Individual Differences in the Evaluation of Online Images

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Abstract

The internet has facilitated the proliferation of misleading and conspiratorial content that has led to increasing distrust in government and other major institutions. Although such content is often textual (e.g. misleading accounts of major events), it is also often accompanied by out-of-context or doctored images that support particular views. Despite many studies into conspiracy theory (CT) beliefs, relatively little psychological research has been conducted to examine whether certain people are more, or less, susceptible to visual manipulations in online environments. This study examined individual differences in the perception of image credibility and how this relates to pre-existing CT beliefs. The study involved participants assigning credibility ratings to images in a 2 fake/real x 2 CT/non-CT related design. A total of 329 online participants were presented with original or highly edited images of real-world scenes: half were CT-related and the other half were not. Performance was measured by the difference between credibility ratings assigned to real vs manipulated images. Consistent with study predictions, individuals with high conspiracy beliefs performed significantly worse in discriminating between fake and real images. This effect was stronger when images depicted CT related content. This research contributes to the limited research related to online visual deception by showing how people who have stronger CT beliefs find it harder to discriminate real from manipulated content.

Keywords: conspiracy theory, image perception, credibility, fake news, social media

Declaration

This thesis contains no material which has been accepted for the award of any other degree or diploma in any University, and, to the best of my knowledge, this thesis contains no material previously published except where due reference is made. I give permission for the digital version of this thesis to be made available on the web, via the University of Adelaide's digital thesis repository, the Library Search and through web search engines, unless permission has been granted by the School to restrict access for a period of time.

Signature:

September, 2020

Contribution Statement

In writing this thesis, my supervisor and I collaborated to generate research questions of interest and design the appropriate methodology. I conducted the literature search, completed the ethics application, and wrote the Qualtrics Survey. I created the sample of manipulated images to be checked by my supervisor and was in charge of conducting a pilot test for all study materials. My supervisor dedicated personal funding provided by the University to recruit the necessary number of participants via the Prolific research platform. I was responsible for all data collection and thesis write-up. Data analysis was conducted with direct supervision.

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Lastly, I'd like to thank the School of Psychology staff who have made this Honours year possible despite great challenges. Seeing how they adapted the course to meet such unprecedented circumstances gave me confidence that I could continue my studies throughout the year. In what has been a very unsettling year for most I have been very glad to have had the stability of my own little project and unwavering support system.

Individual Differences in the Evaluation of Online Images

Fake news refers to the spread of misinformation, hoaxes and satire about well-known events shared primarily through social media platforms (Allcott & Gentzkow, 2017; Anthony & Moulding, 2018). Exploiting the weaknesses of a heavily content focused network, viral propagation of fake news content can have serious consequences at a civic level, from undermining democratic procedures to compromising public health (Lazer et al., 2018; Tandoc, Lim & Ling, 2017). One of the most notable manifestations of online misinformation is the proliferation of *conspiracy theories*, with recent concerns relating to the spread of misinformation regarding the COVID-19 pandemic and the prevalence of vaccine conspiracy theories (Roose, 2020). This has led the World Health Organisation to label the crisis an "Info-demic" (Frenkel, Alba & Zhong, 2020). For these reasons, investigating individual vulnerabilities to misinformation is an increasingly important issue as users turn to social media as their primary news source (Tandoc et al., 2017; Pew Research Centre, 2016). At present, we understand little about the individual factors leading to belief in fake news stories and the role of belief systems in credibility judgements online. This review examines these emerging online phenomena, potential individual differences of importance, and methodological approaches to the study of online conspiracy beliefs.

1.1 Misinformation in Online Environments

Various features of social media sites enable the propagation of fake news or misinformation (Lazer et al., 2018; Rhodes, 2019). Fake stories are not the majority of information posted on social media networks, but they are more rapidly propagated in social contexts than truthful content (Vosoughi, Roy & Aral, 2018). For example, a study by Vosoughi et al. (2018) found that false information was 70% more likely to be retweeted by users than truthful content. Repeated exposure is known to increase the credibility of fake content, irrespective of the veracity of the information as a result of familiarity and fluency

biases (Fielden, Grupac & Adamko, 2018; Pennycook, Cannon & Rand, 2018). Fluency biases explain the tendency for repeated information to be more easily processed and interpreted heuristically to infer accuracy. Similarly, familiarity biases refer to the preference to believe what is familiar to us and easily recognisable. Therefore, increasing exposure to fake news poses a severe risk to misinformation by users.

Additionally, source ambiguity and the growing level of content produced on social media platforms has led to an 'information cascade' whereby users are exposed to an overwhelming amount of information. Facilitated by user generated content, this information cascade makes it more difficult to distinguish between fake from real content online than in the past (Flanagin & Metzger, 2007; Shen et al., 2018). Of growing concern is the development of 'echo chambers' in which users are predominantly shown information that support their pre-existing views. This network feature reduces the likelihood that users will be exposed to information that challenges their predispositions, encouraging polarization of views (Del Vicario et al., 2016). Research shows that even when users are exposed to attitude inconsistent information, if this originates from unfamiliar sources, they are likely to ignore that information (Sunstein, Bobadilla-Suarez, Lazzaro & Sharot, 2016). These effects of information overload and source ambiguity are most strongly exemplified in the development of conspiracy theories.

A *conspiracy theory* (CT) can be described as a set of shared beliefs regarding the cause of an event which is attributed to malevolent power(s) achieving a self-serving goal (Anthony & Moulding, 2019; Georgiou, Delfabbro & Balzan, 2019). The inclusion of social media in everyday life has blurred the lines between mainstream news and conspiracist generated content (Miller, 2002). Additionally, studies show CT beliefs are more likely to be evoked in content rich environments such as those seen on social media (Del Vicario et al., 2016). CTs are viewed as a coping strategy in the face of uncertainty and chaos associated

with significant events (Van Prooijen, Douglas & De Inocencio, 2017). Social media may lead users to be more confused and overwhelmed with the volume of content they receive regarding an event, activating these conspiratorial lines of thought as a compensatory mechanism.

A consistent finding in the literature is that belief in one conspiracy is a predictor of belief in others (Brotherton, French & Pickering, 2013; Swami, Chamarro-Premuzic, & Furnham, 2010; Swami, Voracek, Stieger, Tran, & Furnham, 2014; Uscinski, Klofstad & Atkinson, 2016). It has been proposed that, rather than individuals evaluating each individual conspiracy based on evidence, there are stable psychological traits that reflect the individual's tendency to see the world in conspiratorial terms, labelled *conspiracist ideation* (Swami et al., 2010). Certain individuals are more prone to conspiracist ideation. These individuals perceive causal connections between random events (Swami et al., 2014) often as a way of simplifying reality and resolving uncertainty (Del Vicario et al., 2016; Douglas, Sutton & Cichoka, 2017). The reliance on conspiracies is theorized as a tool to meet certain psychological needs, such as the desire for order, certainty and control (Douglas et al., 2017; Miller, Saunders & Farhart, 2015; Spohr, 2017). These needs are heightened during events that increase individuals' vulnerability or feelings of powerlessness, leading to greater adoption of conspiratorial style reasoning (Swami et al., 2010, 2014). The argument that CT beliefs are a mechanism to regain control is supported by the high levels of CT beliefs among stigmatised minority groups (Van Proojien & Douglas, 2018). Studies establishing conspiracist ideation as an antecedent of belief have shown the predictive validity of these measures for both general and specific CTs (Brotherton et al. 2013; Douglas et al., 2017; Miller et al., 2015; Swami et al., 2010, 2011, 2014; Ucinski et al., 2016). One study showed that conspiracist ideation was able to predict belief in entirely fictional conspiracy theories created by the researcher (Swami et al. 2011).

Another important finding in this area is that conspiracy ideation is a significant predictor of belief in conspiratorial and non-conspiratorial fake news content (Anthony & Moulding, 2018; Swami et al., 2014). Individuals with high CT beliefs tend to be less capable of interpreting fact from fiction in social media stories (Douglas et al., 2017). They are also highly susceptible to confirmation biases, carefully selecting and interpreting information in a way that does not disturb their current worldview (Douglas et al., 2017). Robust findings show conspiracy aligned reasoning is associated with a number of psychological traits such as greater distrust in authority, lower self-esteem and paranormal beliefs (Brotherton et al., 2013; Swami et al., 2010, 2014). Future research is needed to establish the influence of conspiracist ideation on the ability of individuals to process information and the settings in which these beliefs are activated.

1.2 The Role of Visual Stimuli in Online Environments

To date, studies of the relationship between conspiratorial ideation and fake news have focused largely on textual or verbal stimuli. For example, studies have asked respondents to complete validated measures such as the General Beliefs in Conspiracy Scale (GCBS) (Brotherton et al., 2013) or the Beliefs in the Conspiracy Theory Inventory (BCTI) (Swami et al., 2010). Such inventories ask people whether they believe that certain events were engineered by the government or if the authorities act with malevolent intent. However, relatively less attention has been directed towards the role of visual imagery in the development or maintenance of CTs or ‘fake news’.

According to a number of researchers, fake images may play an instrumental role in the reception of news content (Zillman, Gibson & Sargent, 1999; Zillman, Knobloch & Yu, 2001). Such images may also play a significant role in the spread of fake news (Greer & Gosen, 2002; Gupta, Lamba, Kumaraguru, & Joshi, 2013; Morris, Counts, Roseway, Hoff & Schwarz, 2012). This effect occurs because people often view images as more objective

representations of reality than textual content (Gary & Wade, 2005; Zillman et al., 1999) and studies have shown they can influence future behaviour, attitudes and even memory (Sachhi, Agnoli and Loftus, 2007; Wade et al. 2002). Imagery can greatly influence the perceptions of content in news reports, affecting both the short- and long-term memory of readers (Paivio, Rogers & Smythe, 1968; Zillman et al., 1999). Moreover, images serve as a powerful storytelling tool and lead to more selective reading of news content (Knobloch et al., 2003; Zillman et al., 2001). Popular social media platforms such as Twitter, Facebook and YouTube are increasingly dominated by visual content such as images and videos, transforming public discourse and social communication (Spohr, 2017). Not only do images consolidate textual information, but they can also convey a large body of information instantaneously and have become a highly strategic form of communication online (Russmann & Svensson, 2020).

Given the importance of visual imagery in potential development of fake news or CTs, an important psychological question is whether certain people might be more responsive or influenced by visual images than others. In general, the literature shows that people are poor evaluators of image authenticity (Farid, 2006), with studies repeatedly showing that individuals can only distinguish real from fake at levels just above chance (Chandakkar & Li, 2020; Nightingale et al., 2017; Shen et al., 2018). As digital imaging technology has become more accessible and sophisticated, doctored images are increasingly difficult to detect (Popescu & Farid, 2005; Stirk & Underwood, 2007). However, relatively little is known about individual differences in the perception of visual manipulations and susceptibility to fabricated images (Chandakkar & Li, 2020; Farid & Bravo, 2010). Studies of image manipulation have shown people are remarkably nonreceptive to changes in light and cast shadows of objects (Ostrovsky, Cavanagh, & Sinha, 2005), addition or subtraction of objects (Kasra, Shen & Obrien, 2018) and physically implausible changes to real world scenes

(Nightingale et al., 2017). Nightingale et al. (2017) proposed that instead of looking for objective signs of image tampering, individuals try to match the image to their expectations to reach a decision regarding authenticity. This flawed pattern of reasoning results in individuals often missing large cues to image manipulation.

