Title: The relationship between cognitive reflection and morality judgments are mediated by thinking dispositions.

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Abstract:

Performance on Cognitive Reflection Test (CRT) is thought to predict moral judgments concerning the Moral Foundations Questionnaire (MFQ). This relationship is hypothesised to be mediated by the tendency toward thinking dispositions such as actively open-minded thinking (AOT), rational (REI-R) and experiential thinking (REI-E), and religiosity. The relationship between cognitive reflection, intuitive thinking and moral judgments with thinking dispositions are examined. As the MFQ measures five types of moral judgments which include 'individualising values' – harm and fairness, and 'binding values' - loyalty, authority and purity it was hypothesised that performance on these moral foundations would be influenced by thinking dispositions and cognitive reflection. Results indicate that the relationship between cognitive reflection and moral judgments were mediated differently by thinking dispositions. Religious participants and intuitive thinkers alike scored highly on binding moral values. Analytic thinkers and non-religious participants scored highly on individualising moral values. The data is consistent with religiosity and intuition being inherently linked and suggests that moral values are influenced by individual differences in thinking dispositions and cognitive style.

Keywords:

Religiosity, Cognitive style, Moral psychology, Intuitive thinking, Analytic thinking

1. Introduction

Morality is a set of cultural values, rules, standards and principles that are thought to have developed when our early ancestors began to live in social groups (Mithen, 1994; Bekoff, 2001). Evolutionary psychologists and anthropologists posit that in order to succeed as a social group a set of common shared values are needed – namely moral judgments and values (Fitzpatrick, 2017; Pölzler, 2017). These values both, ensure that members of the group are treated fairly and enhances the chances for the continuation of their genes through the thriving of the group (Darwin, 1859).

Nonhumans and humans alike, show evidence of moral values (Paxton, Ungar, & Greene, 2012; Fitzpatrick, 2017). These moral values differ in degree rather than kind across species (Bekoff, 2004; FitzPatrick, 2008). The same moral values are acted out in accordance with the societal, biological, and cultural limitations of their respected species. For example, the many animal species that live in stable social groups that resemble the social groups of our early human ancestors exhibit similar cross-species moral judgments (King, 1976; Boesch & Tomasello, 1998; Cronin, Van Leeuwen, Vreeman, & Haun, 2014). These groups care for their young, share food and divide labor costs (Layton & O'Hara, 2010; Gilby et al., 2015). For example, chimpanzees police the behavior of members of their own social group (De Waal & Aureli, 1996; Webb, Franks, Romero, Higgins, & De Waal, 2014) and cooperate when hunting prey (Gilby et al., 2015).

In humans the larger pre-frontal cortex which constitutes 29% of the total cortex (Fuster, 2002), but only 17% in chimpanzees (Fuster, 2002) facilitates higher order functioning such as reasoning (Goel, Stollstorff, Nakic, Knutson, & Grafman, 2009), impulse control (Cheng & Lee, 2015), and planning (Tanji & Hoshi, 2001). This comparatively larger pre-frontal cortex provides humans with the capacity to engage in intuitive thinking or analytic thinking, where we can favor one of these cognitive styles over the other (Stanovich & West, 1997; Svedholm-Häkkinen & Lindeman, 2018). Furthermore, we can conform to particular patterns of behavior that fit with pre-existing beliefs called thinking dispositions (Epstein, Pacini, Denes-Raj, & Heier, 1996; Haran, Ritov, & Mellers, 2013). Such dispositions influence

our judgments and decisions (Stanovich & West, 1997; Svedholm-Häkkinen & Lindeman, 2018). This relationship between cognitive style and moral judgments has been evidenced by the work of Pennycook et al., (2014) where they reported a negative correlation between performance on measures of analytic thinking (the Cognitive Reflection Test, base-rate) and binding moral values (e.g., respect for traditions and authority, loyalty, avoiding carnal pleasures and disgusting things). Conversely, Garvey and Ford (2014) found a positive correlation between performance on measures of analytic thinking and individualizing moral judgments (kindness, fairness, avoiding harm and supporting the rights of others). The results of both studies suggest that cognitive style and thinking dispositions have an influence on moral judgments, however, the exact nature of this relationship is unclear. This paper examines the mediatory influences of thinking dispositions on the relationship between cognitive style and moral judgments.

