures*.

Bilewicz, M., Cichocka, A., & Soral, W., eds. (2015). *The Psychology of Conspiracy.* Routledge.

Broad, C. D. (1953). The relevance of psychical research to philosophy. In J. Ludwig (Ed.), *Philosophy and parapsychology* (pp. 43- 63). Buffalo, NY: Prometheus.

Brotherton, R., French, C., & Pickering, A. (2013). Measuring belief in conspiracy theories: The Generic Conspiracist Beliefs Scale. *Frontiers in Psychology, 4,* 279.

Bunge, M. (1984). What is pseudoscience? *The Skeptical Inquirer, 9,* 36-46.

Cattell, R. B. (1943). The description of personality: Principles and findings in a factor analysis. *American Journal of Psychology, 58,* 69-90.

Chandler, J., Mueller, P., & Paolacci, G. (2014). Nonnaïveté among Amazon Mechanical Turk workers: consequences and solutions for behavioral researchers. *Behavioral Research Methods, 46(1),* 112-130.

Chashnik, I. (1920). *Suprematism.*

DeYoung, C., Quilty, L., & Peterson, J. (2007). Between Facets and Domains: 10 Aspects of the Big Five. *Journal of Personality and Social Psychology, 93(5),* 880-896.

DeYoung, C. G., Quilty, L. C., Peterson, J.B., & Gray, J.R. (2014). Openness to experience,

intellect, and cognition. *Journal of Personality Assessment, 96(1),* 46-52.

DeYoung, C. G. (2014). Openness/Intellect: A dimension of personality reflecting cognitive exploration. In M. L. Cooper and R. J. Larsen (Eds.), *APA handbook of personality and social psychology: Personality processes and individual differences* (Vol 4, pp. 369–399). Washington, DC: American Psychological Association.

Douglas, K. M., & Sutton, R. M. (2008). The hidden impact of conspiracy theories: Perceived and actual influence of theories surrounding the death of Princess Diana. *Journal of Social Psychology*, *148*, 210-222.

Ecker, U. K., Lewandowsky, S., Chang, E. P., & Pillai, R. (2014). The effects of subtle misinformation in news headlines. *Journal of Experimental Psychology: Applied, 20(4),* 323–335.

Fasce, A., & Picó, A. (2018). Conceptual foundations and validation of the Pseudoscientific Belief Scale. *Applied Cognitive Psychology, 33(4),* 617-628.

Fenster, Mark. 2008. *Conspiracy Theories: Secrecy and Power in American Culture*. Minneapolis: University of Minnesota Press.

Fiske, D. W. (1949). Consistency of the factorial structures of personality ratings from different sources. *Journal of Abnormal and Social Psychology, 44,* 329-344.

French, J.W. (1953). *The description of personality measurements in terms of related factors.*

Educational Testing Service. Princeton, N.J.

Gignac, G. E., & Szodorai, E. T. (2016). Effect size guidelines for individual differences researchers. *Personality and Individual Differences, 102,* 74-78.

Gilbert, D. (1991). How mental systems believe. *American Psychologist, 46(2),* 107-119.

Grant, A. M., & Schwartz, B. (2011). Too much of a good thing: The challenge and opportunity of the inverted U. *Perspectives on Psychological Science, 6,* 61-76.

Goertzel, T. (1994). Belief in conspiracy theories. *Political Psychology, 15(4),* 731-742.

Hansson, S.O. (2017). Science and Pseudo-Science. *Stanford Encyclopedia of Philosophy, Summer 2017 Edition.*

Haran, U., Ritov, I., & Mellers, B. (2013). The role of actively open-minded thinking in information acquisition, accuracy, and calibration. *Judgment and Decision Making, 8(3),* 188-201.

Hartley, M. (c. 1913). *Abstraction: Blue, Yellow and Green.*

Hofstadter, R. (1966). "The paranoid style in American politics." In *The Paranoid Style in American Politics and Other Essays*, ed. R. Hofstader (New York, NY: Knopf), 3–40.

Johnson, J.A. (2014). Measuring thirty facets of the Five Factor Model with a 120-item public

domain inventory: Development of the IPIP-NEO-120. *Journal of Research in Personality, 51,* 78-89.

John, O. P., & Srivastava, S. (1999). The big five trait taxonomy: History, measurement, and theoretical perspectives. In L. A. Pervin, & O. P. John (Eds.), *Handbook of personality: Theory and research* (pp. 102-138). New York: Guilford Press.

Jolley, D., & Douglas, K.M. (2014). The Effects of Anti-Vaccine Conspiracy Theories on Vaccination Intentions. *PLoS One, 9:2.*

Josefson, D. (2001). Rebirthing therapy banned after girl died in 70-minute struggle. *BMJ, 322.*

Kata, A. (2010). A postmodern Pandora's box: Anti-vaccination misinformation on the internet. *Vaccine*, *28,* 1709-1716.

Kaufman, S. B., Quilty, L.C., Grazioplene, R. G., Hirsh, J. B., Gray, J. R., Peterson, J. B., & DeYoung, C. G. (2016). Openness to experience and intellect differentially predict creative achievement in the arts and sciences. *Journal of Personality, 84(2),* 248-258.

Lee, K., & Ashton, M. C. (2004). Psychometric properties of the HEXACO personality inventory. *Multivariate Behavioral Research, 39,* 329-358.

Lee, R. T., Hlubocky, F. J., Hu, Je-Jen., Stafford, R. S., & Daugherty, C. K. (2008). An international pilot study of oncology physicians' opinions and practices on complementary and alternative medicine (CAM). *Integrative Cancer Therapies, 7(2),* 70-75.

Lie, D., & Boker, J. (2004). Development and validation of the CAM Health Belief Questionnaire (CHBQ) and CAM use and attitude amongst medical students. *BMC Medical Education, 6,* 58-63.

Lilienfeld, S. O., Lohr, J. M., & Morier, D. (2001). The teaching of courses in the science and pseudoscience of psychology: Useful resources. *Teaching of Psychology*, 28, 182-191.

Lilienfeld, S., Basterfield, C., Bowes, S., & Costello, T. H. (2019). Nobelists Gone Wild: Case Studies in the Domain Specificity of Critical Thinking. In Sternberg, R., & Halpern, D., (eds). *Critical Thinking in Psychology,* (pp. 10-38). Cambridge University Press.

Lilienfeld, S.O. (2017). Teaching skepticism: How early can we begin? *Skeptical Inquirer, 41:5.*

Lilienfeld, S. O. (2019). Pseudo-profound art evaluation task. *Novel measure created for the purposes of this study*.

Lobato, E., Mendoza, J., Sims, V., & Chin, M. (2014). Examining the relationship between conspiracy theories, paranormal beliefs, and pseudoscience acceptance among a university population. *Applied Cognitive Psychology, 28, 617-625.*

Loftus, E. (2005). Planting misinformation in the human mind: A 30-year investigation of the malleability of memory. *Learning and Memory, 12,* 361-366.

McCrae, R.R. (1987). Creativity, divergent thinking, and openness to experience. *Journal of*

Personality and Social Psychology, 52, 1258-1265.

McCrae, R. R., & Costa, P. T. (1987). Validation of the five-factor model of personality across instruments and observers. *Journal of Personality and Social Psychology, 52,* 81-90.

McCrae, R. R. (1993). Openness to experience as a basic dimension of personality. *Imagination, Cognition, and Personality, 13,* 39-55.

McCrae, R. R., & Costa, P. T., Jr. (1997). Conceptions and correlates of openness to experience. I n R. Hogan, J. A. Johnson, & S. R. Briggs (Eds.), *Handbook of personality psychology* (p. 825–847). Academic Press.

McHoskey, J. W. (1995). Case closed? On the John F. Kennedy assassination: biased assimilation of evidence and attitude polarization. *Basic Appl. Soc. Psych.* 17, 395–409.

Mondrian, P. (1921). *Lozenge Composition with Yellow, Black, Blue, Red, and Gray.*

Mondrian, P. (1940-1941). *Study for a Composition.*

Novella, S., et al. (2018). *The Skeptics' Guide to the Universe: How to Know What's Really Real in a World Increasingly Full of Fake.* Grand Central Publishing.

Oliver, J., & Wood, T. (2014). Conspiracy theories and the paranoid style(s) of mass opinion. *American Journal of Political Science, 58,* 952-966.

Palan, S., & Schitter, C. (2018). Prolific.ac—A subject pool for online experiments. *Journal of Behavioral and Experimental Finance, 17,* 22-27.

Peer, E., Brandimarte, L., Samat, S., & Acquisiti, A. (2017). Beyond the Turk: Alternative platforms for crowdsourcing behavioral research. *Journal of Experimental Social Psychology, 70,* 153-163.

Pennycook, G., Cheyne, J., Barr, N., Koehler, D., & Fugelsang, J. (2015). On the reception and detection of pseudo-profound bullshit. *Judgment and Decision Making, 10(6),* 549-563.