1.3 Individual Differences in the Ability to Process Visual Images

One particular factor that might be important in the processing of images are attitudes and emotional states (Whitson & Galinsky, 2008). In their research, Whitson and Galinsky (2008) demonstrated that experimental conditions designed to illicit a lack of control resulted in increased *illusory pattern perception* by participants, with individuals perceiving images in static where none existed. The same study showed that a lack of control was a significant predictor of CT belief, leading the researchers to suggest pattern perception and conspiracy ideation are both a method of regaining certainty and control in the face of ambiguity. Whitson and Galinsky (2008) focused on one form of visual pattern perception, but it is yet to be established whether similar results would be seen in visual detection tasks based on real world images, such as those frequently encountered on social media.

Other individual differences have been examined in the context of visual perception and media credibility. These have included social media use (Shen et al. 2018), attitudes towards digital manipulation (Greer & Gosen 2002; Kasra et al., 2018) and interest in photography (Nightingale et al., 2017). For example, Greer and Gosen (2002) showed that familiarity with technology and social network platforms is associated with media credibility evaluations. The greater experience people have with a medium, the more likely they are to be aware of the associated risks and apply a more thorough inspection to assess credibility of content (Flanagin & Metzger, 2007; Zubiaga & Ji, 2014). This finding is also evident in phishing email studies which show that those who are more familiar to digital technology are more aware of potential deception strategies (Pattinson, Jerram, Parsons, McCormac, &

Butavicius, 2012). Another study by Flanagin & Metzger (2007) on credibility judgements online found that individuals who are more sceptical have higher self-reported verification behaviours, however are not necessarily more accurate in their evaluations of site verity. These results suggest that while internet experience may be related to attitudes regarding the credibility of web-based content, it is unclear whether this translates into superior performance in assessing the authenticity of information. In contrast, Morris et al. (2012) showed that higher twitter use was negatively correlated with performance in credibility judgements, consistent with research showing frequent social media users are overconfident in their ability to analyse information credibility (Breakstone, Smith & Wineburg, 2019). Therefore, it is unclear whether experience with a medium and awareness of potential deception strategies provides a significant protective role in credibility judgements online.

Additionally, high social media users may be more susceptible to the impacts of confirmation biases seen in online searches which enhance the selective exposure of users to attitude consistent information. Social media algorithms designed to personalise content leads to users being exposed to greater levels of attitude consistent information, which is known to increase attitude strength regardless of the credibility of sources (Knobloch-Westerick, Johnson & Westerick, 2014). This initial result suggests that when information online is consistent with an individual's pre-existing attitudes or beliefs, the credibility of the source is less influential on whether the message is adopted by the user.

More broadly, those with higher digital media skills have been shown to more critically judge the authenticity of images (Kasra et al., 2018; Shen et al., 2018). Shen et al. (2018) suggests that those familiar with photography are potentially more aware of the manipulation techniques possible through digital editing software and are more likely to judge fake images as less credible. However, it is difficult to ascertain whether skilled participants are generally more sceptical of images or if they are better equipped to judge

their veracity. Nightingale et al. (2017) looked at both real and fake images and found interest in photography to be a weak predictor of ability to detect manipulations in real world scenes. As such, it could be reasoned that rather than photography experience influencing credibility, scepticism towards image authenticity may mediate this relationship with credibility judgements.

Scepticism has been established as a potential protective factor against misinformation in online settings (Aribarg & Schwarz, 2019; Obermiller & Spangenberg, 1998). Studies on native advertising on social platforms show high levels of scepticism can encourage more accurate appraisals of website trustworthiness (Aribarg & Schwarz, 2019; Lee, Kim & Ham, 2016). This can affect the types of content participants access and share, and how likely they are to be persuaded by the content they see. However, levels of scepticism can be context-specific, selectively triggered in certain types of environments (Van Prooijen et al., 2017). For example, users who are generally receptive and trusting of news content they receive in traditional print media may be selectively suspicious of news content received online. Individuals are generally more critical of information inconsistent with their pre-existing beliefs (Taber & Lodge, 2006) as a form of confirmation bias. Specific investigations of people's reaction to visual images show that trustworthiness and general scepticism play an important role in the perceived credibility of images (Shen et al., 2018). However, a limitation of Shen et al. (2018) is that they only examined false images, so it was not possible to examine whether variations in scepticism affected image discrimination. Highly sceptical people may regard all images as fakes and so it is important to examine whether they show good discrimination through the employment of a combination of fake and real images.

Studies have also examined the nature of decision-making or the implied depth of information processing and whether people who make more rapid decisions might be less

likely to detect false images. Measures of cognitive *impulsivity* such as the Cognitive Reflection Test (CRT) have shown predictive validity in similar studies of online credibility (Pattinson et al., 2012). Those who have high impulsivity are less likely to take deliberate and careful appraisal of visual content and are more likely to make decision making errors (Lee, et al., 2016). Studies on image credibility show that participants who take a more patient consideration of an image are more critical of image veracity (Nightingale et al., 2017). Therefore, it is intuitive that highly impulsive individuals are less likely to carefully evaluate the veracity of images online and more likely to incorrectly distinguish between false and real.

A final factor is the potential role of pre-existing belief structures. Pre-existing beliefs have been shown to influence appraisal of image credibility (Kasra et al., 2018; Shen et al., 2018), with individuals showing motivated reasoning to believe images that align with their beliefs or expectations (Brotherton et al., 2013; Douglas et al., 2017; Nash, Wade & Brewer, 2009). Kasra et al. (2018) found individuals purposefully search for cues of manipulation in images due to pre-existing dispositions regarding the authenticity. They studied six doctored images of varying context, with pro-issue attitude a significant predictor of image credibility scores. When participants supported the issue depicted in the image, such as a photo of a same-sex couple with a child, they showed significantly more positive credibility ratings for that image. These findings are consistent with previous research demonstrating that individuals perceive photos as believable if they make sense, not on the grounds that they are complete representations of reality (Greer & Gosen, 2002; Shen et al., 2018).

Complex and resilient belief systems such as conspiracy theories have not been explored in the context of image evaluation. The motivations behind CT development are well documented and the presence of a unique system of logic related to CTs is consistent across a range of environments (Georgiou et al., 2019; Swami et al., 2014; Van Prooijen et

al., 2018). Conspiratorial reasoning has been associated with lower analytical ability and increased intuitive and biased reasoning (Oliver & Wood, 2014; Swami et al., 2014). It is associated with the tendency to seek simplistic and intuitive explanations for environmental events or conflict (Georgiou et al., 2019), greater distrust in authority and lower self-esteem (Douglas et al., 2017; Swami et al., 2014). An individual difference that appears to influence cognitive ability and perception, CT beliefs may significantly impact the appraisal of online images.

1.4 The Current Study

The aim of this study was to investigate individual difference variables as predictors of performance in the evaluation of online images, extending previous research that has predominantly been based on textual self-report measures. Participants were asked to rate the credibility of a range of images that were fake or real, with content varied so as to relate/not relate to pre-existing CT belief systems. A repeated measures design was used in the form of a 2 by 2 photo type, manipulating verity (fake/real) and theme (CT related/unrelated). Participants completed a range of measures that captured their individual differences and belief systems.

Based on the broader visual perception literature (Shen et al., 2018; Nightingale et al., 2017), it was hypothesised that participants would show poor detection ability in distinguishing between fake and real images. It was also predicted that CT beliefs would significantly influence the appraisal of images. This was based on work showing that individuals with high conspiratorial ideation show heightened motivation to find patterns in the environment when their belief system is triggered (Van Prooijen & Douglas, 2018; Whitson & Galinsky, 2008). Additionally, initial research into image evaluation suggests that pre-existing beliefs may influence performance on visual detection tasks. Based on these findings, the current study anticipated main effects of CT belief and image type on credibility

ratings. This study will also examine the general relationship between the strength of CT beliefs and the ability to discriminate real from fake images. Furthermore, the role of other covariates including experience with digital editing, level of scepticism and impulsivity will be examined. The strength of the CT discrimination performance will be investigated after controlling for these potentially confounding factors. No directional hypotheses are specified for this relationship because this is a novel investigation without precedent in the literature. We anticipate, however, that greater discrimination performance irrespective of the type of image should be better for those with digital editing experience, who are more sceptical, and less impulsive in their decision-making. Aims and hypotheses are summarised in Table 1.

Table 1

Aims and hypotheses for the current study

Aim 1: To investigate individual ability to discriminate between real and fake images in social media contexts.
Hypothesis 1: Participants will display difficulties in differentiating between real and fake images as reflected by no significant difference between credibility ratings assigned to real and fake images.
Aim 2: To investigate the relationship between individual belief systems and accuracy in discrimination between real and fake images.
Hypothesis 2: The level of CT belief will have a significant effect on discrimination ability. a) High CT belief individuals will perform worse than low CT belief individuals when asked to rate CT relevant photos as reflected by a significant difference in accuracy scores. b) The performance of high vs low CT belief individuals is not expected to differ when images are non-CT related as reflected by no significant difference in accuracy scores.

CHAPTER 2

Method

2.1 Participants

A total of 329 participants (64.7% men and 35.3% women) aged between 18 and 69 years (M = 27.29, SD = 8.38) were included in the study. Participants were mostly college educated, with 26.1% having completed some college, 29.4% having completed a 4-year degree and 16.4% having completed a professional degree. Participants came from a variety of backgrounds, with over 40 nationalities identified and the highest proportion from Europe (30.2%) and North America (23.6%). This is consistent with online research platforms providing a participant base of mostly US geographical origin, high English fluency and high education level (Peer et al. 2017). Participants were highly experienced with the internet, with 77.6% reporting a daily average use of over 3 hours. Demographic variables are summarised in Table 2.

2.2 Procedure

Participation involved completion of an online survey. Participants had to be at least 18 years of age and have good English language proficiency. The survey took approximately 15 minutes and was accessed via the website Prolific. Participants who matched the inclusion criteria received a URL link to the Qualtrics based survey. The study was advertised as an investigation of individual differences in evaluation of online images and was available online for 48 hours. Participants were required to complete the survey in one sitting. As an incentive to complete the study, participants received a small monetary reward as compensation for their time and effort (around 5 UK pounds equivalent).

Participants first responded to a range of psychometric measures (see Table 3). They were then presented with 16 images consecutively in a random order, accompanied with credibility measures so they could evaluate the image whilst answering questions related to

that image. All measures of conspiracist ideation were presented following the visual detection questions so as to not prime participants of the study intentions. Debriefing upon conclusion informed participants of the intentional manipulation of some images (Appendices A-D).

Table 2

Demographic characteristics of the current sample

Characteristics	*N*	*%*
Gender		
Male	213	64.7
Female	116	35.3
Education		
Less than High School	11	3.3
High School Graduate	63	19.0
Some College	86	26.0
2 Year Degree	14	4.2
4 Year Degree	97	29.3
Professional Degree	56	16.9
Doctorate	4	1.2
Nationality		
North America	78	23.6
South America	65	19.6
Europe	100	30.2
UK	23	6.9
Other	65	19.7
Social Media Use Daily		
Less than 30 mins	1	.3
30 to 60 mins	4	1.2
1 to 2 hours	15	4.5
2 to 3 hours	54	16.3
3+ hours	257	77.6

Note. N=329

2.3 Data Screening

Prior to data analysis, participants' responses were examined to assess data quality. We identified signs of content non-responsivity (Meade & Craig, 2012) such as repeated or patterned responses. Upon evaluation, 12 participants were excluded from the final analysis resulting in a final sample of 329 participants. All assumptions of the analyses were met, with the dependent variables measured on a continuous scale and a dichotomous independent variable. Due to the large sample size (N = 329) it was assumed our dependent variable approximates a normal distribution, however visual inspection of histograms and scatterplots were used to ensure normality and inspect for outliers (Appendix H-I).

2.4 Ethics Approval

The study was approved by the *University of Adelaide's School of Psychology's Human Research Ethics Committee* (Approval No. 20/26). Participants were informed they were free to withdraw from the study at any time without comment or penalty and that their results were voluntary and anonymous.