1.1. Towards a method of measuring morality and its importance

Since our capacity to make moral judgments is thought to have evolved when our ancestors began to live in social groups (McGinn, 1979; Broom, 2006) it is important that we attempt to develop an empirically based understanding of morality. To this end, two theories of morality stand out, namely, the Social Intuitionism Model (SIM) (Haidt, 2001; Haidt & Bjorklund, 2008) and Moral Foundations Theory (MFT) (Haidt & Joseph, 2004; Landmann & Hess, 2018).

The Social Intuitionism Model (SIM) states that all moral judgments are made intuitively, quickly and with little-to-no effort (Haidt, 2001). Accordingly, when we see a theft, an act of gratitude, or a violent act we instantly evaluate the action with a flash of intuition. This flash of intuition makes us aware of one single solution (e.g., the action was fair/unfair) without the need for a complex and time-consuming evaluation of the action. Haidt and Bjorklund (2008) state that intuition in SIM is much like intuitive thinking in the decision making literature where decisions can be made without the need for the evaluation of all potential solutions to a problem (Osman, 2004; Evans, 2012). Next, moral

reasoning, which is effortful and controlled (as opposed to moral judgment), is engaged in an attempt to evaluate the judgment (Haidt, 2001; Haidt & Bjorklund, 2008). During this reasoning a person searches for arguments that support their previously made judgment.

Moral foundation theory (MFT) built on SIM by conceptualising the moral intuition component of the SIM as “foundations” (Haidt & Joseph, 2004; Clifford, Iyengar, Cabeza, & Sinnott-Armstrong, 2015). The most recent version of the MFT postulates that there are five of these foundations that have evolved to each solve certain social dilemmas that arise from living in groups (Haidt & Joseph, 2004; Renner, Ramalingam, & Pirta, 2013). These foundations being harm/care, fairness/reciprocity, in-group/loyalty, authority/respect, and purity/sanctity. As such the harm/care foundation is concerned with the suffering of others, virtues for caring and compassion. The fairness/reciprocity foundation is concerned about the treatment of others, abstract notions of justice and rights, and cheating behaviour. The third foundation, in-group/loyalty concerns obligations for group membership, for example loyalty, vigilance against betrayal and self-sacrifice. The authority/respect foundation is concerned with social order and the obligations of individuals within the social order, respect, and the fulfilment of duties. The final foundation, purity/sanctity, concerns physical and spiritual contagions, including the control of diseases and virtues of chastity. These foundations can be loosely grouped into two groups based on the conceptual distinctiveness across these foundations. The first group, called individualising moral values, contains the foundations that are concerned with the individual – harm/care, fairness/reciprocity. The second group, consists of the binding moral values, that are concerned with binding behavior to the group – in-group/loyalty, authority/respect and purity/sanctity. Individually, each of these foundations has a separate evolutionary origins, as such they are important for building human communities (Haidt, 2007; Renner et al., 2013). The MFT is operationalised in the Moral Foundations Questionnaire (MFQ) (Haidt & Joseph, 2004) which to date has been used to examine political ideology and attitudes (Day, Fiske, Downing, & Trail, 2014), the uptake of vaccinations (Amin et al., 2017), attitudes toward climate change (Rottman, Kelemen, & Young, 2015), and in-group and out-group attitudes (Simpson & Rios, 2016).

