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COGNITIVE REFLECTION AND RELIGIOSITY: A TEST OF TWO MODELS

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COGNITIVE REFLECTION AND RELIGIOSITY: A TEST OF TWO MODELS

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APPROVAL

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DECLARATION ON RESEARCH ETHICS AND PUBLISHING METHODS

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In addition, I acknowledge that any claim of irregularity that may arise in relation to this work will result in a disciplinary action in accordance with the university legislation.

Fırat Şeker

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Date: 25/06/2024

To my family…

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ABSTRACT

It is argued that the evolved cognitive structure of humans forms an intuitive cognitive basis for religious beliefs. The Dual-process Model (DPM) of religious belief posits that individuals more prone to use reflection should show decreased religious belief. In line with that, previous research has consistently demonstrated a negative relationship between reflective thinking and religious belief. Another model, the Expressive Rationality Model (ERM), suggests that reflection serves an identity-protective function. Individuals who perceive a topic as relevant to their social identity might use reflection to reinforce their beliefs about that topic. Despite the substantial support for the DPM in current literature, previous studies have not recruited a sample of identity groups that are equally represented to test both the DPM and the ERM. In this study, we recruited a large number of both religious believers (n = 580) and non-believers (n = 594), who were all American adults, to overcome this limitation. We used various measures of cognitive reflection to test the predictions of both models, investigating the relationship between these measures and belief in God and disbelief in evolution. In our full sample, all measures of reflection were negatively correlated with religious belief and disbelief in evolution. However, when the sample was divided into believers and non-believers, some negative correlations were observed to be significantly weaker for believers, which supports the ERM. Overall, our results mainly support the DPM's explanation, and the predictions of the ERM also appear to be detectable in our sample.

Keywords: Dual-process model, cognitive style, cognitive reflection, intuition, belief in God, religious belief, analytic atheism, expressive rationality model.

BİLİŞSEL STİL VE DİNİ İNANÇ: İKİ MODELİN TESTİ

ÖZET

İnsanların evrimleşmiş bilişsel yapısının dini inançlar için sezgisel bir bilişsel temel oluşturduğu savunulmaktadır. İkili İşlem Modeli (İİM) derin düşünmeye daha yatkın bireylerin dini inançlarının azalması gerektiğini öne sürmektedir. Bu doğrultuda, önceki araştırmalar derin düşünme ile dini inanç arasında büyük oranda tutarlı olarak negatif bir ilişki olduğunu göstermiştir. Bir başka model olan Dışavurumcu Rasyonalite Modeli (DRM), derin düşünmenin kimlik koruyucu bir işlevi olduğunu öne sürmektedir. Bir konuyu sosyal kimlikleriyle ilgili olarak görenler, bu konuda sahip oldukları görüşlerini güçlendirmek için derin düşünmeyi kullanabilirler. Mevcut literatürde İİM büyük destek görmüş olmasına rağmen önceki çalışmalar hem İİM'yi hem de DRM'yi test etmek için kimlik gruplarını eşit şekilde temsil eden bir örneklemden veri toplamamıştır. Bu çalışmada, bu sınırlamanın üstesinden gelmek için hem dindar (n = 580) hem de inançsız (n = 594) Amerikan katılımcılardan veri topladık ve çeşitli derin düşünme ölçümleri kullandık. Hem İİM hem de DRM'nin öngörülerini test etmek adına bu ölçümlerin Tanrı'ya inanç ve evrime inançsızlıkla ilişkilerini inceledik. Örneklemimizin tamamında, tüm derin düşünme ölçümleri Tanrı'ya inanç ve evrime inançsızlıkla negatif korelasyon göstermiştir. Bununla birlikte, örneklemi dindarlar ve inançsızlar olarak ikiye ayırdığımızda bazı negatif korelasyonların dindarlar için daha zayıf olduğu gözlemlenmiştir; bu da DRM'yi desteklemektedir. Genel olarak, sonuçlarımız ağırlıklı olarak İİM'nin açıklamasını desteklemektedir ve DRM'nin öngörüleri de örneklemimizde tespit edilebilir görünmektedir.

Anahtar Sözcükler: İkili işlem modeli, bilişsel stil, derin düşünme, sezgisel düşünme, Tanrı'ya inanç, dini inanç, analitik ateizm, dışavurumcu rasyonalite modeli.

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LIST OF ACRONYMS AND ABBREVIATIONS

4-CTSQ: 4-Component Thinking Styles Questionnaire

AOT: Actively Open-minded Thinking

BIDR: Balanced Inventory of Desirable Responding

CMT: Close-minded Thinking

CRED: Credibility Enhancing Display

CRM: Counter-normative Rationality Model

CRT: Cognitive Reflection Test

CPT: Cognitive Performance Test

DPM: Dual-process Model

ERM: Expressive Rationality Model

HADD: Hyperactive Agency Detection Device

MCI: Minimally Counter-intuitive Concept

PET: Preference for Effortful Thinking

PIT: Preference for Intuitive Thinking

WEIRD: Western, Educated, Industrialized, Rich, Democratic

1. INTRODUCTION

For those with religious beliefs, disbelief can be shockingly puzzling. “After all, how can people reject such a fundamental aspect of reality?” a Christian might ask. While it is perhaps not as shocking for psychological scientists of the 21st century, how disbelief occurs is still puzzling. To understand the origins of religious disbelief, it is essential first to understand the roots of religious belief. Evolutionary theory offers several explanations for this.

For example, byproduct accounts of religious belief argue that the formation of supernatural beliefs relies on humans' cognitive biases, such as mind-body dualism (Bering, 2011; Bloom, 2007) and attribution of agency (Barrett, 2000; Guthrie, 1993). For example, mind-body dualism, the perception of the mind as separate from the physical body, comes naturally to children (Bering & Bjorklund, 2004; Gottfried et al., 1999) and is prevalent in adult populations as well (Riekki et al., 2013). This natural tendency to perceive mind and body as distinct paves the way for the concepts of spirit and after-life (Bloom, 2007). Cognitive shortcuts such as these make the acquisition of religious beliefs through cultural learning intuitive and easy (Atran & Norenzayan, 2004; White et al., 2021). This provides a theoretical basis for the emergence of religious belief based on relatively more automatic cognitive processes.

The Dual-process Model of Mind (DPM) argues that there are two types of information processing: Type 1 and Type 2 (Evans & Stanovich, 2013). Type 1 (intuitive) processes occur rapidly and automatically with little effort, while Type 2 (reflective) processes demand more effort and are slower. These two processes usually occur together and compete for responses to situations. If reflective processes are stronger than intuitive ones, they deliver a reflective response over intuitive ones (Evans, 2019; Pennycook et al., 2015). As stated, the cognitive biases that catalyze the acquisition of supernatural beliefs occur fast and effortlessly. In the dual-process literature, these processes fall into the category of Type 1 processes. This is the foundational argument of the intuitive religious belief hypothesis: if humans acquire religious

beliefs through intuitive processes, then reflection should lead to a decrease in religious beliefs (Bloom, 2007; Norenzayan & Gervais, 2013).

Several studies demonstrated a negative correlation between reflection and religious beliefs, specifically, belief in God (Bahçekapili & Yilmaz, 2017; Pennycook et al., 2012; Shenhav et al., 2012; Yilmaz et al., 2016). Moreover, a meta-analysis on a North American sample (N = 15,078) by Pennycook and colleagues (2016) demonstrated a meta-analytic correlation coefficient of r = -.18 between reflection and religious belief scale scores. These findings were corroborated by cross-cultural data (e.g., Stagnaro et al., 2019).

While the DPM can be used to explain the relationship between cognitive reflection and religious belief, there are other frameworks that can be employed. The Expressive Rationality Model (ERM) posits that individuals use reflection as an identity-protective tool to solidify their already-held beliefs (Kahan, 2017). The model predicts, therefore, that belief in God should be positively correlated with reflection for those who see it as an essential aspect of their identity. To test the predictions of ERM, Kahan and Stanovich (2016) investigated the relationship between reflection and belief in evolution in a US sample since belief in evolution is a topic closely tied to the social identity of religious believers. Their results showed that as reflection increased, belief in evolution increased. However, the increase was specific to less religious participants, as more religious participants did not display such an increase. This implies that reflection might serve as an identity-protective tool for believers; it aids in strengthening their position on topics they see as central to their social identity, such as evolution.

There is also the Counter-normative Rationality Model (CRM; Gervais et al., 2018). This model claims that reflection is used to question cultural norms, such as religious beliefs, and was derived to explain the positive association between reflection and belief in God, as found in a UK sample by Gervais and colleagues (2018). The model posits that if religious disbelief is the common cultural norm, reflection might lead to religious belief instead. However, the

positive correlation between reflection and belief in God found in the UK by Gervais et al. (2018) was not replicated (Stagnaro et al., 2019).

A study by Baimel et al. (2021) attempted to test the predictions of these three models using pre-existing datasets. Using both the original Cognitive Reflection Test (Frederick, 2005) and reverse-coded Faith in Intuition Scale (Pacini & Epstein, 1999) scores as measures of reflective thinking tendency, they conducted Bayesian regression analyses on how these reflection scores were associated with belief in God, Karma, and witchcraft. Their results supported mainly the DPM and, to some extent, the ERM on samples of Americans, Indians, and Canadians. Belief in God was negatively correlated to reflection measures, but primarily for liberal participants. For more conservative participants, the negative relationship between reflection and belief in God was weaker or not detectable. No support for the CRM was found.

Previous studies, including Baimel et al. (2021), did not have samples that equally represented different identity groups, which makes it difficult to test the predictions of ERM. With the emergence of data collection services that allow the pre-screening of participants, it is possible to test two demographically matched groups effectively today. In this study, we attempted to test the predictions of ERM and DPM. We investigated the association between belief in God, belief in evolution, and cognitive reflection on demographically matched samples of believers and non-believers. By including belief in evolution, we were able to better test the predictions of ERM since the ERM predicts a positive correlation between reflection and topics central to one's social identity. Belief in evolution is one such topic for religious believers and non-believers (Kahan & Stanovich, 2016). Moreover, we used a wide range of cognitive reflection measures, including both performance-based and self-report tests.

1.1 Intuitive Roots of Religious Belief

The adaptationist approach to the evolution of religious beliefs argues that religious beliefs were selected because they provided an adaptive advantage to specific pressures in the environment, improving the survival and reproduction of the organism (Atran, 2002; Boyer, 2001). On the other hand, the byproduct approach posits that religious beliefs did not evolve to improve survival or reproduction on their own but as a byproduct of several evolved cognitive biases, which were the results of adaptations in the brain (Bloom, 2007; Norenzayan & Gervais, 2013). Today, these two accounts are seen as complementary: humans' cognitive biases (which evolved as adaptations to other problems) enabled the formation of religious beliefs; after they were formed, some of them proved adaptive through cultural evolution and were preserved through generations (Liddle & Shackelford, 2021). The cultural transmission of beliefs that exploit these biases is argued to be more successful compared to those that do not (Boyer, 2001).

1.1.1 Agency detection

As stated, the byproduct account of religious belief posits that several cognitive biases of humans enable the formation and acquisition of religious beliefs. One of these is the sensitivity to detect agency (Barrett, 2004; Guthrie et al., 1980; Guthrie, 1993). Stewart Guthrie argued in his seminal paper that humans have a need to explain ambiguous stimuli, and the best potential culprits behind those ambiguous events are humans since they have the highest potential for behavioral variation (Guthrie et al., 1980). Therefore, humans likely evolved to seek agents with human minds to explain ambiguous stimuli, and this is argued to be adaptive because failure to detect agents is riskier than guessing they are there and being wrong.