2.5 Measures

2.5.1 Photographing Editing Experience

Photography skills were assessed via two self-report items as previously used in image manipulation research (Shen et al., 2018; Nightingale et al., 2017). Items were on a 7-point Likert scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*). The questions asked participants to rate how familiar they were with both digital photography and digital photography editing software.

2.5.2 Online News Access

News access self-report questions were included to assess how often participants rely on the internet for news. Two items were used (e.g. "*I access news articles from online*

sources regularly") with participants rating agreement on a 7-point Likert scale. Higher average scores indicated greater levels of online news access (*M*= 5.92, *SD*= .99).

2.5.3 Social Media News Access

A measure introduced to this study was the reliance on social media as an online information source. Participants rated 2 items on a 7 -point Likert scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*), (e.g. "*Social media is my preferred source for online news*").

2.5.4 Scepticism

Scepticism towards online messages was measured using a version of the 9-item SKEP scale (Obermiller & Spangenberg, 1998) designed to measure scepticism towards advertising messages. The scale was modified to assess scepticism towards messages received in social media (as seen in Shen et al. 2018). Participants rated agreement on a 5-point Likert scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*) in relation to statements about their social media behaviour and attitudes (e.g. "*In general, news from social media presents a true picture of the world as it is*."). The Cronbach's Alpha for the present study was very good*: α*= .88.

2.5.5 Impulsivity

A modified version of the Cognitive Reflection Test (CRT) (Frederic, 2005) was used to assess impulsivity. Those with high cognitive reflection tend to engage in more conscious processing in decision-making tasks and cognitive reflection shows good predictive ability for measures of impulsivity (Pattinson et al., 2012). Due to the popularity of the measure, many users of crowdsourcing research platforms like Prolific may have been previously exposed to the CRT. To avoid any familiarity with the test items, the modified *CRT-2* was included in this study (Thomson & Oppenheimer, 2016). The CRT-2 has four items and shows similar internal reliability to the CRT (α = .511 compared to α = .624 respectively),

with the responses on the two scales highly correlated (r_s = .905, p < .01). It has also been shown to reduce numeric and gender biases associated with the original test. Each item had an intuitive but false response, for example, "*Emily's father has three daughters. The first two are named April and May. What is the third daughter's name?".* Participants who override the intuitive response, "*June*" to reach the correct answer, *"Emily*" receive one mark. Scores out of 4 are calculated, with greater total scores reflecting higher levels of cognitive refection and lower levels of impulsivity.

2.5.6 Conspiracist Ideation

Conspiracist ideation was measured using two well established measures of both specific and general conspiracy theory beliefs.

a) Generic Conspiracy Beliefs Scale (GCBS). This measure, created by Brotherton et al. (2013), was used to assess general conspiracy beliefs with scores based on 15 self-report item measures. The GCBS predicts conspiracy ideation through the use of abstract statements, aligning with a broad range of CT beliefs, such as '*the government permits or perpetrates acts of terrorism on its own soil'*. Responses were scored on a 5-point Likert scale ranging from 1 (*definitely false*) to 5 (*definitely true*), total scores are added by summing responses, ranging from 15 to 75. The GCBS shows good predictive validity for belief in specific CTs (e.g. 9/11 conspiracies). This scale assesses how favourable conspiracy theories reasoning is for participants to explain real world actions, without the need for reference to specific historic events. The Cronbach's Alpha for the present study was very good (α= .91).

b) Belief in Conspiracy Theory Inventory (BCTI). The BCTI is a similar measure of conspiracist ideation that focuses on specific CT beliefs with good internal validity (Swami et al. 2010). The 14-item inventory measures popular CTs on a 9-point scale ranging from 1 (*completely false*) to 9 (*completely true*) (e.g. "*The Apollo moon landings never happened*

and were staged in a Hollywood film studio"). The BCTI serves as a second measure of conspiracist ideation as well as identifying individuals' exposure to well established conspiracies. Conspiracy ideation is related to a number of psychological traits and reasoning tendencies, so it is possible that individuals can have high conspiracist ideation without necessarily being exposed to popular CTs in the public dialogue. As this study employed images designed to trigger beliefs relating to specific CTs, the BCTI was used to confirm exposure to well-established CTs in popular culture. The Cronbach's Alpha for the present study was very good (α = .91).

2.5.7 Images of Real-World Scenes

Common manipulation techniques identified by Kasra et al. (2018) were employed in this study to systematically fabricate images of real-world scenes, notably: elimination, addition and retouching. These manipulation strategies alter the message behind an image, such as through the addition of a person in an image of an event. By consequence, this fabrication alters the reality perceived by viewers. A total of 16 images were created to satisfy four images per category highlighted in Table 4. All fake images included either addition or subtraction of a person or object, with retouching used to disguise major disturbances to the scene. Preliminary testing of visual materials was conducted in order to ensure the image manipulations were of adequate difficulty. A pilot study of 25 sample photos (N = 44) showed accuracy in detection similar to chance levels (as seen in previous work: Chandakkar & Li, 2020; Nightingale et al., 2017). Nine images were eliminated due to inappropriate levels of difficulty resulting in the final sample of 16 images. The images were created especially for this study using Photoshop editing software (version 21.2.1), as opposed to using pre-existing fake images online in order to reduce the effects of prior exposure (Appendix J).

The content of these images was designed to relate to political and social issues in the public dialogue, as consistent with prominent conspiracy theories (Georgiou et al., 2019; Miller et al., 2016). Brief captions accompanied each image as seen commonly on social media platforms. In conspiracy themed images, captions were descriptive but did not explicitly highlight the CT. For example, the image depicting President Obama visiting relatives in Kenya is associated with the popular "Birther" conspiracy that Obama was born in Africa. Our image was given a neutral description, "*President Obama waiting to meet his family in Kenya, 2015*".

All images presented were a uniform size (3:5 portrait, 5:3 landscape) and were labelled as '*retrieved from news sites online'*, with no reference to the credibility/veracity of the image. Images were presented one at a time to prevent consecutive comparison, with the credibility questions directly below to allow participants to see the image as they completed the scale of related questions. Unlike other studies assessing image evaluation (Nightingale et al., 2017; Shen et al., 2018), real images were included to control for participants who were more suspicious of the images and not necessarily more skilled at detecting the veracity of the image, a limitation outlined by Shen et al. (2018). A full list of images included can be found in Appendix C.

2.5.8 Credibility Ratings

The dependent measure of detection performance was assessed through participant's ranking of the credibility of 16 different real-world images. Credibility was measured using a modified version of the *Scale of Message Credibility* (Flanagin & Metzger, 2007) used in previous studies assessing image manipulation (Shen et al., 2018) (Appendix E). Participants ranked the credibility of the 16 images by the extent to which it is *believable, accurate, trustworthy, biased, complete* and *manipulated* on a Likert scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*). Negative items were reverse coded to create a composite

score out of 42. The accuracy scores were calculated for each condition, with high credibility scores for real images representing greater accuracy. Low credibility scores for fake images reflected greater accuracy.

2.6 Analytical Approach

The study involved a within-subjects repeated measures design. Analysis was conducted through the *Statistical Package for Social Sciences* (SPSS Version 26.0) (IBM SPSS, 2019). Participants rated all 4 groups of photos: real images (CT relevant, not CT relevant) and fake images (CT relevant and non-CT relevant). A 2 fake/real x 2 CT/non-CT ANOVA was conducted to examine whether credibility ratings were higher for real than fake photos (main effect) and CT vs. non-CT photos. The 2 x 2 design made it possible to determine whether the fake vs. real comparison was qualified by the interaction (i.e., the fake - real difference might differ for CT vs. non-CT photos). Performance in this task was based on accuracy scores: credibility ratings for fake images subtracted from credibility ratings for real images. The higher this value, the better the individual was in differentiating between the two types of image. A further analysis based on *Signal Detection Theory* (Green & Swets, 1966) was used to examine discrimination ability and levels of response bias. Performance was then analysed to examine the correlation between image discrimination and CT belief scores (a negative relationship was anticipated). It was also possible to divide people into high CT and low CT groups to examine whether performance (the ability to distinguish fake from real photos) was poorer for high CT believers when they were asked to rate CT-relevant photos vs. non-CT relevant photos. A final set of analyses examined general individual difference predictors of image discrimination performance using correlation analysis and multiple regression.

CHAPTER 3

Results

3.1 Analysis of Statistical Power

The sample size was based on the need to obtain a sufficiently large sample to conduct regression analyses with multiple predictors (with at least 30 cases per predictor). *Post Hoc* power analyses run through G*Power (Version 3.1.9.6) determined that power across the main analyses based on the obtained sample size was over .95 to detect a small effect (*d* = .2) (Appendix F). This exceeded the recommended power benchmark of .80.

3.2 Descriptive Statistics

Table 3 summarises the descriptive statistics for the principal psychometric measures. It shows that participants generally scored in the mid-point range for the two conspiracy belief scales, scepticism and impulsivity. Most reported being quite high users of social media and online news. The sample included people with average photographic editing skills, but with some clear variability in ability as indicated by the actual range of scores.

Table 3

Descriptive statistics for primary psychometric measures

Measures	Mean (SD)	Possible Range	Actual Range
GCBS	42.21 (12.15)	15-75	15-75
BCTI	59.84 (22.12)	14-126	14-117
Scepticism	35.55 (8.84)	9-63	9-63
Social Media News Access	13.18 (3.37)	2-14	2-14
Online News Access	11.83 (2.00)	2-14	2-14
Photography Skills	8.95 (3.29)	2-14	2-14
Impulsivity	2.59 (1.03)	0-4	0-4

Note: N = 329. BCTI = Belief Conspiracy Theory Inventory. GCBS = General Conspiracy Belief Scale.

3.3 Respondent Ability to Discriminate Real from Fabricated Images

The first aim of the study was to examine individual differences in the ability to discriminate between real and fake images, with the hypothesis being that people would find this task very difficult as indicated by similar credibility scores for both types of images (Hypothesis 1). A summary of the credibility ratings is provided in Table 4 and these data were analysed using a 2 fake/ real x 2 CT/ non-CT-related factorial ANOVA. Three effects were examined: a main effect for image type (fake vs. real) and whether this effect was qualified by any interaction with the image content (i.e., whether it was CT or non-CT related). Consistent with expectations, there was no significant fake/real main effect, $F(1, 330) < 1$, but there was a significant CT/ non-CT effect, $F(1, 330) = 384.1$, $p < .001$ ($n^2 = .54$), with a very large effect size and a significant real/fake x CT/non-CT interaction, $F(1, 330) = 156.7$, $p < .001$ ($n^2 = .32$). Inspection of Table 4 indicates that CT images were rated less credible than non-CT images, but that credibility was lowest when the images were fake and CT related. In other words, while the broad hypothesis (namely, that people find it hard to distinguish fake from real in general) was supported, participants correctly assigned the lowest credibility to CT-related fake images. They were generally poorer at picking the fake non-CT related images (19.80 was the highest of the four means).