Pennycook, G., & Rand, D. (2019). Who falls for fake news? The roles of bullshit receptivity, overclaiming, familiarity, and analytic thinking. *Journal of Personality, 88,* 185-200.

Rapp, D. N. (2016). The consequences of reading inaccurate information. *Current Directions in Psychological Science, 25(4),* 281-285.

Sagan, C. (1987). The burden of skepticism. *Skeptical Inquirer, 12(1)*.

Sagan, C. (1995). Wonder and skepticism. *Skeptical Inquirer, 19,* 24-30.

Shapiro, G., Holding, A., Perez, S., Amsel, R., & Rosberger, Z. (2016). Validation of the vaccine conspiracy beliefs scale. *Papillomavirus Research, 2,* 167-172.

Shermer, M. (2009). Agenticity. *Scientific American, 300(6)*, 36.

Stanovich, K., & West, R. (1997). Reasoning independently of prior belief and individual differences in actively open-minded thinking. *Journal of Educational Psychology, 89(2)*, 342-357.

Swami, V., and Coles, R. (2010). The truth is out there: belief in conspiracy theories. *The Psychologist, 23(7),* 560-563).

Swami, V., Coles, R., Stieger, S., Pietschnig, J., Furnham, A., Rehim, S., & Voracek, M. (2011). Conspiracist ideation in Britain and Austria: evidence of a monological belief system and associations between individual psychological differences and real-world and fictitious conspiracy theories. *British Journal of Psychology, 102,* pp. 443-463.

Tobacyk, J., & Jones, G. (1984). Paranormal beliefs of high school students. *Psychological Reports, 55*, 255- 261.

Tobacyk, J. J. (2004). A revised paranormal belief scale. *International Journal of Transpersonal Studies, 23(1),* 94–98.

Tupes, E., & Christal, R. C. (1961). *Recurrent personality factors based on trait ratings* (Tech. Rep.). Lackland Air Force Base, TX: USAF.

Tupes, E. C., & Christal, R. C. (1992). Recurrent personality factors based on trait ratings. *Journal of Personality, 60,* 225-251.

Van Prooijen, J-W., Douglas, K. M., & Inocencio, C. (2017). Connecting the dots: Illusory pattern perception predicts belief in conspiracies and the supernatural. *European Journal of Social Psychology, 48(3)*, 320-335.

Whitson, J. A., & Galinsky, A. D. (2008). Lacking control increases illusory pattern perception. *Science, 322,* 115-117.

Wood, M. J., Douglas, K. M., & Sutton, R. M. (2012). Dead and alive: Beliefs in contradictory conspiracy theories. *Social Psychology and Personality Science, 3(6)*, 767-773.

Tables

Table 1. *Factor pattern matrix.*

	Factor 1	Factor 2
BFASINT	-.051	**.785**
BFASOPEN	**.944**	.001
HEXAA	**.651**	.165
HEXINQ	.004	**.581**
HEXUNC	.288	.413
HEXCREA	.352	.364
NEOART	**.806**	.007
NEOIMAG	**.665**	-.069
NEOEMOT	**.553**	-.216
NEOADV	-.130	**.643**
NEOINT	.032	**.790**
NEOLIB	.018	-.331
AOT	-.154	**.521**

Note: BFASINT = Big Five Aspect Scales Intellect aspect; BFASOPEN = Big Five Aspect Scales Openness aspect; HEXAA = HEXACO-PI-R Aesthetic Appreciation facet; HEXINQ = HEXACO-PI-R Inquisitiveness facet; HEXUNC = HEXACO-PI-R Unconventionality facet; HEXCREA = HEXACO-PI-R Creativity facet; NEOART = IPIP-NEO Artistic Interests facet; NEOIMAG = IPIP-NEO Imagination facet; NEOEMOT = IPIP-NEO Emotionality facet; NEOADV = IPIP-NEO Adventurousness facet; NEOINT = IPIP-NEO Intellect facet; NEOLIB = IPIP-NEO Liberalism facet; AOT = Actively Openminded Thinking Scale.

Table 2. *Total variance and eigenvalues of factor analysis*.

	Total	**% of variance**	**Cumulative %**	**Total Rotation**
Factor 1	5.398	41.521	41.521	**4.408**
Factor 2	1.372	10.552	52.073	**4.317**
Factor 3	1.203	9.256	61.329	-
Factor 4	.850	6.537	67.866	-
Factor 5	.784	6.031	73.896	-
Factor 6	.717	5.519	79.416	-
Factor 7	.597	4.453	83.869	-
Factor 8	.561	4.312	88.181	-
Factor 9	.463	3.560	91.741	-
Factor 10	.406	3.121	94.862	-
Factor 11	.279	2.146	97.008	-
Factor 12	.214	1.643	98.651	-
Factor 13	.175	1.349	100.00	-

Note: Extraction method: Principle Axis Factoring.

Table 3. *Intercorrelations among openness facets.*

	BFASI	BFASO	HEXA	HEXI	HEXC	HEXU	NEOIM	NEOA	NEOE	NEOAD	NEOL	NEOI	AOT
BFASI	*.725*	.511**	.427**	.499**	.468**	.431**	.308**	.404**	**.090**	.396**	.121**	.670**	.270**
BFASO	-	*.827*	.725**	.419**	.557**	.518**	.597**	.769**	.369**	.286**	.244**	.566**	.232**
HEXA	-	-	*.828*	.462**	.485**	.407**	.355**	.780**	.232**	.343**	.213**	.506**	.186**
HEXI	-	-	-	*.779*	.338**	.323**	.217**	.353**	.015	.309**	.174**	.415**	.251**
HEXC	-	-	-	-	*.808*	.474**	.447**	.485**	.160**	.423**	.146**	.480**	.153**
HEXU	-	-	-	-	-	*.775*	.474**	.415**	.232**	.275**	.310**	.548**	.289**
NEOIM	-	-	-	-	-	-	*.846*	.413**	.335**	**.099**	.184**	.338**	.121**
NEOA	-	-	-	-	-	-	-	*.797*	.249**	.306**	.184**	.496**	.130**
NEOE	-	-	-	-	-	-	-	-	*.840*	.064	.117**	.163**	**.090**
NEOAD	-	-	-	-	-	-	-	-	-	*.859*	.201**	.447**	.208**
NEOL	-	-	-	-	-	-	-	-	-	-	*.860*	.268**	.381**
NEOI	-	-	-	-	-	-	-	-	-	-	-	*.729*	.311**
AOT	-	-	-	-	-	-	-	-	-	-	-	-	*.799*

Note. bolded= p<.05, ** = *p*<.01. BFASI = Big Five Aspect Scales Intellect, BFASO = Big Five Aspect Scales Openness, HEXA = HEXACO Aesthetic Appreciation, HEXI = HEXACO Inquisitiveness, HEXC = HEXACO Creativity, HEXU = HEXACO Unconventionality, NEOIM = NEO-IPIP Imagination, NEOA = NEO-IPIP Agreeableness, NEOE = NEO-IPIP Emotionality, NEOAD = NEO-IPIP Adventurousness, NEOL = NEO-IPIP Liberalism, NEOI = NEO-IPIP Intellect, AOT = Actively Openminded Thinking Scale.

*Not*e. Italicized along diagonal = Cronbach's alpha (α) indicating the internal consistency of measures.

Table 4. *Correlations between openness factors.*

	Imagination	Intellect
Imagination	1	.791**
Intellect	.791**	1

Note: ** is *p*<.01

Table 5. *Correlations between openness factors and conspiracy measures.*

	Imagination	Intellect
Vaccine	-0.85	-.160*
GCBS	0.89	-.027
Dead/Alive	-.017	-.109**

Note: Bolded is $p<0.001$, * is $p<0.01$, and ** is $p<0.05$.

Vaccine = Vaccine Conspiracy Belief Measure; GCBS = Generic Conspiracist Belief Scale; Dead/Alive = Dead or Alive Contradictory Beliefs

Note: Given that data was excluded on a pairwise basis, numbers ranged from (N=450) to (N=458).

Table 6. *Correlations between openness factors and pseudoscience and paranormal measures.*

	Imagination	Intellect
PSEUDO	.188*	-.020
CAM	.212*	.031
RPBS	.039	.008

Note: Bolded is $p<0.001$, * is $p<0.01$, and ** is $p<0.05$.

PSEUDO = Pseudoscientific Belief Scale; CAM = Complementary and Alternative Medicine Health Belief Questionnaire; RPBS = Revised Paranormal Belief Scale

Note: Given that data was excluded on a pairwise basis, numbers ranged from (N=437) to (N=456).

Table 7. *Correlations between openness factors and patternicity and bullshit receptivity measures.*

	Imagination	Intellect
Coin Toss	-.017	-.093**
Snowy Pictures	.018	-.011
BSR	.150*	-.018
ArtEval	.283*	.175*

Note: Bolded is $p<0.001$, * is $p<0.01$, and ** is $p<0.05$.