While Guthrie attributed this tendency to "anthropomorphism," the term "Hyperactive Agent Detection Device," which was later changed to "Hyperactive Agency Detection Device," was coined by Justin Barrett (HADD; Barrett, 2000). The HADD revises Guthrie's arguments and

covers intentionality in general instead of just human intentionality (Barrett & Lanman, 2008). Various studies empirically demonstrated the presence of attribution of agency in both children and adults (see Atran & Norenzayan, 2004, for a review). However, empirical evidence does not clearly point towards a bias for categorizing ambiguous stimuli as agents; rather, it shows a tendency for religious individuals to show more HADD activity. For example, Van Elk and colleagues found that when presented with ambiguous stimuli that could be interpreted as houses or faces, believers categorized more stimuli as faces instead of houses than atheists (Van Elk, 2015). Similarly, several other studies found a link between prior religious belief, expectation of agency, and agency attribution but no relationship between ambiguity levels (Andersen et al., 2019; Riekki et al., 2013; Van Elk et al., 2016 but see Maij et al., 2019). Consequently, HADD theory has received criticism and revisions in recent years, and new models emphasize that HADD is not a "module" nor a sole cognitive precursor of religious belief but goes hand in hand with predictive cognition (Andersen, 2019). According to predictive cognition theory (Bubic et al., 2010; Clark, 2013), our minds operate similarly to the principle of Bayesian inference; we interpret stimuli based on previous data; therefore, if our previous beliefs make us more prone to detect human agency, we are more likely to detect human agency. This explains why religious believers tend to attribute agency more than atheists (Andersen et al., 2019; Riekki et al., 2013; Van Elk, 2015; Van Elk et al., 2016) since believing in the supernatural usually entails belief in non-physical entities such as ghosts, spirits, and souls. Moreover, HADD is argued to work together with minimally counterintuitive concepts (Atkinson, 2023; Van Leeuwen & Van Elk, 2019), concepts that only minimally deviate from their ontological category and are, therefore, argued to be better memorized compared to normal concepts (MCIs; Boyer, 2001). Accordingly, MCIs and HADD experiences can feed each other, MCIs might lead to more HADD activity (in line with predictive cognition theory), and HADD experiences can lead to better remembering of MCIs (Barret & Lanman, 2008).

1.1.2 Mind-body dualism

Another cognitive bias that potentially plays a role in the acquisition of religious beliefs is the tendency to perceive the mind as a separate entity from the body, i.e., mind-body dualism. Mind-body dualism allows individuals to conceive concepts such as souls, the afterlife, heaven, and hell, which are cornerstone concepts for many religions (Boyer, 2001). Dualistic perspectives are present in both children and adults and are argued to be a natural product of developmental processes (Bering & Bjorklund, 2004; Bloom, 2007; Gottfried et al., 1999). Previous research demonstrates a link between dualistic views and religious beliefs (Chudek et al., 2018; Heflick et al., 2015; Riekki et al., 2013), but these findings do not speak to whether the association between religious belief and dualism is indeed due to dualism being intuitive. A review of recent findings by Barlev and Shtulman (2021) concludes that mind-body dualism might not be intuitive but instead learned. Results of the review show that cultural learning and minimally counterintuitive concepts might play a better role in explaining why dualism is prevalent and has an association with religious beliefs instead of dualism's apparent inherent nature (Barlev & Shtulman, 2021). A recent cross-cultural experimental study on the association between afterlife beliefs and dualism also shows no evidence for intuitive dualism (Barrett et al., 2021). Among adult populations from four different countries (USA, Brazil, Ecuador, Ukraine), all participants judged mental processes to end after death, which supports no universal tendency to separate minds from bodies in contrast to what intuitive dualism argues.

1.1.3 Teleological thinking

The tendency to think teleologically, the tendency to think that everything in the universe has a purpose to meet and exists for that purpose, is also argued to play a role in the formation and acquisition of religious beliefs. This cognitive bias is robust and has been demonstrated repeatedly in Western samples (for a review, see Kelemen, 2004; Kelemen et al., 2013; Mills & Frowley, 2014) and in China (Rottman et al., 2017; Schachner et al., 2017). It persists regardless of education level (Casler & Kelemen, 2008) as well as religious belief (Banerjee

& Bloom, 2014). It is argued that this cognitive bias lays one of the cornerstones for the intuitive development of belief in purposeful and intelligent design (Järnefelt et al., 2015; Kelemen, 2004), which is a key feature of Abrahamic religions (Numbers, 2006). The links between teleological thinking and religious belief have been demonstrated several times (Heywood & Bering, 2014; Willard & Norenzayan, 2013), and the bias is prevalent among both children (DiYanni & Kelemen, 2005; Kelemen, 2004) and adults, including physical scientists (Kelemen et al., 2013) and those with Alzheimer's disease (Lombrozo et al., 2007). However, one study found evidence of teleological thinking in children but not in adults (Banerjee & Bloom, 2015).

1.1.4 Mentalization abilities and theory of mind

Theory of Mind, or mentalization ability, is argued to be central to all these cognitive biases (Atran & Norenzayan, 2004). Humans tend to use their mentalization abilities to attribute human-like characteristics to deities and supernatural beings, such as goals, desires, and emotional states (Gervais, 2013). For example, previous studies found that people with autism reported less belief in a personal God (Norenzayan et al., 2012). Moreover, the brain network associated with Theory of Mind abilities is also activated when participants are praying (Schjoedt et al., 2009) or when they are asked whether they agree with statements about God's involvement or emotion (Kapogiannis et al., 2009). Moreover, it is argued that reminders of God or religion invoke feelings of being watched by a supernatural entity, which requires attribution of mentality to God (Norenzayan, 2013). However, some recent studies failed to find associations between mentalization ability as an individual difference variable and religious belief; they found relationships between a tendency for ontological confusion (e.g., Lindeman et al., 2015) and credibility-enhancing displays (Maij et al., 2017) instead of mentalization abilities. Furthermore, empathy instead of a general mentalization ability seems to be a greater predictor of religious belief (Ishii & Watanabe, 2023; Jack et al., 2016; Łowicki et al., 2020; but see Vonk & Pitzen, 2017).

In addition to the above-mentioned research, some studies put to test whether all these biases were indeed associated with religious belief. Studies by Willard and Norenzayan (2013) show that teleology and mind-body dualism are positively correlated with belief in God, while anthropomorphism (i.e., agency attribution) is positively correlated with paranormal beliefs, but other biases were not correlated to belief in God. The same authors replicated the link between dualism and belief in God and anthropomorphism and paranormal belief in Czechia (Willard et al., 2020).

1.1.5 Minimally counter-intuitive concepts

A bias in human memory is also argued to play a role in the formation of an intuitive basis for religious belief. As Pascal Boyer argues, religious beliefs exploit a tendency of human memory systems, that is, memorability of minimally counterintuitive concepts (MCIs; Boyer, 2001). Boyer argues that humans make instant attributions of ontological categories to any perceived stimulus. MCIs usually preserve all characteristics of the ontological category they belong to, but they deviate only minimally from them. This deviation makes them more memorable than ontologically normal, intuitive concepts (Atran & Norenzayan, 2004; Barrett & Nyhof, 2001; Boyer & Ramble, 2001), and this contributes to religions being spread better because religious texts include MCIs throughout them in minimal amounts (Boyer, 2001). However, a review of research conducted in the field of MCI theory by Purzycki and Willard (2016) shows that the literature is mixed, with some empirical studies lending support to the MCI theory and some not. The authors claim that this might be due to the poor operationalization of what an MCI is and conclude that the concept of MCIs is rather peripheral than central to the development of religious beliefs. The mixed state of the literature still persists today (see Bendixen & Purzycki, 2021). A new theoretical claim proposes that the MCIs can be simplified into the von Restorff effect that has been well studied in the memory literature, which suggests, in simple terms, that unusual concepts among usual ones are remembered better than usual concepts (Sommer et al., 2022, 2023).

Taken together, the recent developments in the field suggest that, overall, the evidence for intuitive cognitive biases playing a role in religious belief acquisition is small (Willard et al., 2022). It appears cultural learning could play a much greater role in the acquisition of religious beliefs than cognitive biases. For example, Maij et al. (2017) found that credibility-enhancing displays (CREDs, Henrich, 2009) had a much greater positive association with having religious beliefs than the theory of mind abilities ($N > 67.000$). Hence, these biases are not seen as the only precursors of religious beliefs but as aids to their formation and consolidation throughout the cultural learning process (White et al., 2021). The theories surrounding the concepts of HADD, MCIs, and intuitive dualism are possibly in need of refinement (Andersen, 2019; Barlev & Shtulman, 2021; Purzycki & Willard, 2016; Sterelny, 2018; Willard et al., 2022).

1.2 Paths to Religious Disbelief

Given the cognitive makeup of the human mind described above and the prevalence of religious beliefs in the world, non-belief might seem to be difficult to occur, but that is not the case. As discussed above and also by Will Gervais (2013), all these cognitive mechanisms are probably necessary but not enough on their own to produce religious beliefs.

There are several paths to atheism and disbelief. It is argued that if there is a lack of CREDs in one's immediate environment while growing up or if there is little presence of religiosity in one's culture, a person might be more likely to develop as a non-believer (e.g., Gervais et al., 2011; Lanman, 2012; Łowicki & Zajenkowski, 2020; Maij et al., 2017). To be more specific, these individuals are likely to hold an indifferent stance toward religion rather than being against it (Norenzayan & Gervais, 2013). Another argument called "apatheism" proposes that the security, comfort, and sense of control that religious beliefs bring is today compensated by secular authorities. A long-standing argument proposes that humans used to face existential threats throughout life that motivated them to seek comfort and meaning, which were provided by the shelter of the afterlife and an all-knowing, just, and merciful God (Atran, 2002). According to the apatheism argument, these needs for security and

certainty are now met by secular institutions such as the government and the police (Norenzayan, 2013; Norenzayan & Gervais, 2013). Therefore, humans may no longer feel the need to seek comfort and certainty in religions, for which the low number of religious people in the Scandinavian countries can be shown as evidence (Zuckerman, 2008). The approach to disbelief that is most related to the scope of this study is termed "analytic atheism."

1.2.1 Analytic atheism

The term analytic atheism, coined by Norenzayan and Gervais (2013), pertains to religious disbelief due to one's propensity to use an analytic cognitive style (henceforth referred to as reflection or reflective thinking) to overcome cognitive tendencies that make religious beliefs intuitive. To broadly explain, it is argued that the evolved cognitive structure of the human mind supports the acquisition of religious beliefs through cultural learning, and beliefs that exploit these intuitive bases spread more rapidly and efficiently. Some individuals repress or revise these intuitions through reflection. Therefore, it is argued that the tendency to rely on reflection should be associated with less religious belief. This explanation relies on the Dual-process Model of human reasoning (Evans & Stanovich, 2013). However, there is not just one approach that explains the relationship between reflection and religious belief. There are models with different explanations that have predictions for different contexts and populations.

1.3 The Dual-process Model

The Dual-process Model (DPM) of reasoning posits that the human mind operates with two distinct sets of reasoning: Type 1 thinking, which is the constitution of several processes rather than a single process, is more rapid, intuitive, heuristic-based, and effortless. Type 2 thinking is slower, heavier on the working memory, controlled, and more effortful than Type 1 processes (Evans & Stanovich, 2013). It is argued that Type 1 processes evolved earlier and are shared with other animals. However, Type 2 thinking evolved much more recently and is

unique to humans. According to the DPM, these two processes occur simultaneously and compete with each other. In some situations, Type 2 responses might overcome the faster and more intuitive Type 1 responses to produce a decision (Evans, 2019; Kahneman, 2011).

The roots of the idea that there might be two separate reasoning styles date back to William James (1890) and his thoughts on human reasoning. However, empirical research and modern theorizing on dual-process theories proliferated in the late 1900s (e.g., Evans, 1984; Evans & Over, 1996; Hammond, 1996; Sloman, 1996). Various scholars used different terms for these two distinct thinking styles, but specifically, the models of Sloman (1996) and Evans and Over (1996) were named the "dual-systems model" due to models consisting of System 1 intuitive and System 2 reflective process systems. The names System 1 and System 2 were later applied as general names to represent the intuitive/automatic and analytic/reflective thinking distinctions in the literature by Stanovich and West (2000). However, Type 1 and Type 2 thinking is also used to refer to the same constructs (Evans, 2019).