Table 4

Descriptive statistics for credibility ratings

Categories	Mean (SD)	Possible Range	Actual Range
Fake CT	15.92 (3.06)	4-28	7-27.17
Fake Non-CT	19.80 (3.40)	4-28	7.33-27.83
Real CT	17.25 (2.84)	4-28	8.17-25.83
Real Non-CT	18.32 (2.81)	4-28	7.67-27

CT = Conspiracy theory related

To further examine the nature of performance, an analysis based on *Signal Detection Theory (SDT)* (Green and Swets, 1966) was conducted to determine the levels of discrimination and bias in the sample. In this study, discrimination refers to the ability to accurately identify the authenticity of an image, as indicated by *A′* values ranging from 0 to 1. As indicated by SDT, an *A′* of 1 demonstrates perfect discrimination and 0.5 reflects ability levels similar to chance. Bias refers to the overall tendency to consistently assign 'real' or 'fake' judgements to images, indicated by *B″* ranging from -1 to 1. A *B″* of -1 reflects a tendency to identify images as false, whereas a *B″* of 1 reflects bias towards identifying images as real. These non-parametric measures were calculated from the common measures of *hit rate* and *false alarm rate* (Stanislaw & Todorov, 1999). In this context, hit rate was when a manipulated image was identified as fake. The modified Scale of Message Credibility (Shen et al. 2018) was converted to a binary score, with participants who responded, "*somewhat disagree*" to '*strongly disagree*' on a false image receiving a 'hit', unsure responses or agreement were conceptualised as a 'miss'. The false alarm response applied to real images that received responses ranging from "*neither agree nor disagree*" to "*strongly disagree*".

This analysis indicated that general discrimination ability (all image sample) was poor *(A′*= .466, 95% Confidence Interval [CI] [0.444, 0.488]) with a small response bias (*B″* =.051, 95% CI [.012, .090]). When separated into image category, these values differed with conspiracy images being slightly easier to evaluate (*A′*=.521, 95% CI [.491, .551]) and a small response bias favouring fake identifications (*B″*= -.123, 95% CI [-.186, -.060]). In contrast, non-CT images were more difficult to evaluate (*A′*= .303, 95% CI [.274, .332]) and had a slight response bias favouring credible identifications (*B″*= .044, 95% CI [.036, .124]). This result suggests that the sample did not evaluate the two types of images in the same

fashion, with differences in *B″* indicating participants were biased towards certain responses in CT or non-CT images.

3.4 The Relationship Between CT Beliefs and Image Discrimination

A second aim was to examine the relationship between CT beliefs and individual differences in the ability to discriminate between fake and real images based on whether they were CT-related (Hypothesis 2a). It was predicted that higher CT beliefs would be negatively correlated with discrimination ability (real - fake credibility ratings) when the images were CT related. However, analysis also compared non-CT related images to test that the effect was only significant in CT related images. Two analyses were conducted, with the first analysis examining CT beliefs as a continuous variable. Performance scores involved calculating the differences between the credibility ratings assigned to real images and fake images (real - fake, with higher scores indicating better performance or greater accuracy) (see Table 5). Table 5 shows that mean credibility ratings were higher for real CT photos and fake ones, whereas this effect was reversed for non-CT images. As previously indicated in the SDT analysis, the data suggests that participants systematically evaluated CT and non-CT images in different ways.

Table 5

Performance accuracy in distinguishing real and fake images

Credibility Scores	Real (M)	Fake (M)	Accuracy Scores (M Difference)
CT relevant	17.25	15.92	1.32
Non-CT relevant	18.32	19.80	-1.48

Note: Mean difference not scored in absolute values as direction implies accuracy

Spearman correlations were used to examine the relationship between CT beliefs as defined by total scores on the BCTI and GCBS and performance accuracy in relating the CT

and non-CT related images (Table 6). The correlations in Table 6 were small, but they indicate a consistent pattern. When images were CT related, performance (real - fake credibility) ratings were lower when CT beliefs were higher for both CT measures. Contrastingly, when images were general and non-CT related, higher CT beliefs displayed no significant relationship (GCBS) or a small positive relationship with performance accuracy. These findings were therefore in the direction that had been hypothesised.

Table 6

Spearman correlations of CT beliefs and performance accuracy

	CT related	Non-CT related
GCBS	-.12*	.068
BCTI	-.11*	.12*

** p <.05 level (two tailed).*

Further comparisons of the correlations obtained for CT and non-CT images were conducted using *Z*-test for correlations derived from the same sample (Lee & Preacher, 2013). The 2-tailed test revealed significant differences for both the GCBS (Z= -2.45, p=.01) and BCTI (Z= -2.89, p <.01). This secondary analysis confirmed the aforementioned effects by examining the results based on a division of people into low vs. high CT believers. Mean performance accuracy scores were then compared between the two CT belief groups using *t* tests for independent samples (Table 7). GCBS and BCTI scores were dichotomised based on a median split for each variable (Mdn=43 and Mdn=62 respectively). For GCBS scores, participants with high CT beliefs showed poorer detection ability in CT related images than those with low CT beliefs. These findings therefore confirmed the results of the Spearman correlations and showed that the effect was reliably shown irrespective of whether CT beliefs were used as a metric or binary measure.

As consistent with the predictions of Hypothesis 2b, no significant difference was found between accuracy scores of high vs low belief individuals in the non-CT related images. This result was consistent for both the BCTI and GCBS. As indicated by Table 7, whilst overall accuracy scores were more negative in non-CT related conditions, there was no difference in high vs low CT belief performance. The effects observed in these analyses are further depicted in Figure 1 to aid the reader (Appendix G).

Table 7

Image discrimination performance classified by low and high CT beliefs

	Low CT beliefs M(SD)	High CT beliefs *M (SD)*	*t*-value (*df* = 329)	Cohen's *d*
GCBS	*N*=174	*N*=155		
CT relevant	1.74(3.48)	.86(3.05)	2.43*	.27
Non-CT relevant	-1.56(2.82)	-1.39(2.89)	-.56	.06
BCTI	*N*= 168	*N*=161		
CT relevant	1.89(3.47)	.74(3.03)	3.21**	.35
Non-CT relevant	-1.69(2.86)	-1.26(2.89)	-1.41	.15

Note: M scores indicate overall accuracy scores, calculated by credibility of fake images subtracted from credibility of real images. N=329.

** p<.05 **p<.001*

3.5 Other Individual Differences and Discrimination Performance

Finally, a Spearman's correlation matrix was calculated for all principal psychometric measures to examine whether the relationship between beliefs and accuracy in CT image conditions was related to other measures captured in the study. No directional hypotheses were specified for this analysis. Measures included: Photography Experience, Scepticism, Impulsivity, Social Media News Access and Online News Access with the main measures of CT beliefs and CT image accuracy scores. Table 8 summarises the results. The principal

results of interest are in the first column of correlations: those who had more photographic experience were more likely to perform better in the study; those who were more sceptical and impulsive tended to perform less well (although these effects were small). Social media and news use generally were unrelated to performance.

Table 8

Spearman's correlation matrix of primary predictor variables in current sample

Scale		1	2	3	4	5	6	7	8
1.	CT Accuracy								
2.	Non-CT Accuracy	.112*							
3.	BCTI	-.106	.117*						
4.	GCBS	-.122*	.068	.828**					
5.	Scepticism	-.126*	-.078	-.078	-.048				
6.	News Access	.019	-.027	-.058	-.057	.195**			
7.	Social Media News Access	-.095	-.076	.120*	.158**	.211**	.251**		
8.	Photography Experience	.113*	-.033	.071	.088	.016	.114*	.127*	
9.	Impulsivity	-.111*	-.029	.128*	.130*	.003	-.089	.056	.069

Note: N= 329. Spearman's rank correlation coefficient as depicted by r_s.
** correlation is significant at the .05 level (two tailed).*
*** correlation is significant at the .01 level (two tailed).*

3.6 Multiple Regression

A final multiple regression was then conducted to investigate what general factors best predicted discrimination performance (real - fake credibility ratings) when participants were asked to rate CT-related images (Table 9). The model was significant (F (4, 326) = 6.07, $p < .001$) and explained only 6% of the total variance, *Adjusted* R^2=.058. Conspiracy belief scores and photographic experience were the two best predictors of performance. Those who had stronger CT beliefs or higher levels of impulsivity had poorer performance

when asked to rate CT relevant images, whereas photographic experience yielded better performance. No other covariates were significant in the model.

Table 9

Multiple Regression of principle psychometric measures on CT image accuracy

Variable	*B*	SE_B	*β*	*t*
GCBS	-.875	*.355*	*-.132*	*-2.46**
Scepticism	*-.333*	*.180*	*-.099*	*-1.85*
Impulsivity	*-.390*	*.172*	*-.121*	*-2.26**
Photography Experience	*.357*	*.108*	*.177*	*3.31***
Constant	*1.71*	*1.06*		

*Note: N=329. * p<.05 **p<.001.*

CHAPTER 4

Discussion

4.1 Overview

The primary aim of this study was to extend previous research on the role of belief systems in credibility judgements online that has primarily focused on textual based content. Specifically, the evaluation of social media images was investigated in the context of conspiracy theory belief systems to examine whether certain individuals are more responsive or influenced by the content of images they see online. All of the hypotheses investigated were fully or partially supported by the data. For example, the study confirmed the hypothesis that participants would show poor image discrimination ability, with no significant difference in credibility ratings for real vs. fake images, but participants did nonetheless assign the highest credibility ratings to fake CT related images. These findings were, therefore, consistent with previous literature (see, for example, Nightingale et al., 2017; Shen et al., 2018). The study also supported the hypothesis that people who score higher on CT beliefs were generally less successful in discriminating between fake and real CT related images than they were when differentiating between non-CT related images. Finally, the study found some support for previous research that experience in photo editing and lower levels of impulsivity were related to better performance on the task.

An important insight arising from these findings is that these results were obtained using a highly educated participant sample who regularly access social media and online news sources. A total of 71.9% of our sample had completed at least college level training and reported high levels of online news access, spending on average more than three hours online daily. Despite being highly familiar with online images, participants struggled to identify a fabricated image as such. This is consistent with research demonstrating that individuals are immune to large variations in the aspect of a scene (Chandakkar & Li, 2020;

Farid & Bravo, 2010) as our sample consisted of key elements either added or eliminated from images.

The second aim of this study was to investigate the relationship between individual belief systems and accuracy in detection of fake images. As anticipated by multiple studies on the reasoning biases of individuals with high conspiracist ideation (Anthony & Moulding, 2018; Douglas et al., 2017; Swami et al., 2014), our second hypotheses were supported in that high CT belief individuals showed significantly worse discrimination ability in the evaluation of CT related images, but not non-CT related images. This supports the literature establishing conspiracy theories as highly resilient to contradictory information due to high levels of confirmation bias (Douglas et al., 2017). This result also has significant implications for the role of CT beliefs in the evaluation of CT images. High CT belief individuals had significantly impaired performance in CT images, suggesting that they are more vulnerable to deception when presented with conspiracy aligned visual content.

The data has implications for the broader literature on visual perception. Our findings are consistent with the limited research evidencing the role of beliefs in visual perception and visual illusions (Whitson & Galinsky, 2008). Research has shown that when motivated reasoning is high, individuals can perceive elements of an image that do not exist, a form of *illusory pattern perception*. However, additional evidence is needed to conclude whether our results support the conclusions of Whitson and Galinsky (2008) that motivated reasoning impairs visual evaluation of an image. Individuals with high CT beliefs may have been more motivated to identify conspiracy themed images as credible even when they are fake in order to protect their belief systems. However, it is unclear from this data if high CT belief participants were oblivious to manipulations in CT images. In fact, participants may have been aware of potential manipulations and simply ignored them if they challenged their beliefs, consistent with confirmatory style reasoning. Accordingly, a recommendation for

future research is to include self-report measures from participants on the location of manipulations in images. As seen in the work of Nightingale et al. (2017), self-report measures help to establish whether individuals have relied upon internal cues within the image in their credibility evaluation. It may also provide valuable information in the types of manipulations that participants notice and those that elude visual perception.