Coin Toss = Coin Toss Pattern Perception; Snowy Pictures = Snowy Picture Task; BSR = Bullshit Receptivity Scale; ArtEval = Art Evaluation Task

Note: Given that data was excluded on a pairwise basis, numbers ranged from (N=425) to (N=455).

Table 8. *Model summary of Imagination and Intellect in predicting endorsement of various beliefs.*

	b (β)	SE	95% CI	R^2	ΔR^2	Sig. ΔF
Imagination						
Vaccine	**.20 (.02)**	.41	-.61, 1.0	.003	.001	.626
GCBS	**.78 (.08)**	.52	-.24, 1.8	.013	.005	.137
Dead/Alive	**1.08 (.07)**	.81	-.52, 2.7	.004	.004	.185
PSEUDO	**-.61 (-.02)**	1.3	-3.2, 1.9	.002	.000	.643
CAM	**-.32 (-.04)**	.43	-1.2, .53	.046	.001	.463
RPBS	**.98 (.03)**	1.5	-2.0, 3.9	.036	.001	.521
Coin Toss	**-.51 (-.05)**	.54	-1.6, .55	.002	.002	.348
Snowy Pictures	**-.71 (-.10)**	.39	-1.5, .06	.009	.008	.069
BSR	**-.11 (-.01)**	1.1	-2.4, 2.1	.023	.000	.925
ArtEval	**.02 (.01)**	.18	-.32, .36	.080	.000	.915
Intellect						
Vaccine	**.85 (.09)**	.45	-.04, 1.7	.033	.008	.060
GCBS	**.17 (.01)**	.58	-.97, 1.3	.001	.000	.770
Dead/Alive	**.54 (.03)**	.89	-1.2, 2.3	.013	.001	.544
PSEUDO	**-2.2 (-.08)**	1.5	-5.1, .64	.005	.005	.127
CAM	**-.01 (-.001)**	.48	-.97, .95	.001	.000	.985
RPBS	**.77 (-02)**	1.7	-2.6, 4.2	.001	.000	.654
Coin Toss	**-1.4 (-.12)**	.58	-2.5, -.28	.022	.013	.015
Snowy Pictures	**-.15 (-.06)**	.13	-.41, .11	.003	.003	.245
BSR	**-.51 (-.02)**	1.3	-3.1, 2.4	.001	.000	.696
ArtEval	**-.31 (-.08)**	.20	-.70, .08	.036	.005	.116

Note. Vaccine = Vaccine Conspiracy Belief Measure; GCBS = Generic Conspiracist Belief Scale; Dead/Alive = Dead or Alive Contradictory Beliefs; PSEUDO = Pseudoscientific Belief Scale; CAM = Complementary and Alternative Medicine Health Belief Questionnaire; RPBS = Revised Paranormal Belief Scale; Coin Toss = Coin Toss Pattern Perception; Snowy Pictures = Snowy Picture Task; BSR = Bullshit Receptivity Scale; ArtEval = Art Evaluation Task

Figures

Figure 1. *Factor analysis scree plot.*

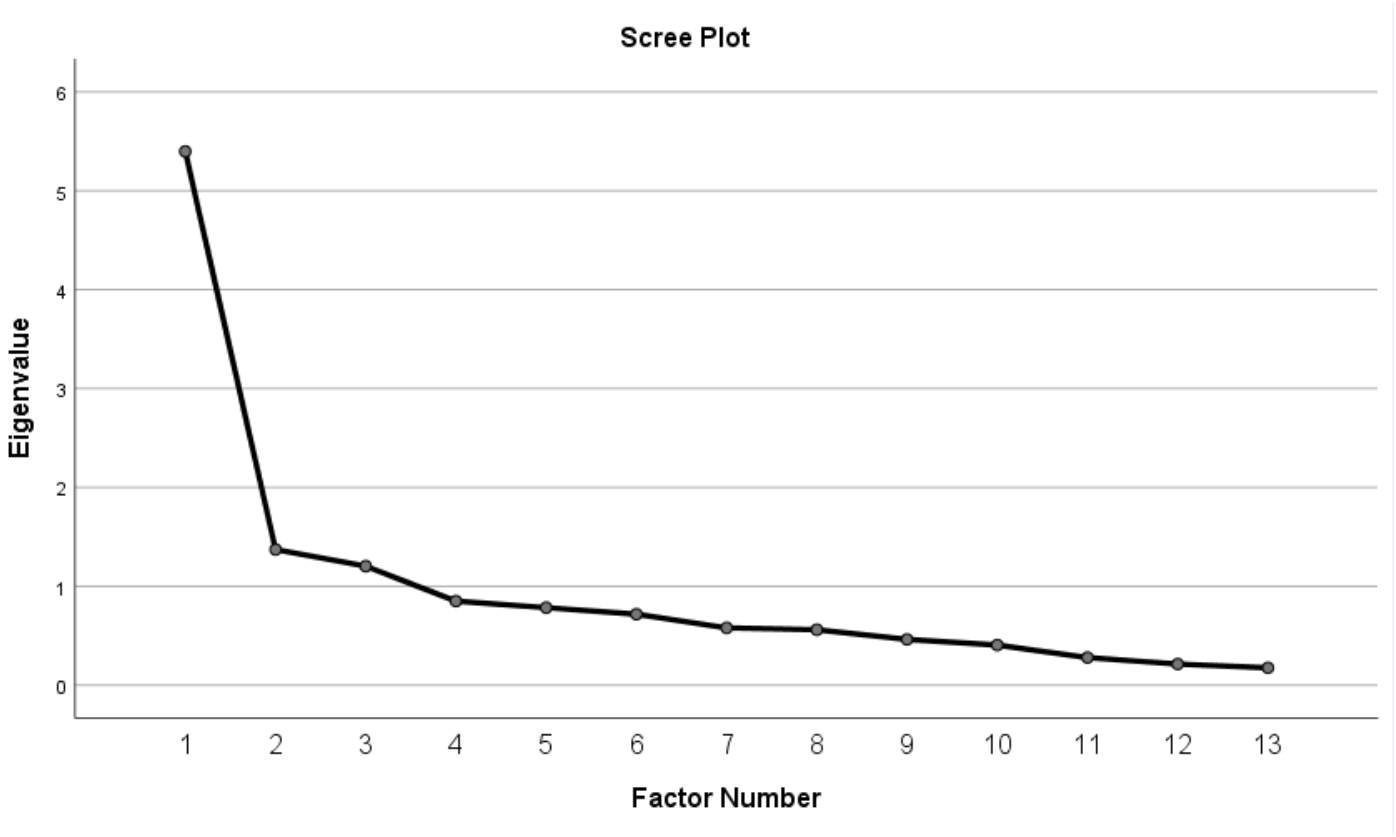


Figure 2. *Novel Art Evaluation Task.*

Novel Art Evaluation Task

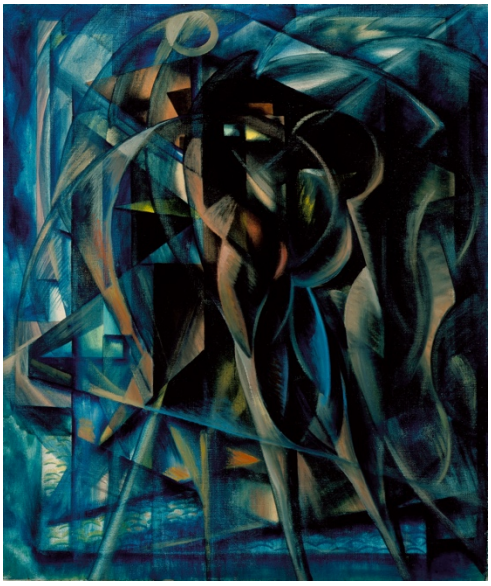
We are interested in how people experience and judge paintings and their descriptions. In this task, you'll find a series of five works of art, followed by statements intended to capture their meaning.

First, we'd like to know how ugly or beautiful you find each painting. Second, let us know how familiar you are with the painting. Third, please read each description and rate how "profound" you think it is. By "profound," we mean, "of deep meaning; of great and broadly inclusive significance". Finally, please rate how well you believe each description captures the painting.