Although there have been different works and models, the modern theoretical framework was laid out by Jonathan Evans and colleagues in 1983 (Evans et al., 1983). Since then, the DPM has been refined further and has received enormous empirical support (see Evans, 2003; Evans & Stanovich, 2013 for reviews). It is widely applied in various fields of research today, such as politics (e.g., Duckitt & Sibley, 2009;Yilmaz & Saribay, 2017b), morality (e.g., Greene, 2015; Yilmaz & Saribay, 2017a), and more recently, artificial intelligence (Booch et al., 2021). However, the theory has also received several criticisms on the grounds that the traditional account of DPM cannot explain the recent empirical findings showing that some logical reasoning outputs can be produced intuitively without the need (or time) for reflection (for a review, see De Neys & Pennycook, 2019). According to these recent criticisms, it is proposed that some intuitive responses occur faster and more strongly than others, and one can produce logical answers intuitively based on fundamental knowledge of logic and probability. The usage of reflection to correct these intuitions is needed if the logical intuition is not stronger than other intuitive responses (De Neys, 2017; De Neys & Pennycook, 2019), and reflection comes into play more often if conflict among these intuitive responses is

detected (Pennycook et al., 2015). Sometimes, when a conflict is detected, an intuitive response can be rationalized through reflection (Pennycook et al., 2015). Therefore, reflection might not always lead to logical and accurate judgments, or intuitive thinking might not always lead to incorrect and biased reasoning.

One of the fields that the DPM has been prevalently applied to is the psychology of religion. As the argument goes, as the tendency for reflection increases, religious belief tends to decrease since the intuitive reasoning outputs that stem from our evolved cognitive structure should be overridden with reflective ones. Hence, the analytic atheism argument can be considered as the prediction of the Dual-process Model. Initial research on the cognitive style differences between believers and atheists looked into the relationship between religious belief and reflection using the Cognitive Reflection Test as the measure of reliance on intuitive versus reflective thinking (CRT; Frederick, 2005). The CRT is a performance-based measure of cognitive style that consists of three questions with three answers, for example: "A baseball and a bat cost 1.10$. If the bat costs 1$ more than the ball, how much does the ball cost?". There is only one answer that is correct (5 pence), which is argued to be only reachable through reflective thinking. One of the other two answers is erroneous but is argued to be easily reachable by intuitive reasoning (10 pence). The third option is an erroneous answer that is not intuitive nor reflective (9 pence). Results of various empirical studies consistently demonstrated negative correlations between performance on the CRT and belief in God (Bahçekapili & Yilmaz, 2017; Jack et al., 2016; Pennycook et al., 2012; Razmyar & Reeve, 2013; Shenhav et al., 2012; Yilmaz et al., 2016). These findings were further corroborated by a meta-analysis conducted on 31 studies with a sample of 15.078 North Americans (Pennycook et al., 2016). The meta-analysis showed a negative meta-analytic correlation coefficient of r = - .18. Furthermore, two large-scale cross-cultural studies also lend support to the DPM's account of religious belief: Ghasemi and colleagues (2024) showed in 19 countries (e.g., the UK, Indonesia, China, Canada, and Romania. N = 7.771), that reflection measured by CRT performance was negatively associated with belief in God whereas intuitive thinking was positively associated (Ghasemi et al., 2024). Another study also showed that reflection was negatively correlated to belief in God in an online sample of

US citizens (Study 1, N = 17.347). The same study also demonstrates cross-cultural support for the DPM across 16 countries (e.g., Egypt, Australia, China, Nigeria, and the Philippines. Study 2, N = 33.480. Stagnaro & Pennycook, 2024).

1.4 The Counter-normative Rationality Model

A cross-cultural study by Gervais et al. (2018) showed that the negative correlation between reflection and belief in God was observable in other cultures as well. However, the effect sizes found by Gervais and colleagues were not consistently negative in all cultures: for example, in Czechia, Netherlands, and New Zealand, the effect was weak, and in the United Kingdom, the relationship between reflection and belief in God was positive, which meant that individuals more prone to use reflection believed in God more than those who relied more on intuition. However, the correlation between reflection and belief in God was negative for more predominantly religious countries, such as the United Arab Emirates and India. In an attempt to explain these findings, Gervais and colleagues (2018) proposed the Counter-normative Rationality model (CRM). According to this model, reflection leads to the questioning of widely accepted social norms, which play a significant role in shaping what humans have intuitions about (Henrich, 2015). In predominantly secular countries, such as the UK and Czechia, atheism can be seen as a more mainstream cultural norm. Therefore, the loss of strength in the relationship between reflection and belief in God might be attributed to more reflective-thinking-oriented people using their analytical thinking capabilities to question the widely accepted social norms and move away from them.

However, research on CRM is scarce, and the studies do not lend supporting evidence to it. A replication of Gervais et al. (2018) by Stagnaro and colleagues failed to find a positive correlation between belief in God and reflection in the UK. Instead, the study demonstrated the predicted negative correlation (Stagnaro et al., 2019). In a similar vein, the negative correlation between reflection and belief in God was also observed in Germany (N = 3.063), which is a secular country (Weiss et al., 2021). A study by Baimel and colleagues (2021) directly tested the predictions of the CRM by looking at the correlations between non-

mainstream beliefs in the USA, such as karma and witchcraft, and CRT performance. Their results showed no support for the CRM; the strength of these beliefs did not increase for Americans as reflection increased (Baimel et al., 2021).

1.5 The Expressive Rationality Model

The Expressive Rationality Model (ERM; Kahan, 2017) proposes that reflective thinking does not always lead to logical and rational reasoning. Kahan argues that the Expressive Rationality Model stems from a type of reasoning called identity-protective cognition (Kahan et al., 2007; Sherman & Cohen, 2006). Accordingly, individuals who use reflective thinking do not always correct their erroneous intuitions but instead, use it to process new information so that it conforms to their previously held beliefs when the topic of reasoning is related to the identity of the individual. In other words, reflective processing of information on identity-related matters leads to the strengthening of previous beliefs on the matter. For example, previous research has shown that individuals judge scientific experts based on whether the expert opinion aligns with their political worldview, which is an identity marker (Kahan et al., 2011). Moreover, it has also been shown that as CRT scores increase, both liberals and conservatives tend to display more motivated reasoning (Kahan, 2013). More importantly, Kahan and Stanovich have shown that the relationship between reflection and religious belief is not immune to identity-protective cognition (Kahan & Stanovich, 2016). Their results suggest that the relationship between reflection and disbelief in evolution was dependent on the prior religiosity levels of participants. While there was a general trend for reflection being associated with less disbelief in evolution in a pooled sample, the trend only continued to hold for those who scored low in religious belief. Among highly religious participants, disbelief in evolution did not increase, and only weakly did it increase for each correct CRT answer. Therefore, the ERM predicts a moderating role of prior identity-related beliefs. Regarding religious belief, the ERM predicts either no correlation or a positive correlation between religious belief and reflection for those who already have religious beliefs and consider religiosity an important aspect of their identity.

In their paper, Baimel and colleagues (2021) ran secondary analyses on data previously collected from 9 different samples to test the predictions of all three models outlined above on the relationship between reflection and religious belief. Their results showed support for the DPM and the ERM. As reflection scores in CRT increased, belief in God decreased for liberals but increased for conservatives in a student sample, which aligned with the ERM. However, the same positive direction was not found among conservatives in a more general sample of adult Americans. Instead, as conservatism increased, the relationship weakened and almost disappeared, but it did not turn positive. Baimel and colleagues also used the Faith in Intuition Scale (Pacini & Epstein, 1999) as a self-report-based measure of intuitive thinking tendency. They showed that as reverse-coded Faith in Intuition scores increased, belief in God generally decreased, but the effect was again more pronounced for liberal participants. For conservative participants, there was either a weak or no relationship. The study found no support for the CRM by investigating the relationship between karmic beliefs and Faith in Intuition scores. They found mainly negative relationships. However, for witchcraft beliefs, there was a significant moderating role of political ideology: for conservatives, the relationship between reflection and witchcraft beliefs was positive, while for liberals, it was negative.

1.6 The Present Study

Previous research that tested the ERM's predictions on religious belief encountered difficulties in equally representing each identity group that the predictions of ERM should be tested on (e.g., Baimel et al., 2021). In this case, the ERM should be tested using a sample of equal believers and non-believers. With the advances in data collection technologies, this process has been revolutionized. It has now become possible to recruit and classify participants based on the information they provided beforehand. This allows us to examine the predictions of the ERM more accurately by recruiting an equal and demographically matched sample of specific groups, such as believers and non-believers. In this pre-registered study, we collected data from 600 Christian believers and 600 non-believers (300 atheists and 300 agnostics) using Prolific to test the predictions of both the DPM and the ERM. We

used these participants' self-reported religious belief as an identity marker to make a more precise test of the ERM.

Another limitation in the literature is the over-reliance on CRT as the sole measure of reflective thinking. The CRT fails to capture all aspects of reflection successfully. It focuses heavily on arithmetic reasoning and overlooks, for instance, verbal reasoning (Hertzog et al., 2018). Moreover, some correct answers to the CRT can be achieved through intuitive thinking (Bago & De Neys, 2019; Raoelison et al., 2021), which contributes to the criticisms directed at the DPM theory today. Hence, relying on the CRT as the only measure of reflection is problematic. To alleviate this, we administered a more comprehensive range of reflective thinking measures, including both self-report scales and performance-based tasks.

In addition to belief in God, we also asked participants about their belief in evolution to test ERM since evolution is a matter of hot debate among religious believers and non-believers and serves as an identity marker for believers (Kahan & Stanovich, 2016). According to the ERM, to signal loyalty to their own identity group, individuals on each side who have a more reflective thinking style will bolster their previously held beliefs on the topic.

The DPM predicts that there will be a negative correlation between belief in God and reflective thinking regardless of participants' prior religious beliefs. On the other hand, the ERM predicts that this relationship will be moderated by these prior beliefs. According to the ERM, while reflection and belief in God will have a negative correlation for non-believers, the correlation coefficient should be positive for believers. Our pre-registered hypotheses are based on the predictions of the two models:

H1: According to the DPM, believers will have lower scores than atheists and agnostics on all reflection measures and higher scores on intuition measures.

H2: While the DPM predicts a negative correlation between belief in God/disbelief in evolution for both believers and non-believers, the ERM predicts a positive correlation for believers and a negative correlation for non-believers.

2. METHOD

2.1 Participants

This study was pre-registered. All materials, data sets, and analysis codes are openly accessible at https://osf.io/5964s/.

The sample size calculation for this study was derived from a separate project that examines the consistency of moral beliefs among religious believers and non-believers (OSF: https://osf.io/rnzy9/). Therefore, we ran sensitivity power analyses for each of our confirmatory analyses. The results of these analyses are reported in footnotes. Before data collection, we pre-screened the participants to match them based on religious affiliation and socioeconomic status. We recruited 1200 participants via Prolific, with 600 believers and 600 non-believers who were invited to participate in an online study in return for financial compensation. Participants received all 25 measures in random order and then completed a demographic questionnaire. Participants were US residents and native English speakers. The median age of the sample was 37 (M_{age} = 39.86, SD_{age} =14.9), and the gender distribution among participants was as follows: 49.1% male, 47.8% female, 2.6% non-binary, and 0.6% preferred not to disclose. The majority of participants (65.1%) reported holding at least an associate, bachelor's, or higher degree.