The results provide limited support for the role of general skills in the evaluation of images. Previous literature has suggested that skills in digital photography (Greer & Gosen, 2002) and familiarity with a medium (social media, online news) may enhance how critically individuals evaluate an image (Kasra et al., 2018; Nightingale et al., 2017). Consistent with the literature (Kasra et al., 2018), photography experience was the strongest predictor in the regression model and explained significant variance in discrimination performance. It is intuitive that knowledge of manipulation techniques possible through digital editing programs gave participants an advantage in the evaluation of images. Indeed, photography experience was a stronger predictor in our model than both measures of conspiracist ideation. Additionally, lower levels of impulsivity were associated with greater performance. Similar results were found by Pattinson et al. (2018), who suggested impulsivity may predict a more careful visual appraisal by participants.

By contrast, the level of social media news access and online news access was not related to image discrimination ability. Online deception research has shown that general scepticism towards online media can influence susceptibility to deceptive strategies (Pattinson et al., 2012). In support of this view, it was found that scepticism was negatively correlated with performance and this effect was significant in the final regression model. One reason for this is that highly sceptical participants may have been less inclined to trust the veracity of images aligned with conspiracies, regardless of whether it was real or fake. This resulted in overall poorer performance from participants as real images were also perceived

as less credible. In general, the regression model explained only 6% of variance in discrimination performance and this suggests that there may be other unmeasured factors potentially related to image evaluation that were not captured in this study.

4.2 Methodological Considerations

It is important to consider several methodological limitations of our study when interpreting the results. The first and perhaps most significant limitation to this study is controlling for variance in manipulation across images. As the human evaluation of digital images is a largely under explored area of research, a uniform method of manipulating images of real-world scenes is yet to be established. For this reason, our study relied largely on limited research establishing the main techniques of manipulation in systematically creating our sample of fabricated images (Kasra et al., 2018; Nightingale et al., 2017). However, research has shown that object salience and the size of manipulated content may influence the appraisal of image verity as a consequence of selective attention (Nightingale et al., 2017). Without a uniform technique of establishing image manipulation, the salience and size of manipulations is subject to uncontrolled sources of variance. As seen in our study, the non-CT related images were significantly more difficult for participants to accurately classify as fake or real. This difference in discrimination ability may be explained by variance in the subtlety of image manipulation between the two image conditions (CT/non-CT).

There was also a limited pool of images easily identified as being conspiracy aligned that could be included in the study. Non-CT related images could depict any socio-political or cultural event and there were less limitations in the sample for image selection. This discrepancy could have led to variance in the level of sophistication of manipulations, with CT related images significantly easier for participants to evaluate. A notable consideration is the disparity in date of the original photographs between the two conditions, with CT images depicting historic events (e.g. Moon landing) generally older than non-CT related images

(Obama presidency). Additionally, the attentional allocation may have been simpler for CT images as the primary message was more easily recognised. Non-CT images may have required a more detailed inspection of the scene as participants were not readily cued to the central message of the image. Research on visual perception has shown that attentional allocation may have a significant impact on evaluation of an image (Nightingale et al., 2017; Stirk & Underwood, 2007), which is a potential confounding variable in this study.

The results of this study are limited in their transferability to social media and online news settings. Whilst the study results are compelling in the context of belief systems and image evaluation, the external validity may be limited. An image and basic caption were used in the study to control for the potential confounding variables of site features and external cues to veracity. Whilst this improved confidence that the observed effects were based on the images themselves, external validity was lessened because the large range of external cues that exist in online environments were not included. Previous work in online deception has consistently shown that accessory features are often used as heuristic cue to credibility, such as source credibility, username, user picture and message topic (Morris et al., 2012). Whilst outside the scope of this study, future research could seek to replicate our findings in social media or online news settings. An interesting factor to consider is whether the social features of social media sites, such as sharing and like functions, enhance the credibility judgements of visual content that would otherwise have been dismissed as false.

Another consideration is whether the CT images used were sufficient to trigger the individual belief systems of those with high conspiracist ideation. Whilst the GCBS and BCTI are robust predictors of conspiracist ideation and relate to a large body of well-known conspiracies (Brotherton et al., 2013; Swami et al., 2010, 2014; Uscinski et al., 2016), it is possible that some images failed to cue this belief system. New conspiracies incorporated in this study such as the Obama ‘Birther’ theory may not have been recognised by all

participants, particularly those who originated from outside the US. Future studies could seek to include follow-up questions to investigate whether the individual conspiracies were identified by participants. Indeed, the recognisability of content may have been influenced by cultural factors across both CT and non-CT conditions. Due to knowledge of fluency and familiarity biases, it is likely that unfamiliar figures or scenes may have resulted in lower perceived credibility of the image. Finally, as our study consisted of voluntary participants accessed via Prolific there are limitations in the generalisability of our data. Similar with other crowd sourcing research platforms (Peer et al., 2017), participants were highly educated and largely from North America and Europe, limiting the contexts to which the findings can be applied. Due to the limited diversity of our sample it is unclear whether individuals who frequently access online and social media news might be better at detecting fakes images than people who are less familiar with those contexts. Additionally, as our sample was largely male (64.7%) and young (M=27.29) it is unclear whether the results would apply to a different demographic or whether age and gender play a predictive role in image discrimination performance. Future research could seek to replicate these results with a wider sample of participants.

4.3 Implications and Future Directions

This study has important implications for the ability of conspiracy inclined individuals to objectively evaluate information that triggers their belief systems. There is concern that poor capacity to assess the verity of information will lead to further growth of online communities that perpetuate conspiracy theories (Douglas et al., 2017). Many of these are likely to emerge in social media contexts where unverified information is perpetuated at an unprecedented rate (Del Vicario et al., 2016; Douglas et al., 2017; Miller et al., 2015). This study shows the beliefs of conspiracy inclined individuals may significantly impair their credibility judgements of images, which may lead to greater susceptibility to visual

deception. This self-perpetuating cycle may be amplified in online settings full of easily manipulated visual content. Future work could extend this study to examine images relating to more specific conspiracies (e.g., images relating to COVID-19) and where individual belief differences are narrowly focused on this topic. Studies could also examine whether differences in visual perception of images correlate with differences in the interpretation of text or if image interpretation alters based on priming or manipulations of context.

Studying the variables that influence credibility judgements and the information that is considered truthful will only become more relevant in an increasingly digital age. Whilst textual based content is a large focus of deception literature, it is reasonable to assume that as social media becomes more of a content focused platform, our reliance on visual content will continue to grow. This research provides an insight into how pre-existing beliefs may influence the appraisal of visual content. As images are particularly compelling elements of news stories online (Gary & Wade, 2005; Paivio et al., 1968; Zillman et al., 1999), it is possible that biased image evaluation may lead to greater belief in the 'truthfulness' of fake news and by consequence, a less informed public.

In order for this area to progress further there may need to be refinements to methodological approaches. For example, an avenue for future research investigating the evaluation of doctored images is to measure the level of pixel distortion underlying images to achieve a uniform level of manipulation. Many studies have examined algorithmic detection or 'digital forensics' as a potential avenue to combat fake images online (Farid, 2006; Popescu & Farid, 2005). Used primarily in computer-based image detection studies (Popescu & Farid, 2005), the emerging field of digital forensics utilises computational methods of assessing inconsistencies and signs of manipulation. Whilst these studies have largely focused on algorithmic strategies to detect fake images, visual judgements online are routinely made by the naked human eye. Developing more accurate ways to measure image

manipulation will help to address concerns about uncontrolled variance in image manipulation studies.

4.4 Conclusions

The results of this research support the consistent finding that individuals are poor at detecting manipulations in images of real-world scenes and that further research may be needed to understand the best self-report predictors of performance in visual contexts. The research shows that both individual differences and contextual factors are important. Pre-existing belief systems such as conspiracist ideation appear to influence how individuals evaluate images in online settings. Such belief systems seem to be most readily applied in contexts where these beliefs are triggered, and this appears to have implications for their ability to distinguish between real and fake information. This study therefore provides an initial insight into the psychometric predictors of individual ability and potential avenues for future research to investigate whether individuals can be trained to resist the content of fabricated images. Protecting the public from misinformation is an important area of research that will continue to become more relevant in an increasingly digital age.

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Appendices A-I

Appendix A: Information Sheet and consent

Individual Differences in the Evaluation of Online Images

The following study concerns the information conveyed in news images online. We seek to better understand the relationship between belief systems and individual's evaluation of the credibility of a photographic image. Through collecting this data we aim to achieve a more in depth understanding of how images are perceived by the public.

You are invited to participate as an active digital media user. You will be asked to complete a series of questions which will take up to 20 minutes to complete. Upon completion of the study you will be reimbursed for your time. Below you will be asked to indicate your consent to participate in this voluntary study. After consent is given or at any time in this study you are free to withdraw.

This research project has been approved by the Human Research Ethics Subcommittee in the School of Psychology at The University of Adelaide (**Approval No. 20/26**).

The information collected in this survey will remain anonymous at all times. Data received may be used for future journal publication and stored under ethical guidelines.

For any complaints or concerns please contact the study provider.

Do you consent to participate in this study?

Yes

No

Appendix B: Collection of Demographic Data

Please answer all of the following questions before continuing to the next page.

What is your gender?

- Male
- Female

What is your age?

What is your highest level of education?

- Less than high school
- High school graduate
- Some college
- 2 year degree
- 4 year degree
- Professional degree
- Doctorate

What is your nationality?

Appendix C: Survey

Please enter an answer for all four of the following questions.

If you're running a race and you pass the person in second place what place are you in? (answer in number form)

A farmer had 15 sheep and all but 8 died. How many are left? (answer in number form)

Emily's father has three daughters. The first two are named April and May. What is the third daughter's name?

How many cubic feet of dirt are there in a hole that is 3" deep x 3" wide x 3" long? (answer in number form)

The following questions apply to your experience with online news content.

Please rate the extent to which you agree with the statement (1=strongly disagree, 7=strongly agree)

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
I access news articles from online sources regularly.	O	O	O	O	O	O	O
The internet is my main source of information for keeping up to date with current news and affairs.	O	O	O	O	O	O	O

On an average day approximately how much time do you spend online?

less than 30minutes	30 to 60minutes	1 to 2 hours	2 to 3 hours	more than 3 hours

The following question applies to your experience with social media (Facebook, Instagram, WeChat, Twitter etc.)

Please rate the extent to which you agree with the following statement (1=strongly disagree, 7= strongly agree)

	Strongly Disagree	Disagree	Somewhat Disagree	Neither agree no disagree	Somewhat Agree	Agree	Strongly Agree
1.Social media is my preferred source for online news.	▭	▭	▭	▭	▭	▭	▭
2.I feel sufficiently informed from updates on social media.	▭	▭	▭	▭	▭	▭	▭
3.I actively seek sources outside of Social Media for news content.	▭	▭	▭	▭	▭	▭	▭

The following questions apply to your current skills or experience with digital photography.

Please rate the extent to which you agree with the statement (1=strongly disagree, 7=strongly agree)

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
1. I have experience with digital photography editing software (e.g. photoshop).	O	O	O	O	O	O	O
2.I have experience with digital photography.	O	O	O	O	O	O	O

You will now be shown a series of 16 images retrieved from news sites online. Please respond with the extent to which you agree with the statements made about each image on a scale of 1 to 7 (1=strongly disagree and 7= strongly agree).

Please study the image below for a few moments and then answer the following questions regarding the extent to which you agree with each statement.