1. How ugly or beautiful do you find this painting? (0 = very ugly; 6 = very beautiful)
2. How familiar are you with this painting? (0 = never seen before; 6 = very familiar)
3. How profound do you find this description of the painting? (0 = not at all profound; 4 = very profound)
4. How well do you think this description captures the painting? (0 = not well at all; 4 = very well)

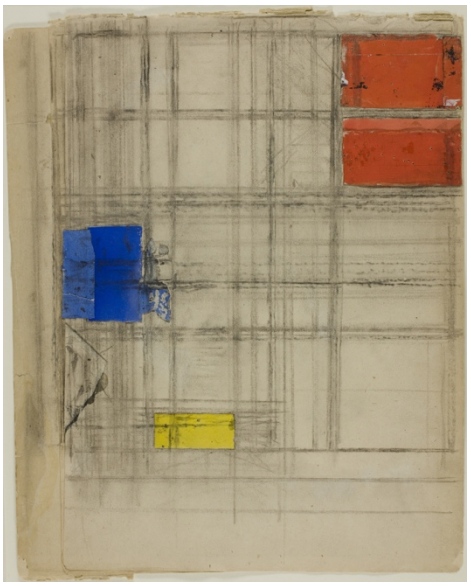
Mondrian, P. (1921). *Lozenge Composition with Yellow, Black, Blue, Red, and Gray.*

As is typical of the artist's late period, this work confronts us with a paradox: striking symmetry of form and equally striking asymmetry of color. Can the two be reconciled, becoming more than the sum of their parts, or are they doomed to compete for our visual attention? Some critics have observed a similar struggle in the artist's other late works, reflecting their deep ambivalence regarding the absurdity of the human condition.



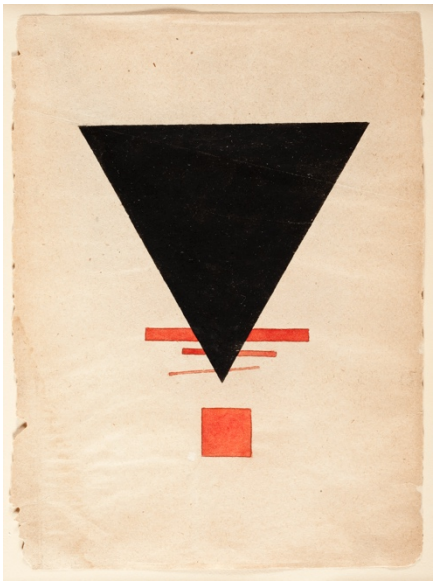
Berlin, Benjamin. (mid-to-late 1920s). *Figures*.

In many respects, this work challenges our core assumptions concerning the very nature of the artistic endeavor. The viewer's visual attention is drawn immediately to the prominent blue lines streaking across the canvas. The artistic experience is reduced to the difficult but universal choice between order and chaos. The hidden artistic meaning is rooted in subjective timelessness.



Mondrian, P. (1940-1941). *Study for a Composition.*

In this painting, the complexity of reality is reduced to its bare bones. By centering primary colors and indistinct lines in the forefront of the piece, the artist throws us a metaphorical curveball. The painting appears mundane at first, perhaps even boring. Upon closer inspection, however, we realize that everything here is unsettled. This painting directly speaks to the intersection of subconscious experience with the ordinary events of day-to-day life.



Chashnik, I. (1920). *Suprematism.*

In this work, we are offered a foreboding vision of the future to come. The presence of sinister darkness on a stark, empty canvas leaves us with an enduring question: Is it possible to be simultaneously aware of all three dimensions of reality? The large triangle hints at a disturbing possibility: that our subjective reality becomes indistinguishable from the permanent loss of consciousness that ensues upon our inevitable demise.

Hartley, M. (c. 1913). *Abstraction: Blue, Yellow and Green.*

These colorful blotches urge us to make a rapid, intuitive decision. Should we direct our attention to them, or to the darker shading behind them? With this choice, there is inevitably a struggle to integrate two incompatible experiences. The conflict is resolved only when we differentiate our choice into a series of infinite decisions, in essence deciding not to decide.

Figure 3. *Additions to the Dead or Alive Contradictory Beliefs Measure.*

Dead or Alive Conspiracies

The following descriptions refer to three prominent individuals that died under mysterious circumstances. Please indicate how true you each think statement is using a 1 (not at all true) to 10 (definitely true) scale.

1. Jeffrey Epstein was assassinated by the FBI in his prison cell to cover-up the FBI's involvement in his crimes.
2. Jeffrey Epstein had actually been dead for years but the government hid this from the public to protect important politicians.
3. Powerful politicians helped Jeffrey Epstein escape from prison and he now is secretly residing on his island, Little St. James.
4. Jeffrey Epstein faked his own death so that he and Ghislaine Maxwell (his partner) could flee the country together.
5. Jeffrey Epstein was murdered by his former business associates so that they could protect themselves from the criminal justice system.