Prolific collects demographic information, such as religious affiliation, to use for pre-screening upon creation of an account. Therefore, if a participant's religious affiliation changes later in their lifetime, they must update this information on Prolific. If they do not, this information remains, creating discrepancies between their pre-screen answers and the more up-to-date answers they provide in a study. When we checked for such discrepancies, we spotted 26 participants with different answers to the religious affiliation question in the

demographic questionnaire than the religious affiliation Prolific pre-screened them on. Because of this, we decided to prioritize answers given to the religious affiliation question in our demographic survey instead of pre-screen since the answer to the demographic question was more recent. Consequently, 6 participants who identified as Jewish and 20 participants who selected "other" were removed from the analyses (2.2% of all participants). The final sample size consisted of N = "174, and the demographic information of these participants is reported in Table 2.1.

Table 2.1 Demographics

	Christians (n = 580)	Atheists (n = 313)	Agnostics (n = 281)	Overall (N = 1174)
Age				
Minimum	18	18	18	18
Maximum	93	81	73	93
Mean	43.6	37.3	35	39.9
Gender (%)				
Male	50.3	48.2	47.3	49.1
Female	49.3	45.4	47.3	47.8
Ideology (with %)				
Conservative	198 (34.1%)	15 (4.8%)	20 (7.1%)	233 (19.8%)
Moderate	167 (28.8%)	46 (14.7%)	55 (19.6%)	268 (22.8%)
Liberal	175 (30.2%)	226 (72.2%)	184 (65.5%)	585 (49.8%)
Libertarian	19 (3.3%)	7 (2.2%)	9 (3.2%)	35 (3%)
Other	21 (3.6%)	19 (6.1%)	13 (4.6%)	53 (4.5%)
SES (%)				
Low	57.4	57.5	61.2	58.6

High	42.6	42.5	38.8	41.4

Since this exclusion was not pre-registered, we re-ran our confirmatory analyses with these 26 participants included to adhere to our pre-registration. Only a few results changed, and these new results were still in line with the results of our main confirmatory analyses. The results are reported in the supplementary materials document, which can be accessed at https://osf.io/5964s/.

2.2 Materials

2.2.1 4-Component thinking styles questionnaire

The 4-Component Thinking Styles Questionnaire (4-CTSQ) is a 24-item Likert-type scale that consists of four subscales and was developed by Newton et al. (2021). The actively open-minded thinking (AOT) subscale measures how prone one is to evaluate one's beliefs upon new evidence (α = .92). The close-minded thinking (CMT) subscale measures one's tendency to see the actions and events around them as only right or wrong (α = .87). The preference for intuitive thinking subscale (PIT) measures the tendency for one to rely on their intuitions when faced with a decision (α = .95). The preference for effortful thinking subscale (PET) measures the tendency for one to rely on analytical and reflective thought processes in face of problems (α = .90). The validity of the 4-CTSQ was also demonstrated in a Turkish sample (Bayrak et al., 2023). The full scale can be found in Appendix A.

2.2.2 Cognitive performance test

The cognitive performance test (CPT) was developed by Isler and Yilmaz (2023) as an extensive performance-based measure of reflective thinking. The test consists of five questions. Three of these questions are the same as the original Cognitive Reflection Test (CRT; Frederick, 2005). The CRT questions measure the tendency to think reflectively and

override cognitive biases using problem-solving questions with reflective and correct, intuitive and incorrect, and non-intuitive and incorrect answers. In addition to the original CRT questions, the CPT also has one conjunction fallacy question and one belief-bias question. Unlike the CRT questions, these two questions do not have non-intuitive and incorrect answers. Together, these questions provide a robust performance-based measure of reflection (Isler & Yilmaz, 2022). "CPT reflection" scores are derived by summing the reflective answers, and "CPT intuition" scores are derived by summing the intuitive answers. The questions can be found in Appendix B.

2.2.3 Raven's progressive matrices

Raven's progressive matrices (Raven, 2000) serve as another performance-based measure of reflective thinking (Baron et al., 2016). We followed the procedure outlined in Mani et al. (2013, study 2) and presented participants with three matrices in a 3x3 format. There are a total of eight figures in these matrices that make up a pattern, but one of the figures is missing. The goal of the task is to solve the pattern and select the missing figure correctly. Higher scores indicate higher reflective ability. The matrices are presented in Appendix C.

2.2.4 Balanced inventory of desirable responding

The Balanced Inventory of Desirable Responding Short Form (BIDR-16) was developed by Hart et al. (2015) as a short measure of the tendency for socially desirable responding. The scale has sixteen items and consists of two subscales. The impression management subscale measures the tendency to answer questions to meet the expectations of others ($\alpha = .82$). The self-deceptive enhancement subscale measures how likely one is to provide exaggerated positive answers about oneself ($\alpha = .78$). Since religious believers were found to respond in a more socially desirable manner, we used the scores of this scale as a covariate in our exploratory analyses. The scale can be found in Appendix D.

2.2.5 Demographic questionnaire

Participants completed a demographic questionnaire at the end of the survey. The questionnaire probed participants for age, sex, income, subjective SES, political ideology, religious beliefs, meaning in life, and happiness. Some key variables in this study were part of this demographic questionnaire; these variables are explained in more detail below. The complete questionnaire can be found in Appendix E.

2.2.5.1 Religious belief

We measured participants' religious affiliation with a single question with 24 answer options to select from. These options included nine Christian affiliations, and participants were coded as Christian if they selected one of these nine options. Participants were coded as atheists if they selected the option "atheist" and as agnostic if they selected the option "agnostic". Participants who selected these two options were later coded together as "non-believers." Participants who selected any other option were removed, as explained in section 2.1. A single-item question: "Do you believe in God?" measured the strength of belief in God with options ranging from 0 = "definitely not" and 10 = "definitely yes". This question served as our main measurement of belief in God.

2.2.5.2 Disbelief in evolution

To measure participants' disbelief in evolution, we asked them "Do you believe in evolution?" in the demographic questionnaire (0 = definitely not, 10 = definitely yes) and reverse scored the answers. Evolution is a topic that serves as an identity marker for religious believers (Kahan & Stanovich, 2016). Since DPM and ERM predict a positive relationship between reflection and disbelief in God for non-believers, we used disbelief in evolution to test the same relationship for believers.

2.3 Data Analysis Strategy

To test H1, we ran seven one-tailed independent samples t-tests for our seven cognitive style measures, comparing believers and non-believers. Grouping was done using the religious affiliation question in the demographic questionnaire. We report Bonferroni corrected *p*-values. To test H2, we ran bivariate correlations between our seven cognitive style measures and belief in God and disbelief in evolution. As exploratory analyses, we ran Fisher's r to z transformation test to explore whether correlations between cognitive style measures and belief in God/disbelief in evolution were different for believers and non-believers. Moreover, we ran partial correlation analyses using the BIDR-16 subscales to check whether correlations were influenced by socially desirable responding. Since there was a reduction in the sample size, we ran sensitivity power analyses for each confirmatory analysis we conducted. These are reported as footnotes for each analysis.

3. RESULTS

3.1 Confirmatory Tests

As pre-registered, we ran seven one-tailed t-tests to test H1: Non-believers will score higher on reflection measures and lower on intuition measures compared to believers[1]. The scores on Raven's matrices, CPT, and 4-CTSQ subscales between non-believers and believers were compared. Table 3.1 summarizes the results of the analyses.

3.1.1 Hypothesis 1

Table 3.1 Mean Differences Between Believers and Non-believers on Study Variables

	Believer (n = 580)	**Non-believer (n = 594)**	
	M (*SD*)		*t*
AOT	3.69 (1.17)	4.94 (0.92)	-20.30**
CMT	3.26 (1.24)	2.38 (1.08)	13.05**
PIT	3.78 (1.18)	3.10 (1.17)	10.012**
PET	4.37 (1.20)	4.75 (1.09)	-5.710**
CPT reflection	1.88 (1.55)	2.67 (1.59)	-8.675**
CPT intuition	2.94 (1.50)	2.16 (1.50)	9.027**
Raven's	1.03 (1.06)	1.46 (1.12)	-6.754**

Note. **$p < .001$. Numbers outside parentheses represent group means, and numbers within parentheses represent standard deviations.

[1] According to the results of a sensitivity power analysis for a one-tailed t-test, we could detect an effect size equal to or greater than $d = .19$ for an $\alpha = .05$ and .95 power for N = 1176.

Results were in the same direction as our predictions. Believers (M = 3.69, SD = 1.17) scored significantly lower than non-believers (M = 4.94, SD = 0.92) on the AOT subscale $t(1172)$ = -20.30, $p < .001$, Cohen's d = -1.185. Likewise, believers (M = 4.37, SD = 1.20) scored lower than non-believers (M = 4.75, SD = 1.09) on the PET subscale $t(1172)$ = -5.710, $p < .001$, Cohen's d = -0.333.

Analyses yielded similar results on performance-based measures. Believers' CPT reflection scores (M = 1.88, SD = 1.55) were significantly lower than non-believers'(M = 2.67, SD = 1.59), $t(1172)$ = -8.675, p <.001, Cohen's d = -0.506. Similarly, believers identified the patterns less correctly (M = 1.03, SD = 1.06) than non-believers (M = 1.46, SD = 1.12) in the Raven's Progressive Matrices $t(1172)$ = -6.754, $p < .001$, Cohen's d = -0.394.

As hypothesized, believers scored higher on all intuition measures compared to non-believers. Starting with CMT scores, believers scored higher (M = 3.26, SD = 1.24) than non-believers. M = 2.38, SD = 1.08), $t(1172)$ = 13.05, $p < .001$, Cohen's d = 0.762. On the PIT subscale, believers had higher scores (M = 3.78, SD = 1.18) compared to non-believers (M = 3.10, SD = 1.17), $t(1172)$ = 10.012, $p < .001$, Cohen's d = 0.584. This pattern found in self-report measures was consistent with the performance-based measure. Believers had significantly higher scores (M = 2.94, SD = 1.50) than non-believers (M = 2.16, SD = 1.50) on the CPT, $t(1172)$ = 9.027, $p < .001$, Cohen's d = 0.527. To control for Type 1 error rate, we used Bonferroni correction while interpreting these p-values. No change of significance was observed at $p < .05$ level for any of our results.

3.1.2 Hypothesis 2

In our second hypothesis, we tested the predictions of ERM and DPM. The DPM predicts that reflection is negatively associated with belief in God and disbelief in evolution for both believers and non-believers. The ERM suggests that reflection can be used as an identity-protective mechanism for some populations and under certain conditions. Therefore, it predicts that reflection can be positively associated with belief in God and disbelief in

evolution for believers but not non-believers. To test these predictions, we ran bivariate correlation analyses. However, a bimodal distribution was apparent in our main variable, belief in God (Figure 3.1). To overcome these apparent floor and ceiling effects, instead of relying on regression, we created a composite variable and disattenuated correlations[2] to correct for the differences in the unreliability of our scales. This composite variable included the scores of 4-CTSQ subscales, the CPT reflection scores, and Raven's matrices scores. CPT intuition scores were not included because they were multicollinear with CPT reflection scores. We took the mean of these six variables based on their z-scores so that each variable is equally weighted and then disattenuated all correlations. This allowed us to work around the floor and ceiling effects by controlling for measurement errors. No results changed significance, nor did any of the differences between correlations become significant after disattenuating the correlations. Standard zero-order correlation tables are presented in the online supplementary materials.