Jill and Joe Biden announce candidacy for presidential nomination, 1987

Click to write the question text

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
1.The image is believable.	○	○	○	○	○	○	○
2.The image is accurate.	○	○	○	○	○	○	○
3.The image is trustworthy.	○	○	○	○	○	○	○
4.The image is biased.	○	○	○	○	○	○	○
5.The image is complete.	○	○	○	○	○	○	○
6.The image is manipulated.	○	○	○	○	○	○	○

Canadian Prime Minister Justin Trudeau and Barack Obama walk together, 2016

Pope Francis on his visit to the Philippines, 2015

US President Donald Trump with professional golfer Tiger Woods, Florida 2019

Trump supporters carry signs at a rally in Ohio, 2019

Members of the Syrian opposition walk with UN observers, Syria 2012

Marriage Equality March, Washington 2017

Moon Landing mission of Apollo 11, July 1969

Lunar night sky in the Apollo 11 mission, July 1969

Barack Obama waiting to meet his family, Kenya 2015

US Marine and Chinese government officials meet at the Wuhan Institute of Technology, 2019

North Korean Leader Kim Jon Un laughing with his officials, 2019

World leaders meet at the Paris Climate Summit, 2015

COVID-19 Lockdown with new technology in the background, Wuhan China 2020

First Lady Michelle Obama exits Air Force One, 2015

A newly discovered crop circle of unknown symbolic meaning, England 2004

The following questions apply to your beliefs in regards to news and information received online. Please rate you answers on the following 5-point scale (1= strongly disagree to 7= strongly agree).

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
1. We can depend on getting the truth in most online news.	O	O	O	O	O	O	O
2. Online news' main aim is to inform the consumer.	O	O	O	O	O	O	O
3. I believe news online is informative.	O	O	O	O	O	O	O
4. The Internet is a reliable source of information about the world.	O	O	O	O	O	O	O
5. News on the internet is generally truthful.	O	O	O	O	O	O	O
6. News on the Internet is truth well told.	O	O	O	O	O	O	O
7. In general, news online presents a true picture of the world as it is.	O	O	O	O	O	O	O
8. I feel I've been adequately informed after reading most articles online.	O	O	O	O	O	O	O
9. Most news stories online provide users with essential information.	O	O	O	O	O	O	O

There is often debate about whether or not the public is told the whole truth about various important issues. The following questions are designed to assess your beliefs about some of these subjects.

Please indicate the extent to which you believe each statement on a 5-point scale (1= definitely false to 5= definitely true)

	Definitely false	Probably false	Neither true nor false	Probably true	Definitely true
1. The government is involved in the murder of innocent citizens and/or well-known public figures and keeps this a secret.	O	O	O	O	O
2. The power held by heads of state is second to that of small unknown groups who really control world politics.	O	O	O	O	O
3. Secret organizations communicate with extraterrestrials, but keep this fact from the public.	O	O	O	O	O
4. The spread of certain viruses and/or diseases is the result of the deliberate, concealed efforts of some organization.	O	O	O	O	O
5. Group of scientists manipulate, fabricate, or surpress evidence in order to deceive the public.	O	O	O	O	O
6. The government permits or perpetrates acts of terrorism on its own soil, disguising its involvement.	O	O	O	O	O
7. A small, secretive group of people is responsible for making all major world decisions, such as going to war	O	O	O	O	O
8. Evidence of alien contact is being concealed from the public	O	O	O	O	O
9. Technology with mind control capabilities is used on people without their knowledge	O	O	O	O	O
10. New and advanced technology which would harm current industry is being surpressed	O	O	O	O	O
11. The government uses people as patsies to hide its involvement in criminal activity	O	O	O	O	O
12. Certain significant events have been the result of activity of a small group who secretly manipulate world events	O	O	O	O	O
13. Some UFO sightings or rumours are planned or staged in order to distract the public from real alien contact	O	O	O	O	O
14. Experiments involving new drugs or technologies are routinely carried out on the public without their knowledge or consent	O	O	O	O	O
15. A lot of important information is concealed from the public out of self interest	O	O	O	O	O

The following questions are related to your beliefs about real historic events.

Please indicate the extent to which you believe each statement on a 9-point scale (1=completely false, 9=completely true).

	Completely False	Mostly False	Somewhat False	Slightly False	Neither False nor false	Slightly True	Somewhat True	Mostly True	Completely True
16. The US government allowed the 9/11 attacks to take place so that it would have an excuse to achieve foreign (e.g., wars in Afghanistan and Iraq) and domestic (e.g., attacks on civil liberties) goals that had been determined prior to the attacks.	O	O	O	O	O	O	O	O	O
17. The assassination of Martin Luther King, Jr., was the result of an organised conspiracy by US government agencies such as the CIA and FBI.	O	O	O	O	O	O	O	O	O
18. US agencies intentionally created the AIDS epidemic and administered it to Black and gay men in the 1970s.	O	O	O	O	O	O	O	O	O
19. Government agencies in the UK are involved in the distribution of illegal drugs to ethnic minorities.	O	O	O	O	O	O	O	O	O
20. The US government had foreknowledge about the Japanese attack on Pearl Harbour, but allowed the attack to take place so as to be able to enter the Second World War.	O	O	O	O	O	O	O	O	O
21. Princess Diana's death was not an accident, but rather an organised assassination by members of the British royal family who disliked her.	O	O	O	O	O	O	O	O	O
22. A powerful and secretive group, known as the New World Order, are planning to eventually rule the world through an autonomous world government, which would replace sovereign government.	O	O	O	O	O	O	O	O	O
23. SARS (Severe Acute Respiratory Syndrome) was produced under laboratory conditions as a biological weapon	O	O	O	O	O	O	O	O	O
24. The Coca Cola company intentionally changed to an inferior formula with the intent of driving up demand for their classic product, later reintroducing it for their financial gain.	O	O	O	O	O	O	O	O	O
25. The assassination of John F. Kennedy was not committed by the lone gunman, Lee Harvey Oswald, but was rather a detailed, organised conspiracy to kill the President.	O	O	O	O	O	O	O	O	O
26. The Apollo moon landings never happened and were staged in a Hollywood film studio.	O	O	O	O	O	O	O	O	O
27. The Oklahoma City bombers, Timothy McVeigh and Terry Nichols, did not act alone, but rather received assistance from neo-Nazi groups.	O	O	O	O	O	O	O	O	O
28. Special interest groups are suppressing, or have suppressed in the past, technologies that could provide energy at reduced cost or reduced pollution output.	O	O	O	O	O	O	O	O	O
29. Special interest groups are suppressing, or have suppressed in the past, technologies that could provide energy at reduced cost or reduced pollution output.	O	O	O	O	O	O	O	O	O

Appendix D: Post study debrief

Some of the questions in this study were designed to assess your beliefs about historic events. Did any of the images presented in this study make you question the role of powerful people involved in these events?

We invite you to comment on this questionnaire.

The study you have just completed is interested in viewing specific individuals' belief systems and how this affects their assessment of image credibility online. More specifically, the individual differences in belief systems we are interested in observing are specifically related to conspiracy beliefs. Some of the images you viewed in this study were intentionally related to common conspiracy theories to assess how this impacted your perception of the image. In addition, some of the images in this study were intentionally manipulated through photo editing programs to observe whether this impacted your perception of the image.

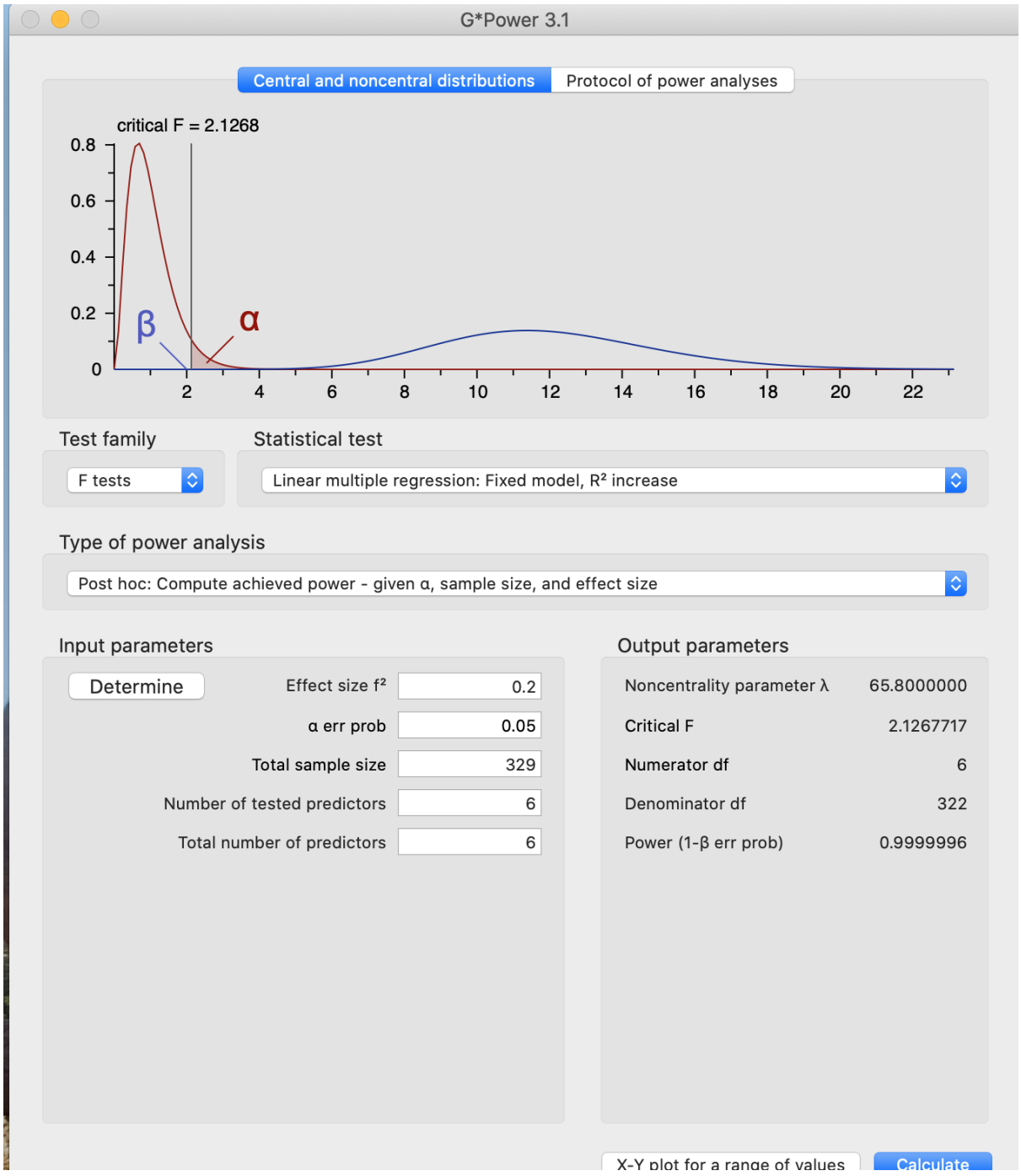
All of the information you received upon commencement of this study is true and your results remain confidential. If you have any concerns regarding your participation in this study please contact the study provider.