Figure 4. *Distribution of Actively Open-Minded Thinking total scores.*

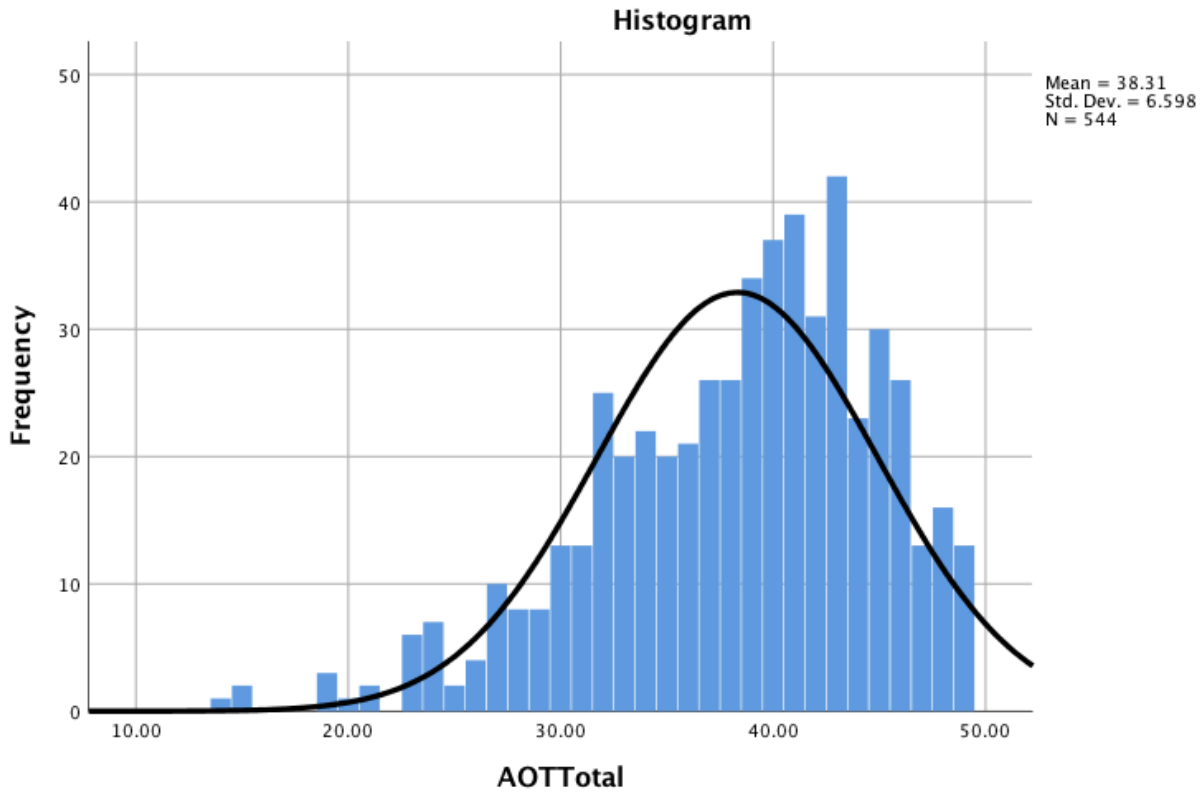


Figure 5. *Distribution of BFAS total scores.*

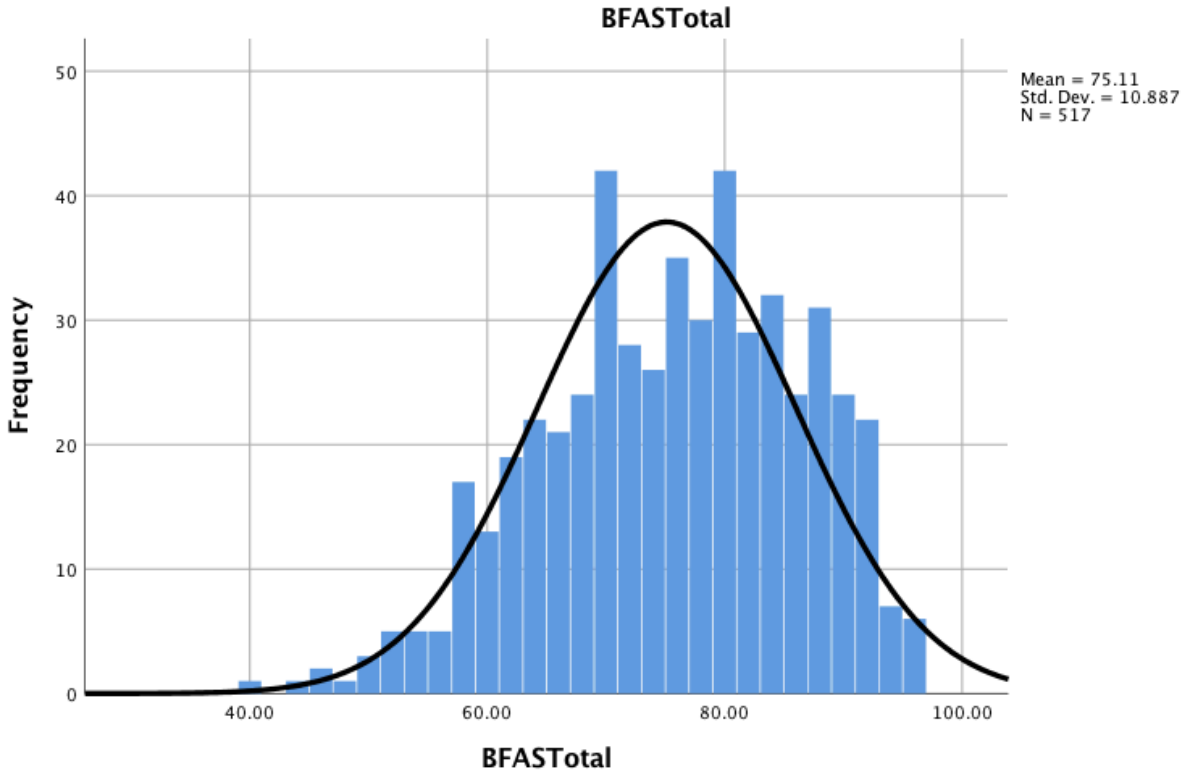


Figure 6. *Distributions of HEXACO total scores.*

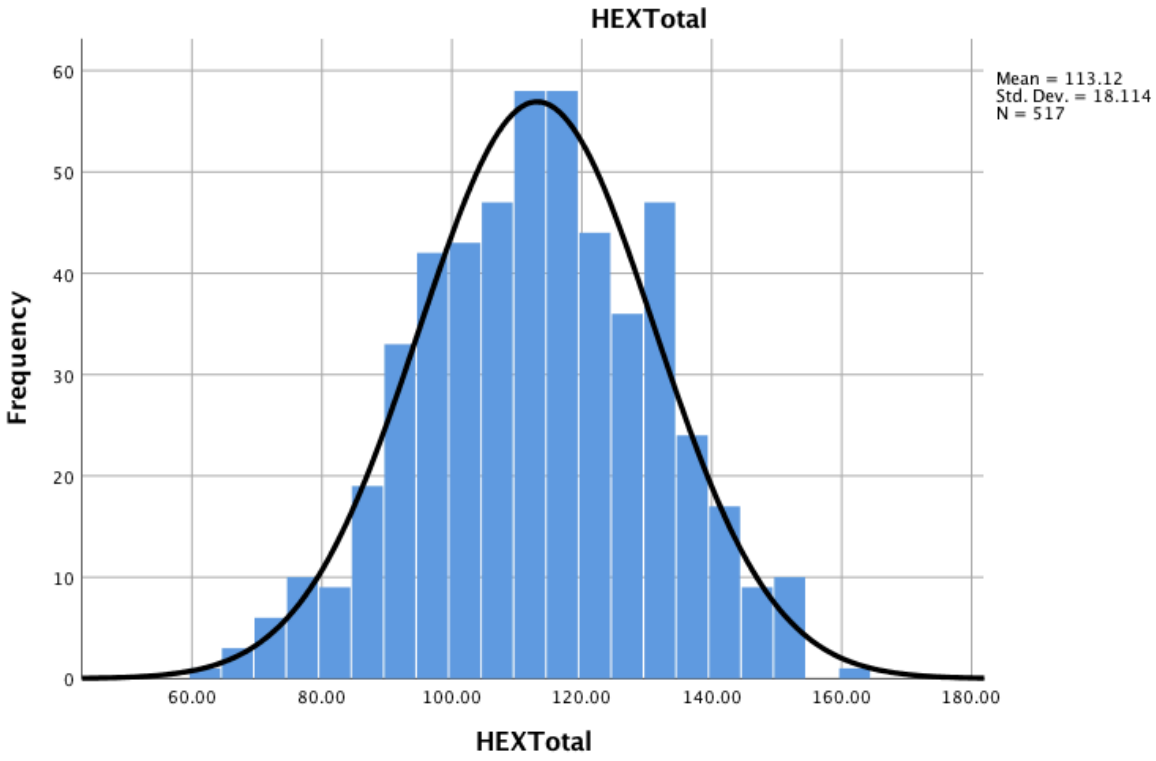


Figure 7: *Distribution of IPIP-NEO total scores.*