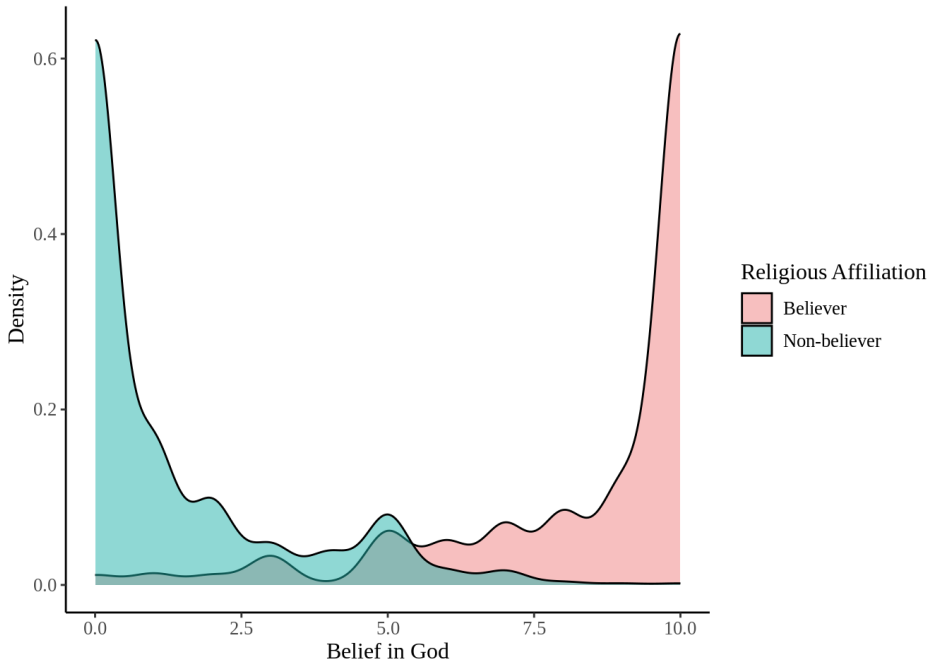

Figure 3.1 Density Plot of Belief in God

[2] The usage of disattenuated correlations was not pre-registered. However, this was a useful advice given during the journal review process of the submitted manuscript and we decided to add it.

First, we looked at the correlations without subsampling religious believers and non-believers. Overall, the results lend support to the predictions of DPM: reflection measures are negatively correlated with belief in God and disbelief in evolution, and intuition measures are positively correlated with the same variables. These pooled sample correlations are presented in Table 3.3.

Table 3.2 Pooled Sample Correlations

	1	2	3	4	5	6	7	8	9	10
1-Belief in God	1	.54**	-.54**	.38**	.33**	-.17**	-.25**	.26**	-.17**	-.49**
2- Disbelief in Evolution	.54**	1	-.44**	.41**	.17**	-.19**	-.22**	.22**	-.17**	-.44**
3- AOT	-.56**	-.46**	1	-.40**	-.47**	.28**	.31**	-.31**	.21**	.72**
4- CMT	.41**	.44**	-.45**	1	.25**	-.21**	-.19**	.19**	-.15**	-.59**
5- PIT	.34**	.17**	-.50**	.27**	1	-.20**	-.30**	.29**	-.18**	-.65**
6- PET	-.18**	-.20**	.31**	-.24**	-.22**	1	.21**	-.20**	.16**	.55**
7- CPT reflection	-.30**	-.26**	.39**	-.24**	-.37**	.26**	1	-.96**	.37**	.64**
8- CPT intuition	.31**	.26**	-.39**	.24**	.36**	-.25**	-1.37**	1	-.35**	-.62**
9- Raven's	-.22**	-.22**	.28**	-.20**	-.23**	.21**	.56**	-.53**	1	.56**
10- Total reflection	-.51**	-.46**	.79**	-.66**	-.70**	.61**	.80**	-.78**	.59**	1

Note. **. Correlation is significant at 0.01 level (two-tailed). Values below the diagonal represent disattenuated correlations, whereas values above the diagonal represent the standard correlations.

3.1.2.1 Correlations with reflection scores

As pre-registered, we ran subsampled correlation analyses to test H2[3]. When believers and non-believers were separated, our analyses again supported the predictions of the DPM.

For believers, belief in God was negatively correlated with scores in AOT (r = -.25, p < .001), but no significant correlation between PET and belief in God was observed (r = -.03, p = .470). While CPT reflection scores were significantly correlated with belief in God scores (r = -.11, p = .008), scores in Raven's matrices were not (r = -.01, p = .810). For non-believers, belief in God was only negatively correlated to AOT (r = -.28, p < .001), which is a self-report measure. Correlations between scores in CPT reflection (r = -.07, p = .088) and Raven's matrices (r = .02, p = .626) and belief in God were not significant. Total reflection and belief in God scores were negatively correlated for both believers (r = .22, p < .001) and non-believers (r = -.19, p < .001).

Similar negative correlations are observed when correlations between disbelief in evolution and reflection measures are investigated. The correlation between disbelief in evolution and AOT (r = -.28, p < .001), PET (r = -.10, p = .015), and CPT reflection (r = -.12, p = .003) was negative for believers. However, Raven's scores were not significantly correlated with disbelief in evolution (r = -.08, p = .054). For non-believers, disbelief in evolution was negatively correlated to all reflection measures: AOT (r = -.31, p < .001), PET (r = -.22, p < .001), CPT reflection (r = -.23, p < .001), and Raven's Progressive Matrices (r = -.19, p < .001). Total reflection was negatively correlated to disbelief in evolution for both believers (r = -.27, p < .001) and non-believers (r = -.35, p < .001)

[3] The results of a sensitivity power analysis for bivariate correlations revealed that we could detect an effect size equal to or greater than r = .10 for an α = .05 and .95 power for N = 1176.

3.1.2.2 Correlations with intuition scores

For believers, the correlation between belief in God and CMT ($r = .25$, $p < .001$), PIT ($r = .14$, $p < .001$), and CPT intuition ($r = .12$, $p = .003$) was significant and positive. For non-believers, CMT ($r = .02$, $p = .626$) and CPT intuition ($r = .08$, $p = .051$) scores were not significantly correlated with belief in God, but PIT scores were ($r = .24$, $p < .001$).

Likewise, disbelief in evolution was positively correlated with CMT ($r = .39$, $p < .001$) and CPT intuition ($r = .12$, $p = .003$) scores for believers, but PIT scores were not significantly correlated ($r = .01$, $p = .810$). For non-believers, all measures were significantly and positively correlated with disbelief in evolution (CMT: $r = .14$, $p < .001$; PIT: $r = .14$, $p < .001$; CPT intuition: $r = .19$, $p < .001$).

Table 3.3 Correlations of Study Variables with Separated Believers and Non-believers

	1	2	3	4	5	6	7	8	9	10
1- Belief in God	1	.31** (.18**)	-.24** (-.27**)	.23** (.02)	.14** (.23**)	-.03 (-.08*)	-.09* (-.06)	.10* (.07)	-.01 (.02)	-21** (-.18**)
2- Disbelief in evolution	.31**(.18**)	1	-.27** (-.30**)	.36** (.13**)	.01 (.14**)	-.10* (-.21**)	.10* (.19**)	.10* (.16**)	-.06 (-.15**)	-.26** (-.33**)
3- AOT	-.25** (-.28**)	-.28** (-.31**)	1	-.33** (-.19**)	-.45** (-.35**)	.20** (.31**)	.28** (.17**)	-.29** (-.15*)	.13** (.13**)	.67** (.59**)
4- CMT	.25** (.02)	.39** (.14**)	-.37** (-.21**)	1	.15** (.18**)	-.17** (-.15**)	-.14** (-.08)	.15** (.06)	-.07 (-.11**)	-.53** (-.49**)
5- PIT	.14** (.24**)	.01 (.14**)	-.48** (-.37**)	.16** (.20**)	1	-.18** (-.14**)	-.29** (-.20**)	.29** (.18**)	-.16** (-.11**)	-.63** (-.59**)
6- PET	-.03 (-.08)	-.10* (-.22**)	.22** (.34**)	-.19** (-.16**)	-.19** (-.15**)	1	.19** (.16**)	-.19** (-.14**)	.12** (.14**)	.54** (.56**)
7- CPT reflection	-.11** (-.07)	-.12** (-.23**)	.35** (.22**)	-.18** (-.10*)	-.36** (-.24**)	.24** (.20**)	1	-.95** (-.96**)	.37** (.31**)	.64** (.59**)
8- CPT intuition	.12** (.08)	.12** (.19**)	-.36** (-.19**)	.19** (.08)	.36** (.22**)	-.24** (-.18**)	-1.36** (-1.37**)	1	-.36** (-.28**)	-.63** (-.55**)

9- Raven's	-.01 (.02)	-.08 (-.19**)	.17** (.17**)	-.09* (-.15**)	-.21** (-.14**)	.16** (.19**)	.56** (.47**)	-.55** (-.42**)	1	.52** (.56**)
10- Total reflection	-.22** (-.19**)	-.27** (-.35**)	.73** (.64**)	-.60** (-.55**)	-.68** (-.63**)	.60** (.62**)	.80** (.74**)	-.79** (-.69**)	.69** (.74**)	1

Note. Out parentheses represent believers, and within parentheses represent non-believers. *$p < .05$; **$p < 0.01$ level (two-tailed). Values below the diagonal represent disattenuated correlations, whereas values above the diagonal represent the standard correlations.

3.1.2.3 Comparison of correlation coefficients

To compare the strength of correlation coefficients between believers and non-believers, we ran Fisher's *r* to *Z* transformation tests as pre-registered using the disattenuated correlations. Some results supported the prediction of the ERM: reflection scores such as PET (Fisher's $Z = 2.11$, $p = .018$), CPT reflection (Fisher's $Z = 1.94$, $p = .026$), and Raven's matrices (Fisher's $Z = 1.92$, $p = .028$) were more strongly correlated with disbelief in evolution for non-believers than believers. The rest of the significant results seem mixed: The positive association between disbelief in evolution and CMT was stronger for believers than non-believers (Fisher's $Z = 4.63$, $p < .001$), and believers had a stronger correlation between belief in God and CMT than non-believers (Fisher's $Z = 4.02$, $p < .001$). However, both disbelief in evolution (Fisher's $Z = -2.24$, $p = .013$) and belief in God (Fisher's $Z = -1.77$, $p = .038$) were more strongly positively correlated with PIT for non-believers than believers.

Table 3.4 Comparison of Correlation Coefficients

	Belief in God			Disbelief in Evolution		
	Believers	Non-believers	Fisher's *Z*	Believers	Non-believers	Fisher's *Z*
AOT	-.25**	-.28**	0.55	-.28**	-.31**	0.56
CMT	.25**	.02	4.02**	.39**	.14**	4.63**
PIT	.14**	.24**	-1.77*	.01	.14**	-2.24*
PET	-.03	-.08	0.86	-.10*	-.22**	2.11*
CPTref	-.11**	-.07	-0.69	-.12**	-.23**	1.94*
CPTint	.12**	.08	0.69	.12**	.19**	-1.23
Raven's	-.01	.02	-0.51	-.08	-.19**	1.92*
TotalRef	-.22**	-.19**	-0.53	-.27**	-.35**	1.51

Note. * $p < .05$; ** $p < .001$. CPTref and CPTint refer to reflection and intuition scores calculated from the CPT, respectively. TotalRef refers to the compound total reflection score.

3.2 Exploratory Analyses

Instead of disattenuated correlations, we ran the exploratory analyses using standard zero-order correlations since the results of our main variables of interest (belief in God and disbelief in evolution) remained almost exactly the same after disattenuating them. Since religious believers tend to respond more in a socially desirable manner in general (Sedikides & Gebauer, 2010; Trimble, 1997), we ran partial correlations by controlling for the scores in BIDR-16 subscales.

First, we controlled for the impression management subscale. The results showed that while the correlation between PET and belief in God turned non-significant (r = -.07, p = .069), the correlation between CMT and CPT reflection became significant (r = -.08, p = .047) for non-believers. When controlling for the self-deceptive enhancement subscale, only one result changed: the correlation between PET and belief in God turned non-significant (r = -.06, p = .147), again, only for non-believers.