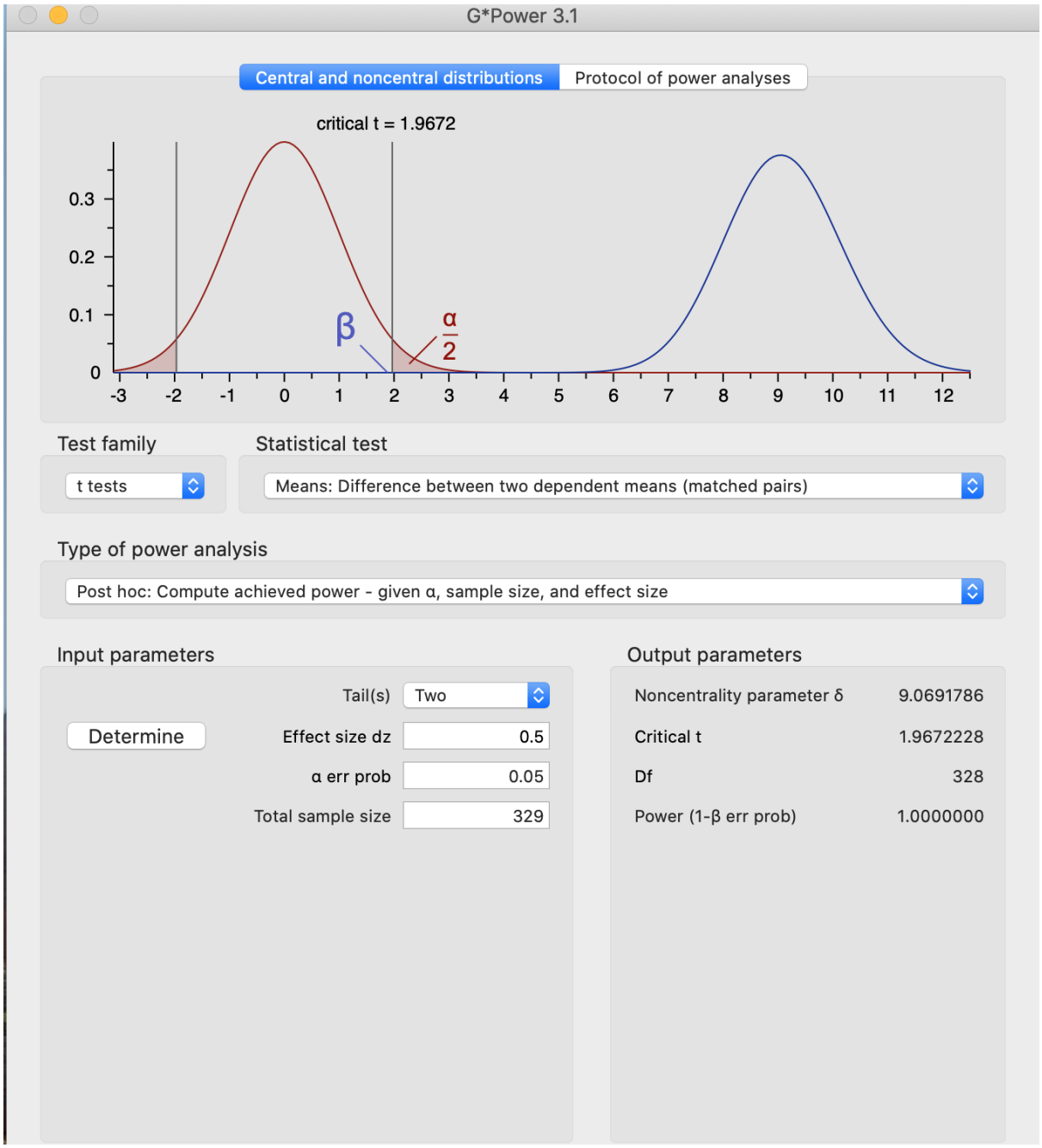
Thank you for your time.

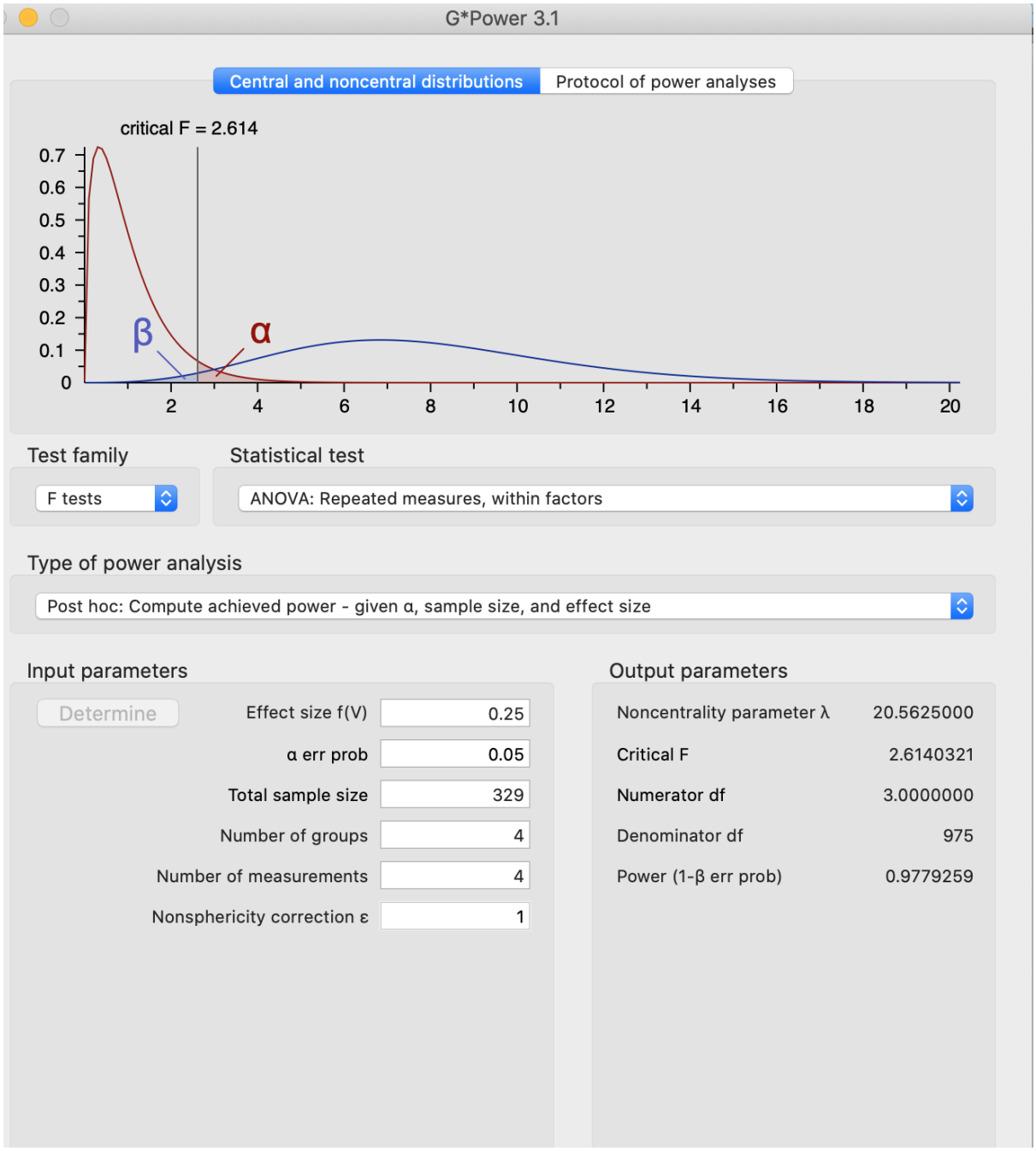
Appendix E: Modifications to the Scale of Message Credibility

Scale of Message Credibility (Flanagin & Metzger, 2007)	*Modified Scale of Message Credibility*
To what extent do you find the information in website as a whole to be:	Please study the image below for a few moments and then answer the following questions regarding the extent to which you agree with each statement.
Believable	The image is believable
Accurate	The image is accurate
Trustworthy	The image is trustworthy
Biased	The image is biased
Complete	The image is complete
	The image is manipulated

Appendix F: Post Hoc power analyses using G Power Version 3.1.9.6



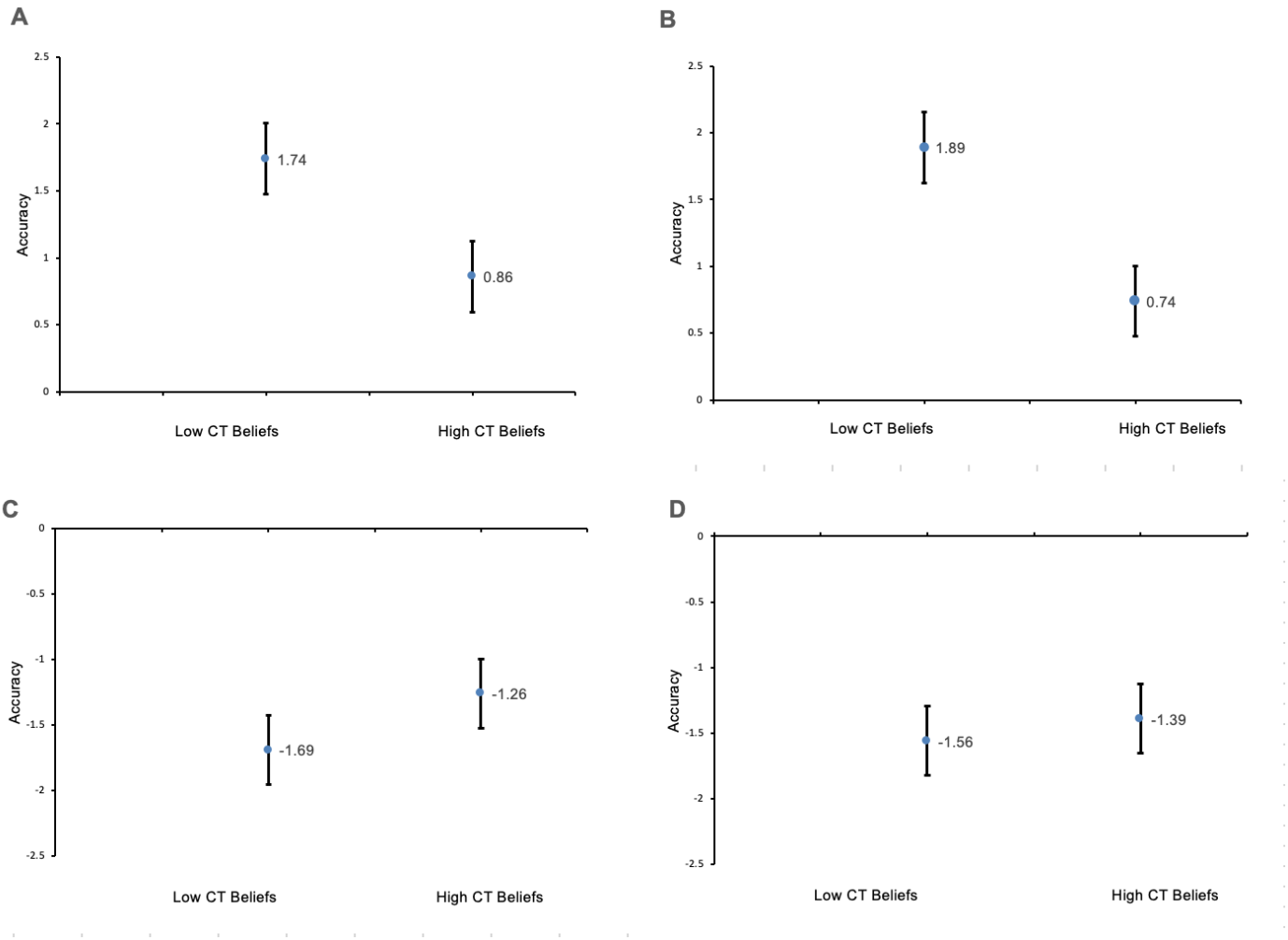

G*Power 3.1
Central and noncentral distributions
Protocol of power analyses
critical t = 1.9672
0.3
0.2
0.1
0
β
α/2
-3 -2 -1 0 1 2 3 4 5 6 7 8 9 10 11 12
Test family
t tests
Statistical test
Means: Difference between two dependent means (matched pairs)
Type of power analysis
Post hoc: Compute achieved power - given α, sample size, and effect size
Input parameters
Determine
Tail(s) Two
Effect size dz 0.5
α err prob 0.05
Total sample size 329
Output parameters
Noncentrality parameter δ 9.0691786
Critical t 1.9672228
Df 328
Power (1-β err prob) 1.0000000