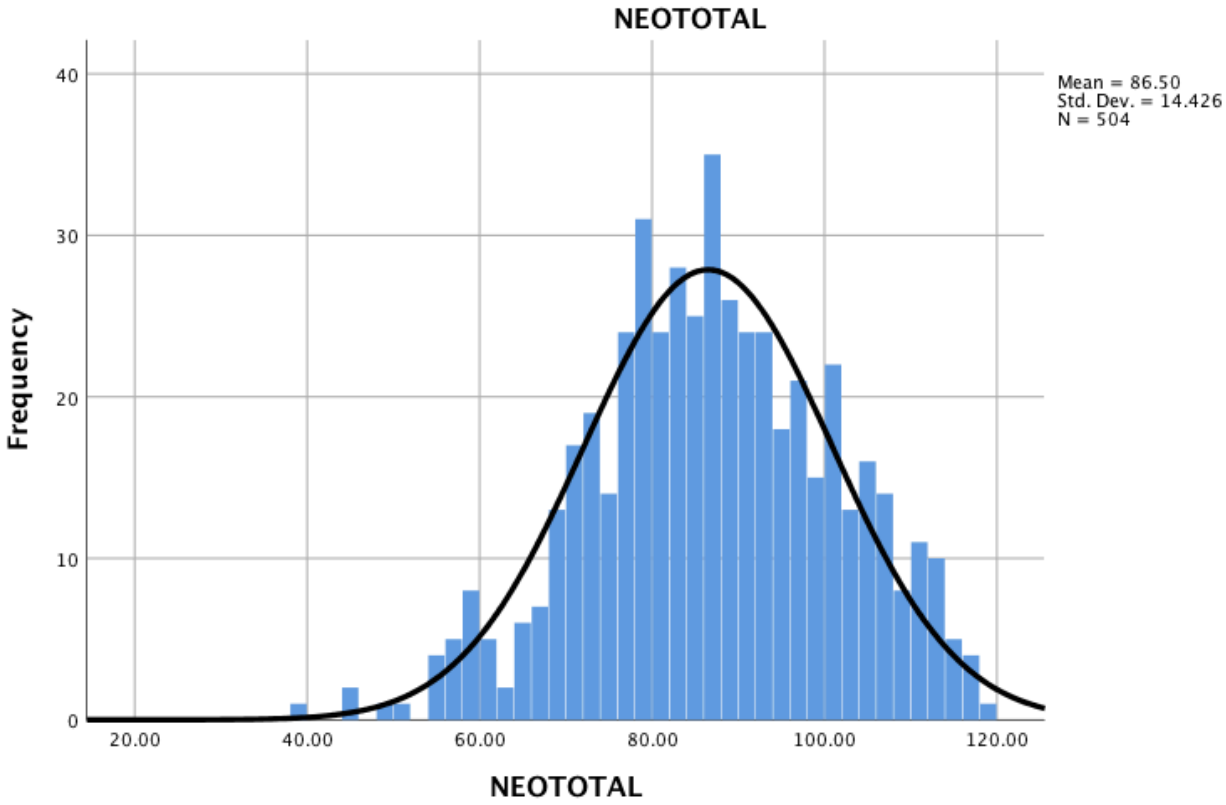


Figure 8. *Distribution of Vaccine Conspiracy Belief Scale total scores.*

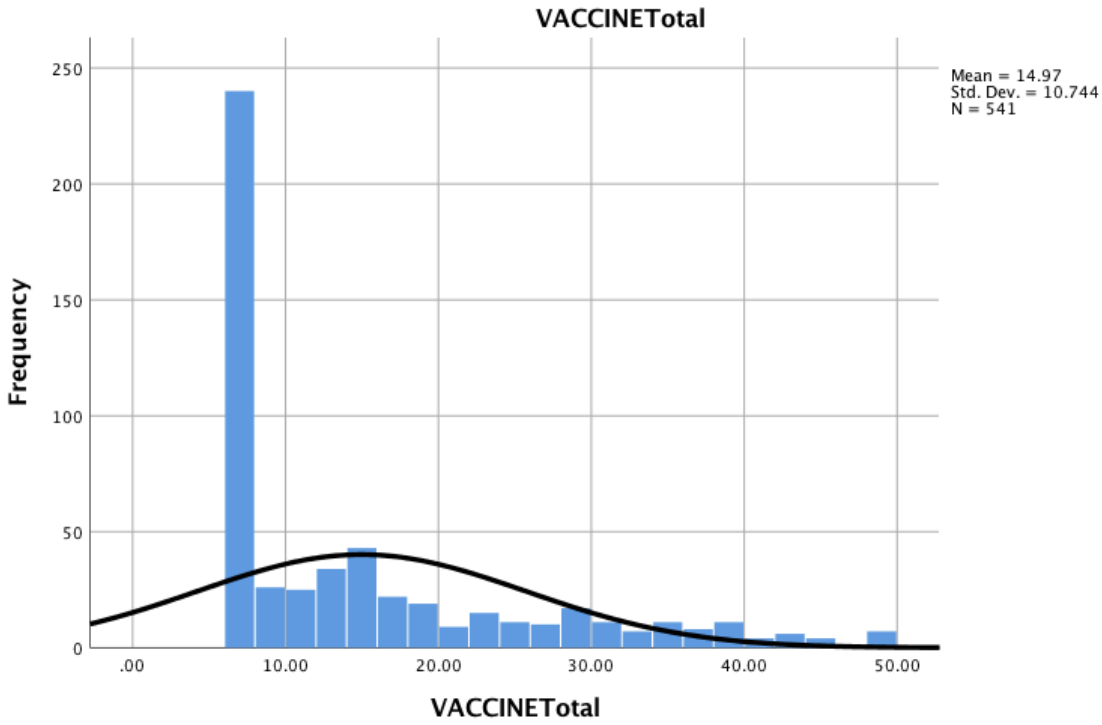


Figure 9. *Distribution of GCBS total scores.*

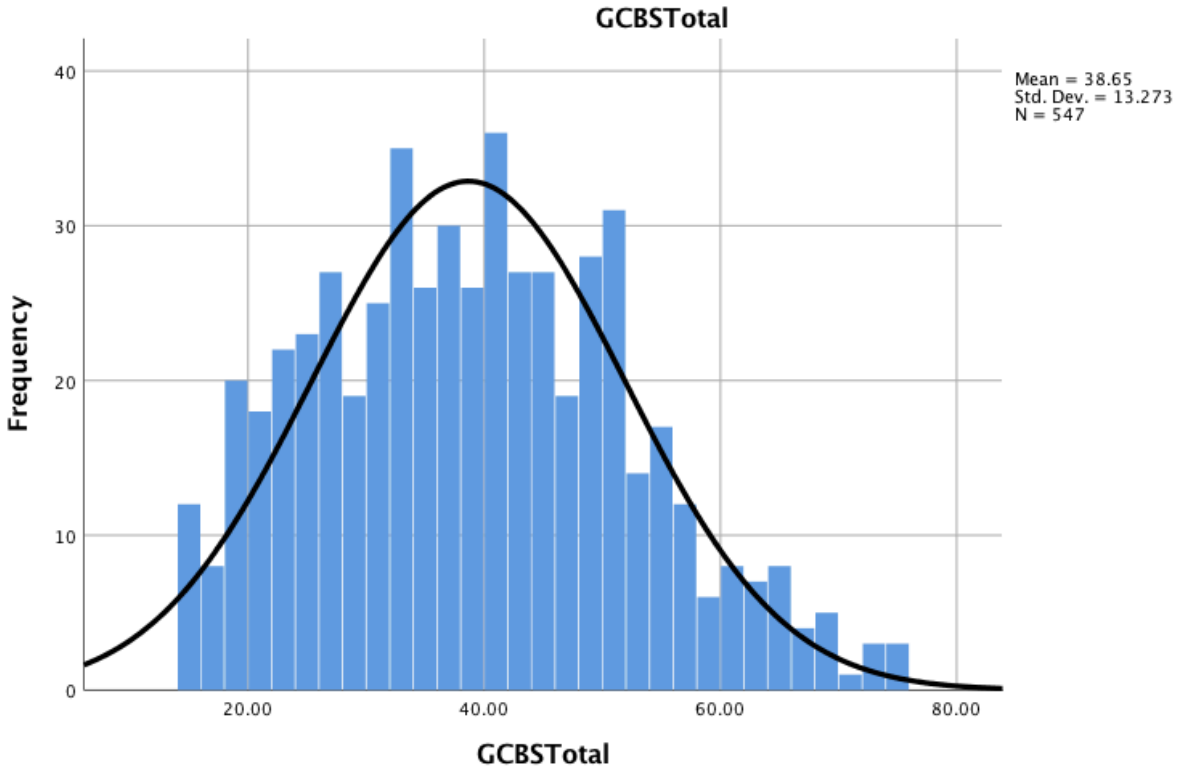


Figure 10. *Distribution of Dead/Alive total scores.*