Additionally, we looked at whether atheists and agnostics differ in cognitive style measures. To test this, we ran one-tailed t-tests. Results revealed some differences between atheists and agnostics. Starting with 4-CTSQ scores, atheists (M = 5.14, SD = 0.88) had significantly higher AOT scores compared to agnostics (M = 4.71, SD = 0.91), t(592) = 5.858, p < .001, Cohen's d = .481. Agnostics, on the other hand, scored higher on the PIT subscale (M = 3.23, SD = 1.08) than atheists (M = 2.97, SD = 1.24), t(592) = -2.758, p = .006, Cohen's d = -.24. Agnostics (M = 2.29, SD = 1.50) also scored higher than atheists (M = 2.03, SD = 1.48) on CPT intuition t(592) = -2.150, p = .032, Cohen's d = -.177. However, this last difference disappeared after the Bonferroni correction.

4. DISCUSSION

This study tested the predictions generated from the Dual Process Model and the Expressive Rationality Model. While the DPM suggests that reflection should lead to a decrease in religious belief, the ERM suggests that some people might use reflection as an identity-protective mechanism to solidify beliefs related to their identity. To test these predictions, we ran correlation analyses with six cognitive style measures, four of which were self-report-based and two were performance-based. We found a clear difference between religious believers and non-believers in how much they rely on intuition and reflection. On average, believers were less reliant on the reflective cognitive style and more reliant on the intuitive cognitive style. This result was apparent in both self-report and performance-based measures and supported our first hypothesis that religious believers would be more intuitive and less reflective compared to non-believers.

We also found correlations between reflection and belief in God/disbelief in evolution to be negative overall in the full sample. When the data was split into believers and non-believers, the results mainly remained constant: reflection was negatively correlated to belief in God and disbelief in evolution. Moreover, the intuition measures were positively correlated with these two variables, again, for both believers and non-believers. These results lend support to the DPM. However, exploratory analyses demonstrated that some of these correlation coefficients might be stronger for one group than the other. For example, the negative correlation between the scores in the PET subscale and disbelief in evolution was stronger for non-believers compared to believers. The DPM cannot explain these differences in magnitudes. It only predicts that there should be a decrease in religious belief as reflection increases, but it cannot explain why some thinking styles are more strongly related to religious belief than others in some groups.

On the other hand, this can be considered as support for the ERM; some measures of reflection were more strongly correlated to disbelief in evolution, which is an identity marker for believers (Kahan & Stanovich, 2016), for non-believers compared to believers. This is in line with the prediction of the ERM since the ERM either predicts a weaker or positive correlation between reflection and disbelief in evolution. For example, while scoring higher on the Raven's matrices was associated with lower disbelief in evolution for non-believers, this association was not present for believers. As ERM indicates, this might be because believers use their reflection abilities to bolster their beliefs, leading to non-significant correlations. Therefore, although these results demonstrate that the explanatory power of DPM is generally high, they also indicate that both mechanisms possess explanatory power, as necessitated by the principle of multiple causality in social and behavioral sciences. In other words, for some individuals, the identity-protective mechanism of the ERM appears to play some role.

On another note, the stronger correlations between the self-reported intuition measures (CMT and PIT) and belief in God/disbelief in evolution were not consistently stronger for one group than the other. The results showed that where there was a difference in magnitude for the reflection measures, the stronger correlation always belonged to non-believers. However, the intuitive thinking measures do not portray a similarly consistent relationship, while CMT is more strongly correlated to belief in God/disbelief in evolution for believers, PIT is more strongly correlated for non-believers. Neither model can explain this difference.

4.1 Implications

It is argued that the acquisition of religious belief is catalyzed by the evolved cognitive structure of humans (Liddle & Shackleford, 2021). Some cognitive biases that were byproducts of other brain adaptations aid the formation and acquisition of beliefs that are central to religions (White et al., 2023), hence creating an intuitive cognitive basis for religious belief (Norenzayan & Gervais, 2013). A prominent hypothesis in the literature, known as analytic atheism (Gervais, 2013) or the intuitive religious belief hypothesis

(Yilmaz, 2021), proposes that individuals who rely more on their reflective thinking capabilities should be less religious. This hypothesis is derived from the Dual-Process Model.

An overwhelming portion of past research consistently documented the predictions of the DPM: both initial (Pennycook et al., 2012; Razmyar & Reeve, 2013; Shenhav et al., 2012; Yilmaz et al., 2016) and more recent cross-cultural and large sample studies (Ghasemi et al., 2024; Stagnaro & Pennycook, 2024) showed that reflective thinking tendency, measured by various variables (mainly, the performance on the CRT), was negatively correlated to religious beliefs (mainly, belief in God). However, although the negative association between reflective thinking and religious belief seems generalizable, some research also underlines that reflection might lead to different outcomes for different people. It is plausible that this negative association might be moderated by other factors, such as social identity. Another model in the literature, the Expressive Rationality Model, argues that reflection can be used for identity protection, strengthening beliefs that are seen as related to one's social identity (Kahan, 2013). For example, Kahan and Stanovich (2016) found that reflection was positively related to belief in evolution only for liberal but not for conservative participants.

The main research question here is, therefore, not whether DPM exists instead of ERM or vice versa. Both models can exist at the same time and their predictions can be observed among different individuals. Here, our results mainly supported the DPM but also demonstrated that the ERM was also detectable, in line with previous studies (Baimel et al., 2021). This indicates that the relationship between reflection and belief in God/disbelief in evolution might not be only simply explainable by reliance on reflection alone. There might be multiple factors, such as social identity, that can influence the relationship. Therefore, both models might contribute to the relationship due to multiple causation. In our sample, the ERM might be the less dominant model, and the relationship between disbelief and reflective thinking might be better explained by the DPM. However, there may be situations where ERM is more applicable. For instance, in cases where initial intuitions are strong, such as being an anti-vaxxer and believing in vaccination-related conspiracy theories, the

explanatory power of the ERM may also be higher (e.g., reflection might lead to a higher endorsement of vaccination-related conspiracy theories among anti-vaxxers).

This study, compared to previous research, had several strengths that allowed us to test the predictions of the two models tested here better. First, we used a wide array of cognitive style measures, including self-report-based scales and performance-based tests. Using various measures for cognitive style enabled us to overcome the literature's over-reliance on CRT as the only measure of cognitive reflection. Second, our sample consisted of demographically matched groups of believers and non-believers. By collecting data from equal amounts from both groups using pre-selection, we were able to make a more controlled test of ERM's predictions. Prior research has also mainly relied on WEIRD (Henrich et al., 2010) samples of college students, which in turn led to study samples being skewed towards politically left-leaning and non-believer participants. This hinders the ability to detect those who use reflection to bolster their beliefs. Instead of equally recruiting participants from different identity groups, these previous studies relied on arbitrary methods, such as median split, to group participants. The hypotheses were then tested based on these arbitrary categorizations. Therefore, sampling errors might have played a role in the lack of clear support for the ERM in previous studies. Third, by complying with open-science principles and recruiting a large sample with high statistical power, this study sets a reliable foundation for future studies. The majority of past research on the topic suffers from insufficient power and was not pre-registered.

4.2 Limitations and Future Directions

There are several limitations to our study. First, the belief in God question we used as the measure of religious belief, combined with the pre-selected demographically matched sampling, led to the bimodal distribution that caused floor and ceiling effects. This is a well-known problem in the literature that is faced by many studies (e.g., Maij et al., 2017). Second, the disbelief in evolution question did not clearly state "human evolution via natural selection" as what is meant by evolution. Therefore, we might have captured less accurate

data by using that, as it might have inflated or deflated the correlation coefficients. Future studies should use a more comprehensive measure of both religious belief and disbelief in evolution.

The results of this study only state an observation: belief in God is negatively correlated to reflection and positively to intuition. The results do not speak to what causes these relationships and how exactly they cause them. It is possible that there are other factors at play that drive this relationship. Dual-process Theories do not address the motivation behind why individuals reflect and shift away from religious beliefs. For instance, Stagnaro and Pennycook (2024) found that performance-based reflection measures do not predict belief in God scores in cultures where belief in God is widespread. This suggests that a person's inclination to question their existing beliefs might contribute to 'analytic atheism.' Moreover, the relationship between reflection and religious belief is also dependent on the type of religious motivation. Research conducted on three non-WEIRD samples of majority Muslim adult participants (N = 1329) found that while reflection was negatively correlated to general religious belief, it was also negatively correlated to intrinsic and extrinsic religiosity, but it was positively correlated with quest religiosity (Bahçekapili & Yilmaz, 2017). Therefore, while culture and the religiosity level in that culture are the first boundary conditions, the second boundary condition is the religious motivation of the individual (Yilmaz, 2021). Actively open-minded thinking (AOT) could be a factor in this process. Defined as the tendency (and the value given) to be open to changing beliefs and ideas when counter-evidence is presented, AOT is related to cognitive reflection but is conceptually distinct (Baron, 2020; Baron et al., 2023). While reflective thinking is primarily related to how thorough and detailed an inquiry is, it is not related to the direction or path it takes (Baron et al., 2015). Therefore, reflection is merely a tool. How that tool is used and for what purpose is dependent on the motivations of the individual. For example, one study found the association between religious belief and AOT to be robust, while the association between belief and CRT was relatively weak (Pennycook et al., 2014). Another candidate is epistemic rationality, which pertains to the value given to how well one's beliefs are accurately represented in the real world. In a recent study, the negative correlation between religious

belief and CRT scores was replicated, and this effect was stronger for those who give more value to epistemic rationality (Ståhl & van Prooijen, 2021). Additional research is needed to determine what specifically drives individuals to use reflection to question religious beliefs.

In addition to the differences in motivations to use reflection, how reflection operates is another important facet that needs to be considered in this relationship. The Dual-process Theory has received significant criticism in the past years (Bago & De Neys, 2019; De Neys, 2017; De Neys & Pennycook, 2019), and new models underscore the importance of conflict detection in the activation of reflective processes (Pennycook et al., 2014, 2015). For instance, Pennycook and colleagues argue that lower conflict detection might have a bidirectional relationship with religiosity; those who are less likely to detect conflicts might be more prone to religious belief, while those with religious beliefs might be less likely to detect conflicts in the first place (Pennycook et al., 2014).

Another factor that significantly separates religious believers from non-believers is differences in epistemic norms. While religious believers rely on religious texts and experiences as primary sources of knowledge, non-believers generally rely on empirical evidence, logic, and scientific reasoning. Hence, mere reflection might not be related to disbelief at all because reflective thinking might have different implications for people holding different epistemic norms. Future studies could, therefore, focus on these differences, and experimental studies can investigate the effects of reflection combined with epistemic norm manipulations (see also Metz et al., 2023; Baron, 2020).

This study did not test the Counter-normative Rationality Model (CRM). This model proposes an alternative explanation for the relationship between cognitive style and religious belief. To test the CRM, we needed data on supernatural beliefs from equally represented samples of cultures where such beliefs are mainstream and where they are not. Due to this restriction, we could not test the predictions of the CRM. To our knowledge, only one study tested the predictions of the CRM and failed to find any support (Baimel et al., 2021). Gervais et al.'s (2018) argument was based on a positive relationship that was observed

between reflection and belief in God. However, as mentioned earlier, this finding was not replicated (Stagnaro et al., 2019). Future studies should, therefore, first establish the existence of a positive correlation. Then, it would become plausible to extend research into the boundary conditions that could explain a positive correlation, such as cultural norms.

We recruited US citizens for this study, which limited our inferences to a WEIRD sample. However, the cross-cultural evidence for the negative relationship between reflection and religious belief has started to mount in recent years (Bahçekapili & Yilmaz, 2017; Gervais et al., 2018; Stagnaro et al., 2019). Two recent studies demonstrated a robust negative association between religious belief and reflection with large cross-cultural samples (Ghasemi et al., 2024; Stagnaro & Pennycook, 2024). Despite the body of cross-cultural evidence, one paper found that, in a Turkish sample, while the negative correlation between reflection and religious belief was replicated for males, reflection was not related to religious belief for females (Caldwell-Harris et al., 2020). The authors of the study argue that societal pressures on women in non-WEIRD samples could influence their religious affiliation, hence, the relationship between reflection and religiosity. While it is known that, in general, males are more reflection-oriented than females (Frederick, 2005; Pennycook et al., 2016; Primi et al., 2018), looking for gender differences in non-WEIRD samples specifically on the relationship between reflection and religious belief is a fruitful area of research.