G*Power 3.1
Central and noncentral distributions
Protocol of power analyses
critical F = 2.614
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
β
α
2
4
6
8
10
12
14
16
18
20
Test family
F tests
Statistical test
ANOVA: Repeated measures, within factors
Type of power analysis
Post hoc: Compute achieved power - given α, sample size, and effect size
Input parameters
Determine
Effect size f(V) 0.25
α err prob 0.05
Total sample size 329
Number of groups 4
Number of measurements 4
Nonsphericity correction ε 1
Output parameters
Noncentrality parameter λ 20.5625000
Critical F 2.6140321
Numerator df 3.0000000
Denominator df 975
Power (1-β err prob) 0.9779259

Appendix G

Figure 1

Accuracy in CT and non-CT images related to GCBS/BTCI scores

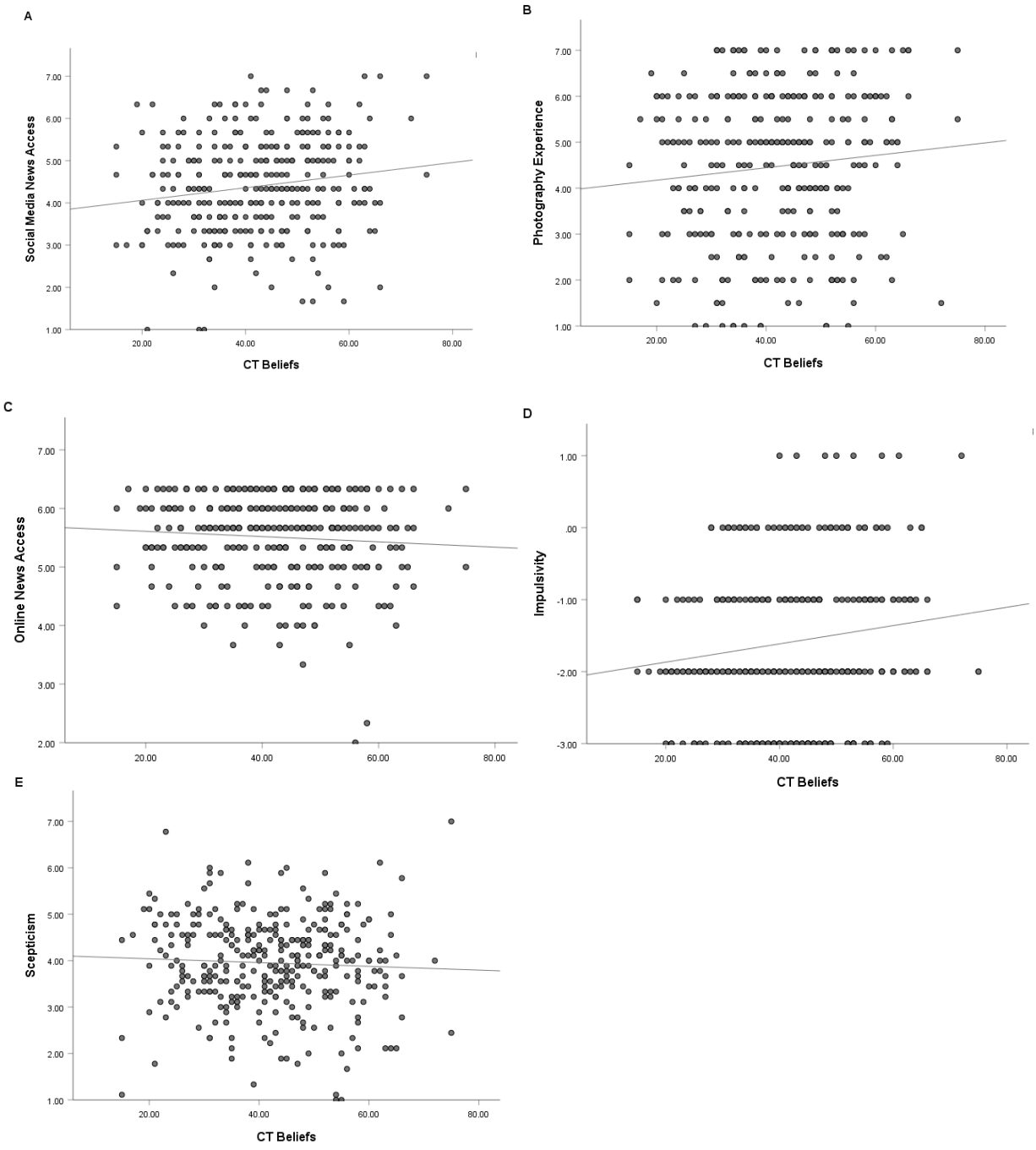


*Note: Accuracy is reflected by total credibility ratings of fake images subtracted from credibility ratings of real images. N=329.Panel A: GCBS scores related to CT images. Panel B: BCTI scores related to CT Images. Panel C: GCBS Scores related to Non-CT Images. Panel D: BCTI scores related to Non-CT Images. *p<.05 **p<.001.*

Appendix H:

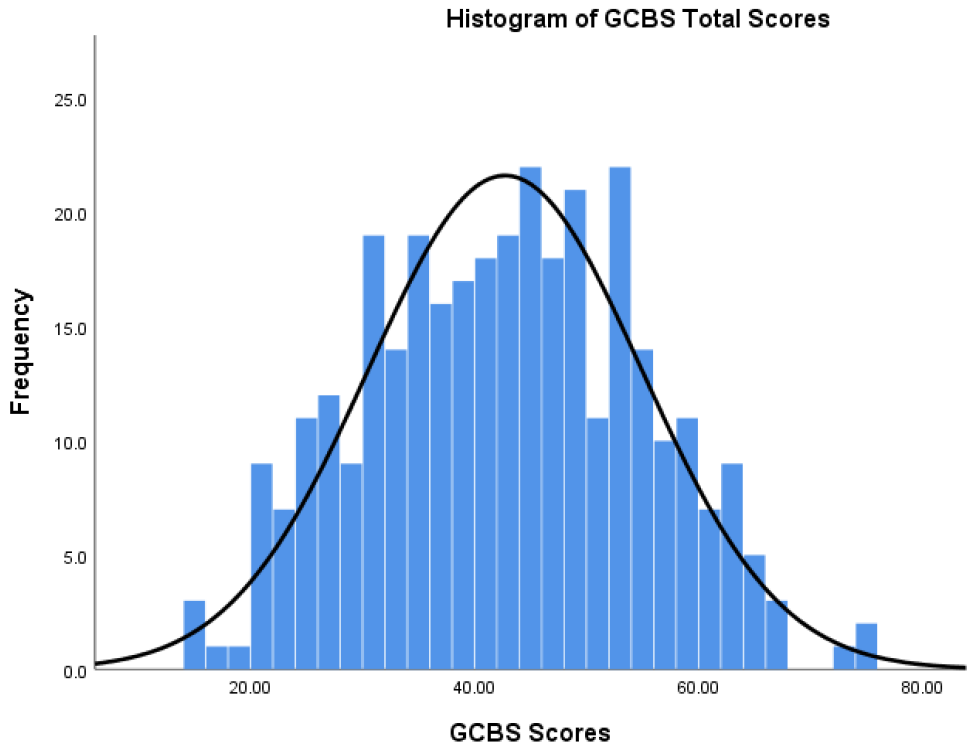
Figure 2

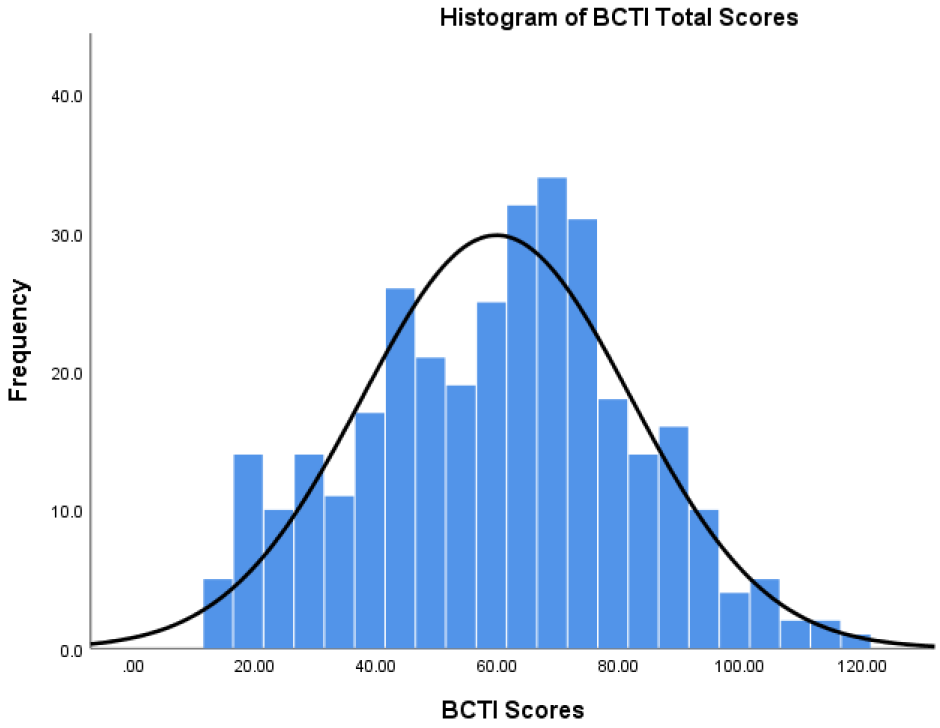
Scatterplots of CT Beliefs and principal psychometric measures



Note: Each dot represents an individual participant. CT Beliefs as defined by total GCBS scores. There is no strong association seen between CT Beliefs and the five psychometric variables (plotted on x axes). Panel A: Social Media News Access. Panel B: Photography Experience. Panel C: Online News Access. Panel D: Impulsivity (CRT reverse coded scores). Panel E: Scepticism.

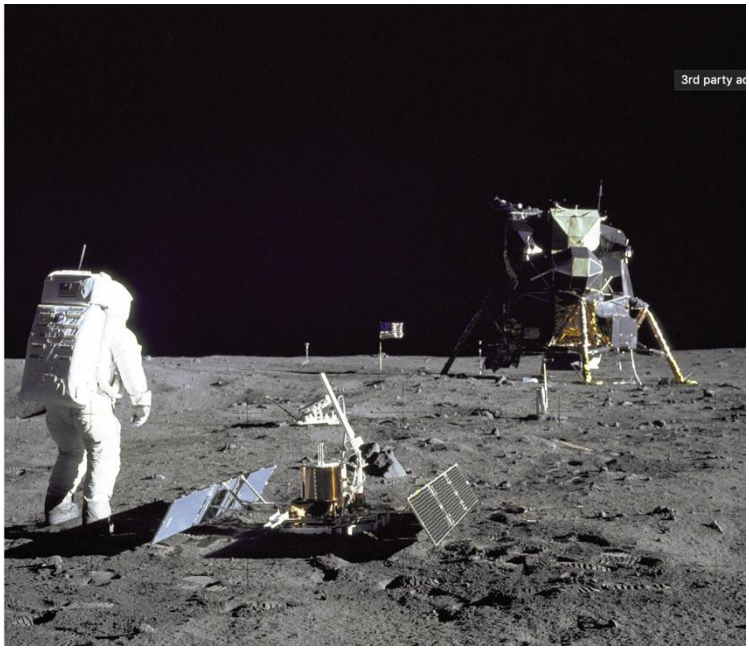
Appendix I: Histograms





Note: N=329.

Appendix J: Original Images


3rd party ac


A 31