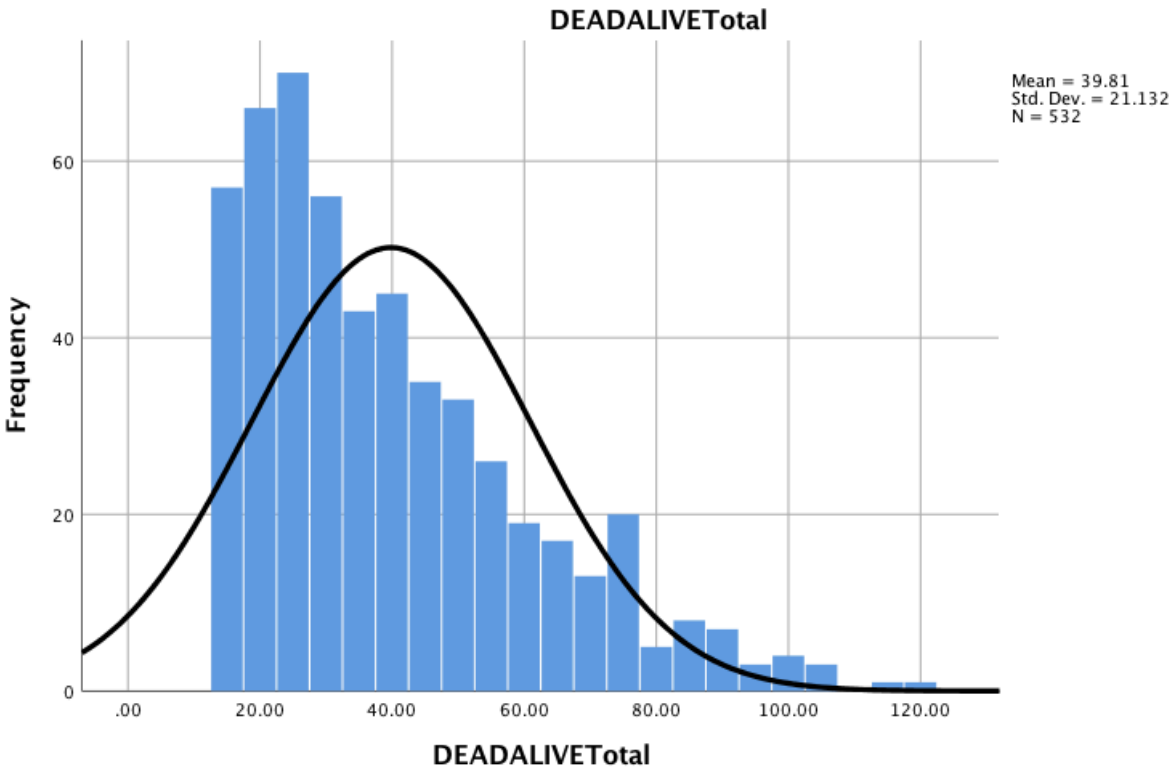


Figure 11. *Distribution of CAM total scores.*

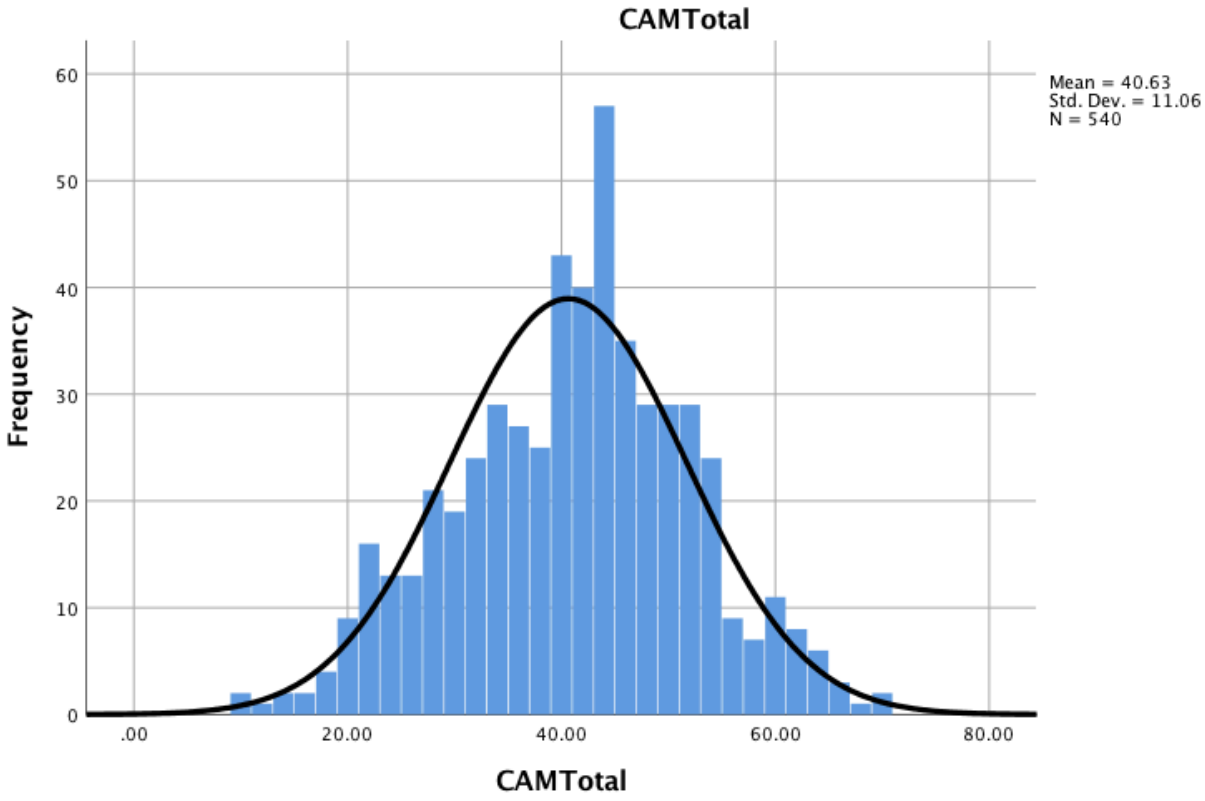


Figure 12. *Distribution of PSEUDO total scores.*

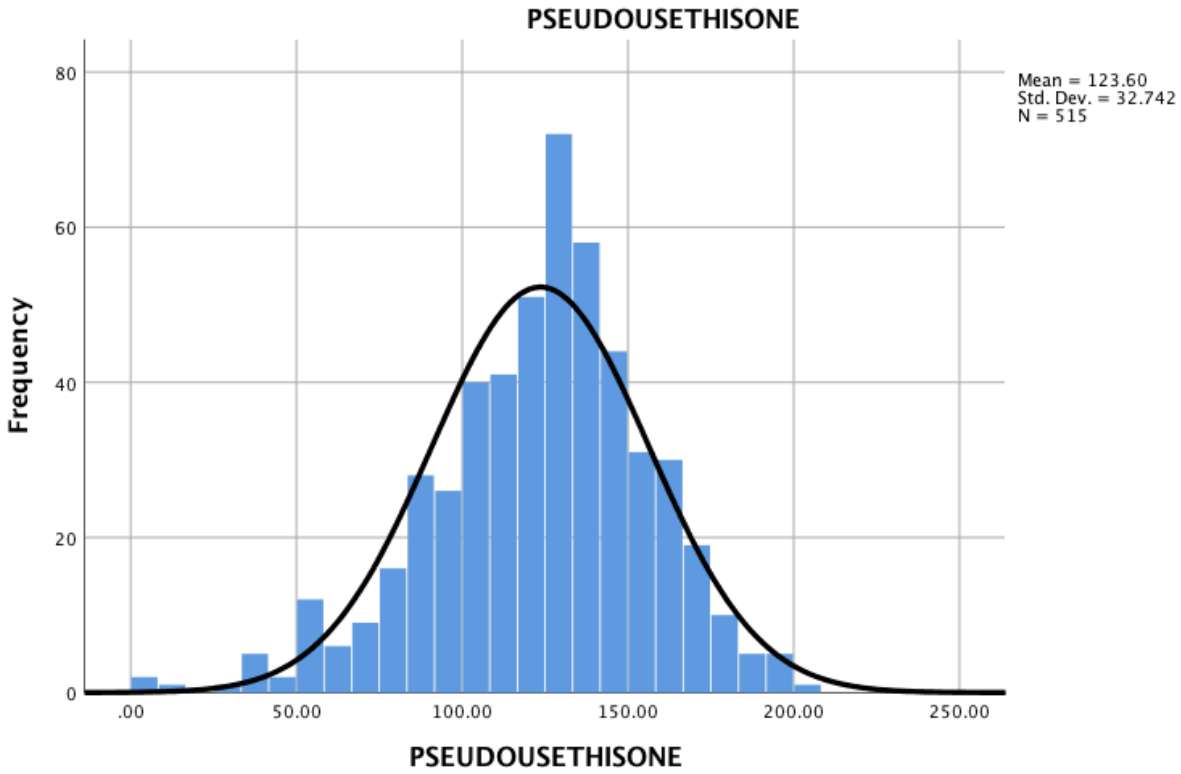


Figure 13. *Distribution of RPBS total scores.*

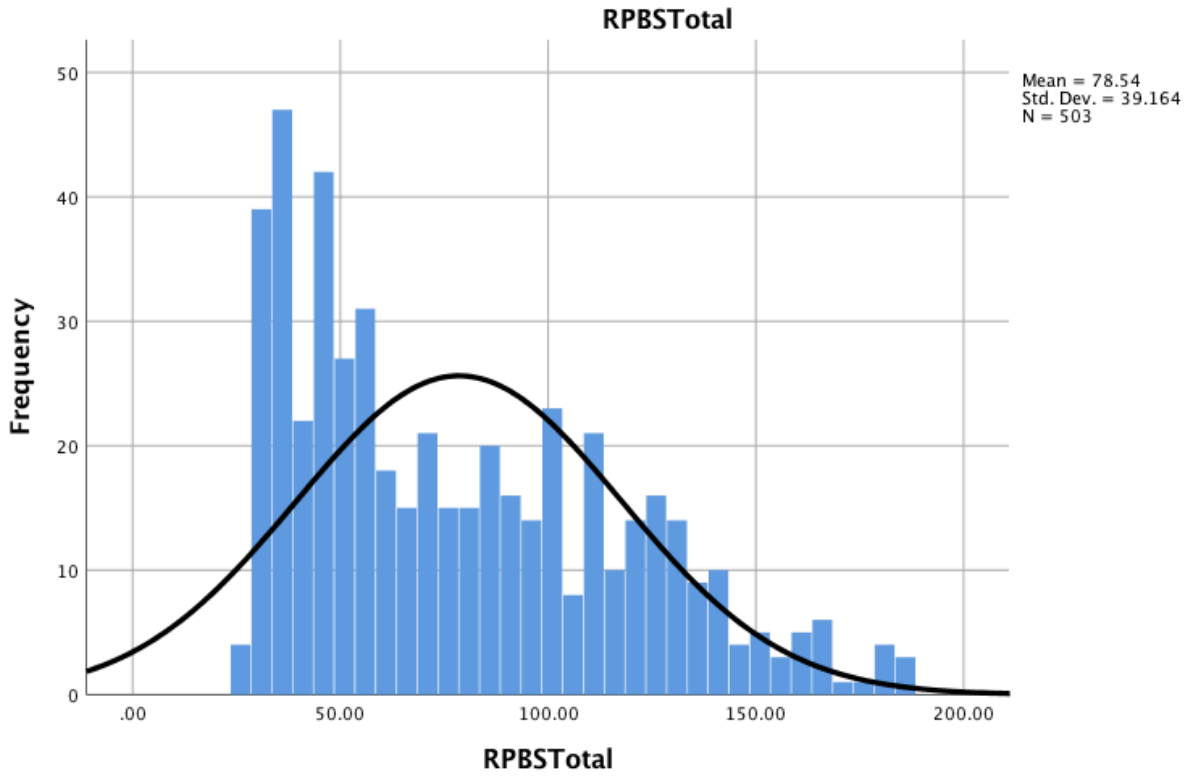


Figure 14. *Distribution of Snowy Picture total scores.*