Our study also did not include extreme or radicalized groups; our sample was a general population adult sample recruited online through Prolific. Future studies might also benefit from including individuals from such extreme groups where intuitions have more influence on beliefs, such as anti-vaxxers or left- or right-wing extremists, which might provide a more effective testing ground for the predictions of the ERM. Among these individuals, it might be easier to observe a bolstering effect of reflection on social identity-related beliefs.

While the current accumulation of research points to the possibility that the negative relationship between reflection and religious belief might be universal, experimental evidence for this is still scarce (Yilmaz, 2021). Although previous experimental studies did

find a negative effect of reflection prime on religious belief (Gervais & Norenzayan, 2012; Shenhav et al., 2012; Yilmaz et al., 2016), they were not replicated (for a review, see Yilmaz 2021). It is argued that implicit priming techniques, which were prevalently used in these experimental studies, lack validity (e.g., Billingsley et al., 2018). Hence, future research should further explore the causal link between reflective cognitive style and religious belief with more robust manipulation techniques.

5. CONCLUSION

In this study, we investigated the relationship between cognitive style and religious belief and also investigated disbelief in evolution, which we used as an identity-marker topic. Using a comprehensive list of cognitive style measures, including self-report and performance-based measures, we tested the predictions of the two prominent models that provide explanations for how reflection will be related to religious belief. Using a demographically matched sample of believers and non-believers from the US, we found that reflective thinking was negatively correlated with both belief in God and disbelief in evolution. While our results mainly supported the DPM, we also found some evidence for the ERM by comparing correlation coefficients. Correlations between some reflection measures and belief in God/disbelief in evolution were stronger for non-believers than believers. Hence, this weaker relationship between reflection and main outcome variables can be explained by some religious believers in our sample using reflection to bolster their beliefs that they saw as important to their social identity, such as their stance on the topic of evolution. Our study was an attempt to test the predictions of both the ERM and the DPM more accurately. By identifying robust phenomena, empirical studies aid the scientific process of theory formation. The negative correlation between reflection and belief in God can be seen as one such robust phenomenon (Ghasemi et al., 2024; Stagnaro & Pennycook, 2024). Detecting these phenomena is important; robust phenomena constitute the first step in the formation of a scientific theory, and they tell scientists where to look by generating testable predictions and dismissing other potential explanations by identifying boundary conditions (Borsboom et al., 2021; Haig, 2018). The DPM has been a significant theoretical model in literature for a long time, but it is still largely descriptive. The exact mechanisms behind intuition and reflection are not well understood, and there are ongoing debates about the specific processes involved (De Neys, 2017). Therefore, as an initial step toward refining the DPM and contributing to broader theory building, it is essential to first identify robust phenomena and empirically test them. This will, in turn, enable us to determine plausible

boundaries for interpretation. Our study can be seen as a step towards establishing this larger framework.

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APPENDIX A

4-Component Thinking Styles Questionnaire

Please indicate to what extent you agree or disagree with the following statements.

(1 = Strongly Disagree; 6 = Strongly Agree)

1- It is important to be loyal to your beliefs even when evidence is brought to bear against them.

2- Whether something feels true is more important than evidence.

3- Just because evidence conflicts with my current beliefs does not mean my beliefs are wrong.

4- There may be evidence that goes against what you believe but that does not mean you have to change your beliefs.

5- Even if there is concrete evidence against what you believe to be true, it is OK to maintain cherished beliefs.

6- Regardless of the topic, what you believe to be true is more important than evidence against your beliefs.

7- I think there are many wrong ways, but only one right way, to almost anything.

8- In my experience, the truth is often black and white.

9- Truth is never relative.

10- The truth does not change.

11- Either something is true or it is false; there is nothing in-between.

12- There is no middle ground between what is true and what is false.

13- I like to rely on my intuitive impressions.

14- I believe in trusting my hunches.

15- When I make decisions, I tend to rely on my intuition.

16- Using my "gut-feelings" usually works well for me in figuring out problems in my life.

17- Intuition is the best guide in making decisions.

18- I often go by my instincts when deciding on a course of action.

19- I’m not that good at figuring out complicated problems.

20- Thinking is not my idea of an enjoyable activity.

21- I try to avoid situations that require thinking in depth about something.

22- I am not a very analytical thinker.

23- Reasoning things out carefully is not one of my strong points.

24- Thinking hard and for a long time about something gives me little satisfaction.

25- This is an attention check question. Please choose 2.

APPENDIX B

Cognitive Performance Test

Please answer the following questions.

A bat and a ball cost £1.10 in total. The bat costs £1.00 more than the ball. How much does the ball cost?

- o 5 pence
- o 10 pence
- o 9 pence
- o 1 pence

CRT2 If it takes 5 machines 5 minutes to make 5 widgets, how long would it take 100 machines to make 100 widgets?

- o 5 minutes
- o 100 minutes
- o 20 minutes
- o 500 minutes

In a lake, there is a patch of lily pads. Every day, the patch doubles in size. If it takes 48 days for the patch to cover the entire lake, how long would it take for the patch to cover half of the lake?

- o 47 days
- o 24 days
- o 12 days

- 36 days

All living things need water. Roses need water. If these two statements are true, can we conclude from them that roses are living things?

- Yes
- No

Claire is 31 years old, single, outspoken and very bright. She majored in philosophy. As a student, she was deeply concerned with issues of discrimination and social justice, and also participated in anti-nuclear demonstrations.

Which is more probable?

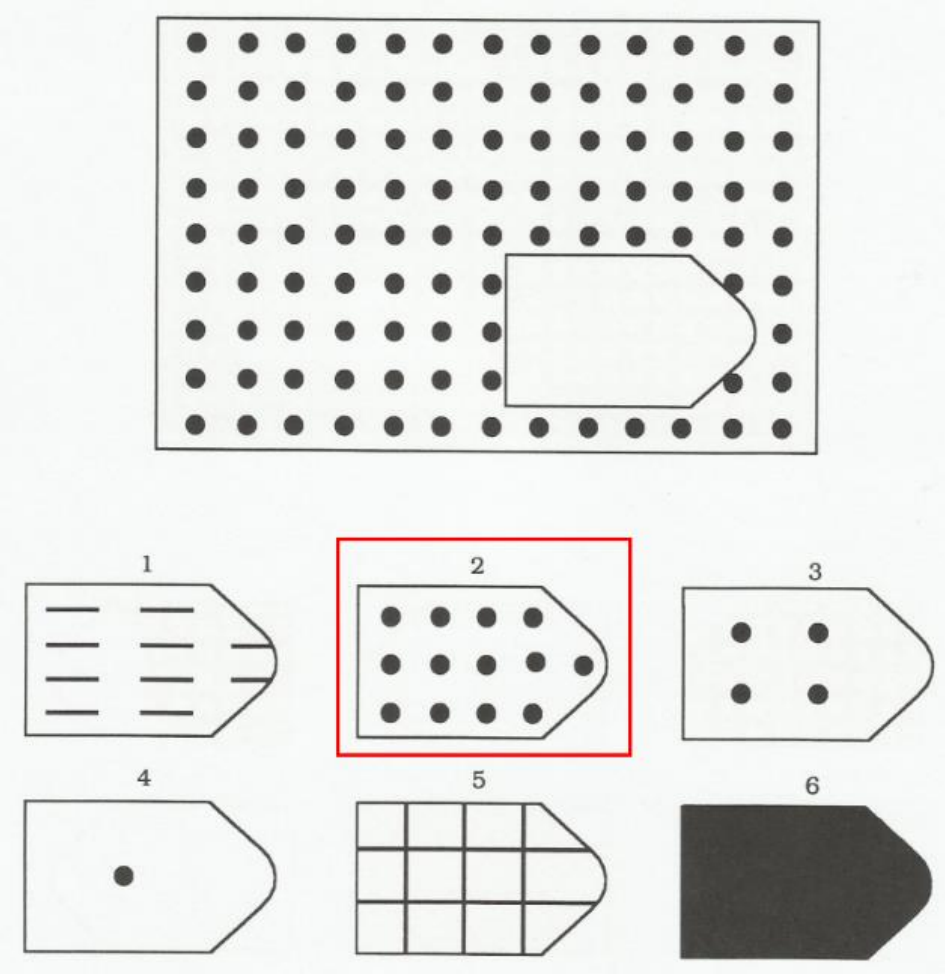
- Claire is a bank teller
- Claire is a bank teller and is active in the feminist movement

APPENDIX C

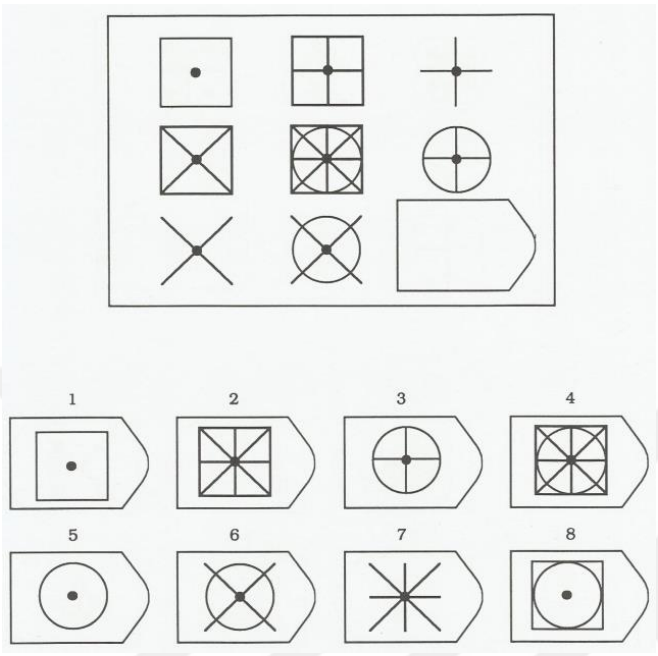
Raven's Progressive Matrices

Please try to correctly answer the next three questions. You will receive 5 pence for each correct answer in addition to the participation fee.

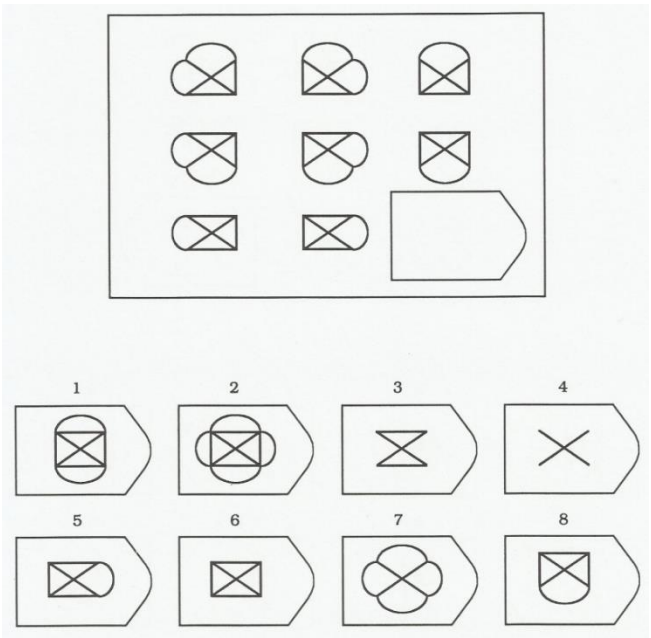
On each of the next three screens, you will be shown an image with a missing piece. You need to choose the missing piece that logically completes the image from among the given options. Please see below for a simple example, where the correct answer is "2".