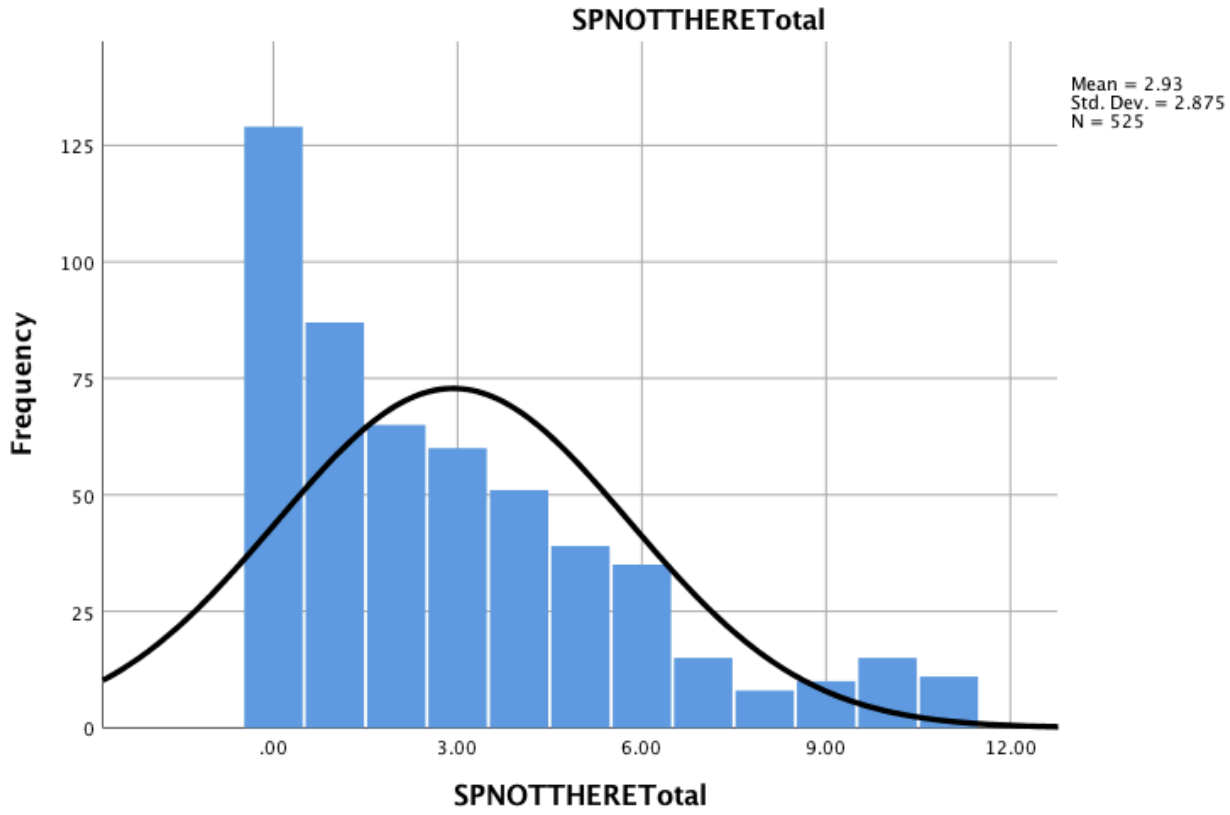


Figure 15. *Distribution of BSR total scores.*

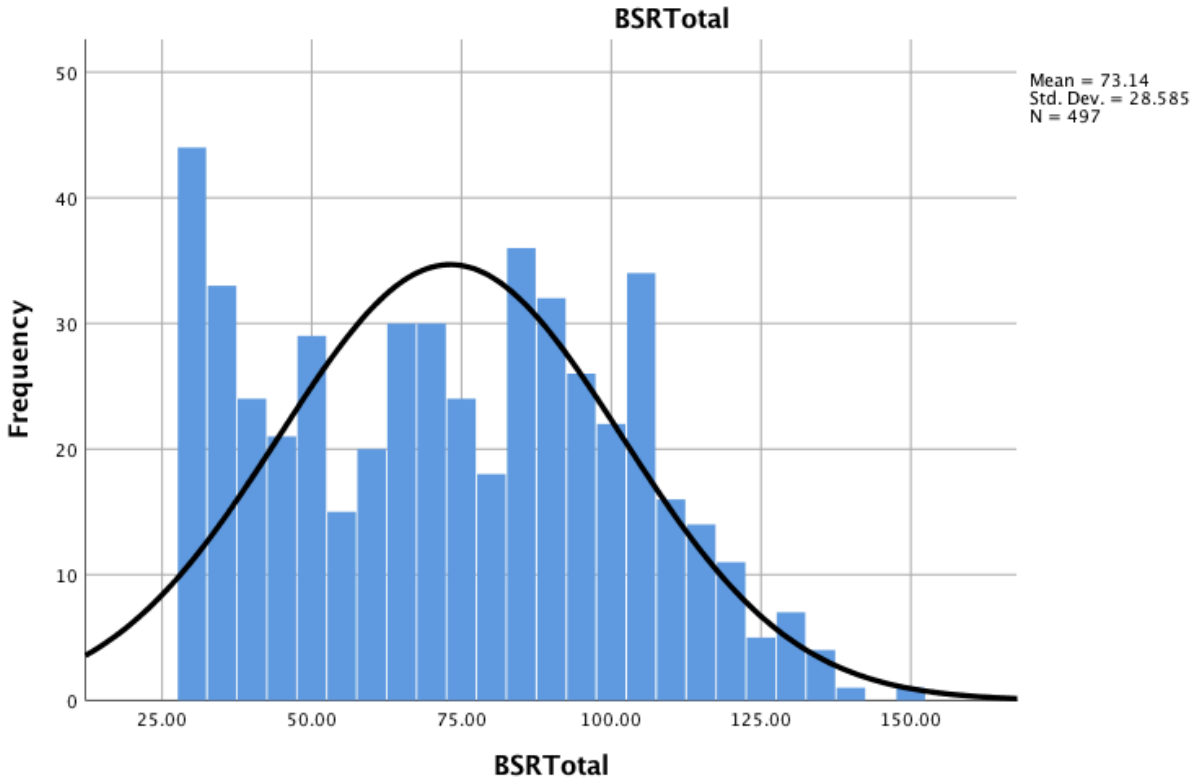


Figure 16. *Distribution of Art Evaluation Task total scores.*

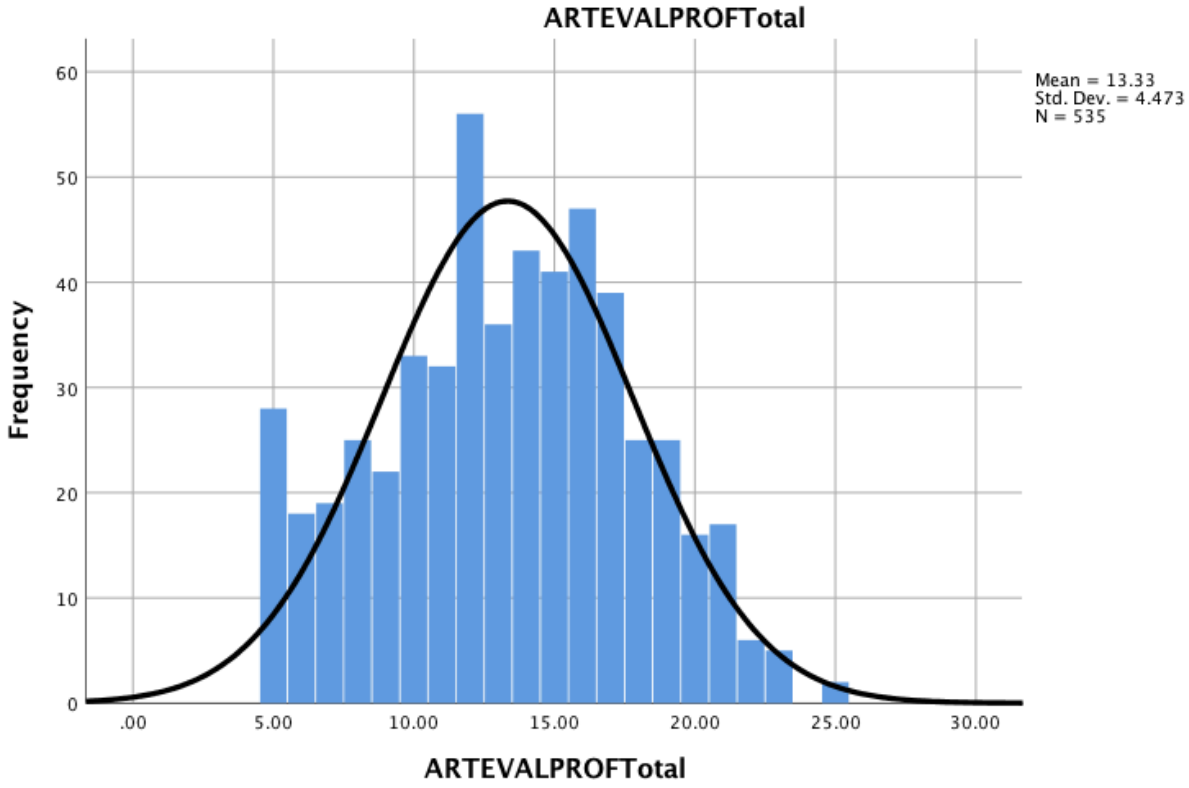


Figure 17. *Distribution of the Coin Toss Pattern Perception total scores.*