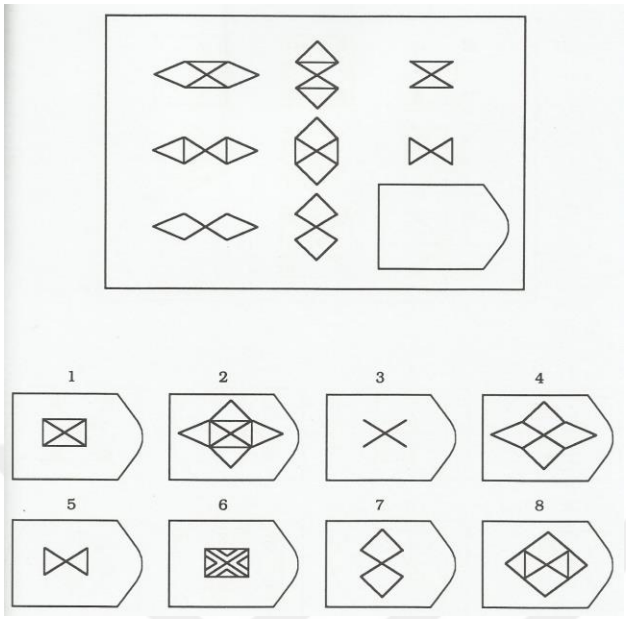
Q1)



Q2)



Q3)


1
2
3
4
5
6
7
8

APPENDIX D

Balanced Inventory of Desirable Responding – Short Form

Using the scale below as a guide, indicate to what extent you think each statement is true. (1 = Not True; 4 = Somewhat; 7 = Very True)

1- I have not always been honest with myself.
2- I always know why I like things.
3- It's hard for me to shut off a disturbing thought.
4- I never regret my decisions.
5- I sometimes lose out on things because I can't make up my mind soon enough.
6- I am a completely rational person.
7- I am very confident of my judgments.
8- I have sometimes doubted my ability as a lover.
9- I sometimes tell lies if I have to.
10- I never cover up my mistakes.
11- There have been occasions when I have taken advantage of someone.
12- I sometimes try to get even rather than forgive and forget.
13- I have said something bad about a friend behind his/her back.
14- When I hear people talking privately, I avoid listening.
15- I never take things that don't belong to me.
16- I don't gossip about other people's business.

APPENDIX E

Demographic Questionnaire

1) What is your gender?
   - Male
   - Female
   - Non-binary / third gender
   - Prefer not to say

2) What is your age in years? _____

3) What is the highest level of education you have completed?

- Some high school or less
- High school diploma or GED
- Some college, but no degree
- Associates or technical degree
- Bachelor's degree
- Graduate or professional degree (MA, MS, MBA, PhD, JD, MD, DDS etc.)
- Prefer not to say

4) What was your total **household income** before taxes during the past 12 months?

- Less than $25,000
- $25,000-$49,999
- $50,000-$74,999
- $75,000-$99,999
- $100,000-$149,999
- $150,000 or more

5) What is the number of people you live together (including you)? _____

6) Imagine that this ladder pictures how American society is set up.

At the top of the ladder are the people who are the best off — they have the most money, the highest amount of schooling, and the jobs that bring the most respect. At the bottom are people who are the worst off — they have the least money, little or no education, no job, or jobs that no one wants or respects.

Now think about your family. Please tell us where you think your family would be on this ladder. Select the place that best represents where your family would be on this ladder.

7) Do you believe in God?
   - ○ Yes
   - ○ No

8) Do you believe in God? (1 – Definitely not, 10 – definitely yes)
9) Please choose the option below that best describes your religious affiliation.
   - □ Christian, Anglican
   - □ Christian, Baptist
   - □ Christian, Catholic
   - □ Christian, Evangelical

- □ Christian, Mormon
- □ Christian, Orthodox
- □ Christian, Protestant
- □ Christian, Unitarian
- □ Christian, Other
- □ Hindu
- □ Jewish, Conservative
- □ Jewish, Orthodox
- □ Jewish, Reform
- □ Jewish, Ultra Orthodox
- □ Jewish, Other
- □ Pagan
- □ Muslim, Kharijite
- □ Muslim, Shia
- □ Muslim, Sunni
- □ Muslim, Other
- □ Buddist
- □ Atheist
- □ Agnostic
- □ Other

10) What is your level of commitment to the religious affiliation you have chosed above?
(0 = Extremely Low; 10 = Extremely High)

11) How religious do you describe yourself?
(1 = Not at all religious, 10 = Very religious)

12) How would you place your political views on this scale, **generally speaking**?
(0 = Extremely Liberal; 10 = Extremely Conservative)

13) When it comes to **social** issues, how liberal or conservative are you
(0 = Extremely Liberal; 10 = Extremely Conservative)

14) When it comes to **economic** issues, how liberal or conservative are you?
(0 = Extremely Liberal; 10 = Extremely Conservative)

15) Where would you place yourself along the political spectrum?

- Conservative
- Moderate
- Liberal
- Libertarian
- Other

16) How happy do you feel in general?
(0 = Extremely Unhappy, 10 = Extremely Happy)

17) Please take a moment to think about what makes your life feel important to you. Please respond to the following statement as truthfully and accurately as you can, and also please remember that it is very subjective question and that there is no right or wrong answer. Please answer according to the scale below:

My life has a clear sense of purpose.

- Absolutely Untrue
- Mostly Untrue
- Somewhat Untrue
- Can't Say True or False
- Somewhat True
- Mostly True
- Absolutely True

18) Do you believe in evolution? (1 – Definitely not, 10 – definitely yes)

19) Do you believe in karma? (1 – Definitely not, 10 – definitely yes)

20) Do you believe in witchcraft? (1 – Definitely not, 10 – definitely yes)

21) Do you believe in alternative medicine? (1 – Definitely not, 10 – definitely yes)

22) All things considered, how satisfied are you with your life as a whole these days? (1 = Completely dissatisfied; 10 = Completely satisfied)

CURRICULUM VITAE

Fırat Şeker

Education:

Master of Arts in Psychological Sciences | 2021 Spt – 2024 August

Kadir Has University – Istanbul

GPA: 3.94/4.00

Bachelor of Arts in Psychology | 2017 Spt – 2021 Jun

Doğuş University – Istanbul

GPA: 3.76/4.00. Graduated with high honors.

Experience:

Lab Manager | 2023 June – 2024 August

Moral Intuitions Research Laboratory – Istanbul, Türkiye

Research Assistant | 2019 May – 2023 June

Moral Intuitions Research Laboratory – Istanbul, Türkiye

Erasmus+ Internship (Research Intern) |2020 Aug – 2020 Oct

Max Planck Institute for Research on Collective Goods – Bonn, Germany

Research Projects & Publications

Preprints:

Toribio-Flórez, D., Cypris, N., Brüggemann, M., **Şeker, F.,** & Baumert, A. (2022). A closer look at third-party punishment under the risk of counterpunishment: An effect of additional material (and not social) costs. [https://doi.org/10.21203/rs.3.rs-2121574/v1]

Under Review:

Şeker, F., Acem, A., Bayrak, F., Yilmaz, O., Dogruyol, B., Isler, O., Bahçekapili, H., (Unpublished manuscript). Cognitive Reflection and Religious Belief: A Test of Two Models. https://osf.io/5964s/

Şeker F., Aktar, B., Bulut, E., Dogruyol, B., Soley, G., Clark, K. J., Yilmaz, O. (Unpublished Manuscript) Tuning Into Prosociality: Do Religious and Secular Music Boost Prosociality Among Believers and Non-Believers? https://osf.io/58pt7/

Under Preparation:

Şeker F., Acem, A., Vurgun, R., Dogruyol, B., Isler, O., Bahçekapili H., Yilmaz, O. (Manuscript under preparation). Divine Verification: Introducing a CAPTCHA-based Religious Priming Technique. https://osf.io/7m5bn/

Vurgun, R., Acem, E., **Şeker, F.,** Dogruyol, B., Isler, O., Bahçekapili, H., Zizzo, D., Yilmaz, O. (Manuscript under preparation) Reflective Thinking Predicts Utilitarian Behavior after 17-months. https://osf.io/6r7gn/

Ongoing Projects:

Lead Author:

Understanding Left-wing Authoritarianism in Turkey: With three studies, we adapted two prominent left-wing authoritarianism scales into Turkish and investigated the relationship between left-wing authoritarianism and cognitive style measurements such as cognitive

reflection and actively open-minded thinking. We are currently finalizing the manuscript of this project where I am the first author.

- https://osf.io/65jb9
- https://osf.io/c79f8
- https://osf.io/cns5w

Co-Authored Projects:

How Can We Promote Cooperation Under Resource Scarcity? Regulatory Role of Intuitive/Reflective Thinking. (Government Funded Research Project - TÜBİTAK): In this project we investigate the influences of resource scarcity in prosocial decision-making contexts and its interactions with intuitive and reflective cognitive styles. We are currently running the final studies of the project where I actively help progress them with other lab members.

- https://osf.io/caj3t
- https://osf.io/2tfj4/

Distinguishing the Psychological Underpinnings of Threat Types: In this project, we are investigating how the psychological representations of different types of threat such as death and resource scarcity differ using network and content analysis methods. I am an active research assistant in this project. We are currently analyzing data.

- https://osf.io/4hzyw/

Conference Proceedings:

Şeker F., Aşık Y., Ceylan M. E., Yilmaz O., Doğruyol B. & Saribay S. A. (October, 2022). Left-wing Authoritarianism in Turkey. *Findings presented at the 21st Annual National Congress of Psychology,* Istanbul, Turkey.

Günaydın G., **Şeker F.,** Velioğlu İ., Bayrak F., Alper S., Doğruyol B., Isler O. & Yilmaz O. (October, 2022). Scarcity, cooperation, and thinking styles: A theoretical test of the Self-

control Account. *Findings presented at the 21st Annual National Congress of Psychology,* Istanbul, Turkey.

Şeker F., Acem E., Bayrak F., Yılmaz O., Dogruyol B., Isler O., & Bahcekapılı H. G. (November 2023). The Relationship between Cognitive Reflection and Religiosity: A Test of Two Models. *Findings presented at the II. National Symposium on Morality Studies in Social Psychology,* Istanbul, Turkey.

Şeker F., Yilmaz O., Dogruyol B., Isler O. (November 2023). Psychological Profiles of Left-wing Authoritarians. *Findings presented at the II. National Symposium on Morality Studies in Social Psychology,* Istanbul, Turkey.

Teaching Experience:

Teaching Assistant: PSY603 – Advanced Theoretical Discussions in Psychological Sciences.

Awards and Scholarships:

Academic Success Grant (2018, 2019, 2020) – Doğuş University: Tuition fee reduction awarded at the end of each academic year to the highest GPA student.

Kadir Has University Graduate Tuition Waiver (2021-2022, 2022-2023, 2023-2024): Tuition waiver awarded to graduate students enrolled in Kadir Has University psychology program.

Research Assistant Scholarship, TÜBİTAK 3501 (2021-2024): Monthly stipend given to research assistants in TÜBİTAK funded projects.

Research Assistant Scholarship, Templeton Religion Trust (2023-2024): Monthly stipend given to research assistants.

Publications/presentations derived from thesis:

Şeker, F., Acem, A., Bayrak, F., Yilmaz, O., Dogruyol, B., Isler, O., Bahçekapili, H., (Unpublished manuscript). Cognitive Reflection and Religious Belief: A Test of Two Models. https://osf.io/5964s/

Şeker F., Acem E., Bayrak F., Yılmaz O., Dogruyol B., Isler O., & Bahcekapılı H. G. (November 2023). The Relationship between Cognitive Reflection and Religiosity: A Test of Two Models. *Findings presented at the II. National Symposium on Morality Studies in Social Psychology,* Istanbul, Turkey.