1.2. Cognitive ability and cognitive style: intuitive and analytic cognition

In recent decades considerable research has contrasted two types of processes for reasoning, judgments and decision making (Evans, 1984; Osman, 2004; Frederick, 2005). The notion of decision making as relying on two processes: intuitive processing/thinking (i.e., Type 1) and analytic processing/thinking (i.e., Type 2) is referred to as the dual-process framework (Sloman, 1996; De Neys, 2006; Stanovich, 2009). The dual-process framework builds on the work of Daniel Kahneman and Amos Tversky (Tversky & Kahneman, 1973, 1981, 1983, 1986), for which Kahneman won the 2002 Nobel Memorial Prize in Economics (Kahneman, 2011). The former, Type 1 processing, is characterized as intuitive, automatic, unconscious and heuristic. The latter process, Type 2 processing is analytic, deliberative, effortful, and time-consuming. There is disagreement about the exact time-course of these processes as some theorists postulate that both of the processes start at the same time and act in parallel (i.e., parallel models) (Epstein, 1973; Sloman, 1996). Accordingly, the first process, whether it's intuitive or analytic, to arrive at a solution to the problem produces the solution. Conversely, proponents of sequential models suggest that intuitive thinking always start first, if this results in no solution then analytic thinking begins (De Neys, 2012; Pennycook, Fugelsang, & Koehler, 2015).

Much like the evolutionary origins of moral values, intuitive and analytic thinking evolved in our early ancestors (Bekoff, 2001; Evans, 2006; Evans & Stanovich, 2013). Intuitive thinking is evolutionary ancient (Evans, 2010) as such we share this capacity for thinking in this way with other species (Brosnan et al., 2007; Kralik, Xu, Knight, Khan, & Levine, 2012). Non-human primates such as chimpanzees (*Pan troglodytes*) (Brosnan et al., 2007; Eckert, Call, Hermes, Herrmann, & Rakoczy, 2018) and rhesus macaque (*Macaca mulatta*) (Hayden, Heilbronner, Nair, & Platt, 2008; Kralik et al., 2012) have been observed to rely on intuitive thinking. Moreover, non-primate species, of which we share a common ancestor, have demonstrated a capacity for intuitive thinking too, for example, pigeons (Fantino, Kanevsky, & Charlton, 2005). Importantly, the capacity for analytic thinking developed with the evolution of the enlarged frontal lobes in humans (Semendeferi, Damasio, Frank,

& Van Hoesen, 1997; Coolidge & Wynn, 2001; Fuster, 2002). The larger frontal lobes in humans endow humans with unique facilities such as reasoning (Coolidge & Wynn, 2001), meta-representation (Evans, 2010), and analytic thinking (Evans & Stanovich, 2013).

Moreover, individual differences in working memory capacity (Barrett, Tugade, & Engle, 2004; Whitney, Rinehart, & Hinson, 2008), intelligence (Stanovich, 2009) and thinking dispositions (patterns of thinking) (West, Toplak, & Stanovich, 2008; Toplak, West, & Stanovich, 2014b) have an influence on judgment and decision making. When we are distracted by something in our environment we are more likely to use intuitive thinking, compared to analytic thinking, as the former only needs a limited working memory capacity to function (Barrett et al., 2004). On the other hand, our capacity to rely on analytic thinking is severely limited when we are distracted by our surroundings (Evans, 2008). Other individual differences that influence human decision making include thinking dispositions (Cacioppo & Petty, 1982; Toplak et al., 2014b). Four thinking dispositions that are of importance for this paper include actively open-minded thinking (Haran et al., 2013), religiosity (Pennycook, Cheyne, Barr, Koehler, & Fugelsang, 2014) rational thinking style (Cacioppo & Petty, 1982), and experiential thinking style (Epstein et al., 1996).

1.3. Religiosity & other thinking dispositions

Thinking dispositions are not limited to actively open-minded thinking (Stanovich & West, 1997), religiosity (Pennycook, Ross, Koehler, & Fugelsang, 2016), rational thinking style (Pacini & Epstein, 1999), and experiential thinking style (Cacioppo & Petty, 1982), however, these dispositions have been examined extensively in the psychology literature (Toplak, West, & Stanovich, 2014a; Stanovich, 2016; Thomson & Oppenheimer, 2016). It is important to develop an understanding of the impact that these thinking dispositions have on our decisions and morality as this can help explain some of variance in decision making and morality alike (Baron et al., 2015; Szaszi, Szollosi, Palfi, & Aczel, 2017).

The original concept of actively open-minded thinking was first published by Baron (1993). It states that to avoid cognitive bias (i.e., the tendency for intuitive thinking to produce an incorrect solution to a problem) we must approach a problem from multiple perspectives (Stanovich & West, 1997). Approaching a problem from a single perspective alone is more likely to generate an incorrect solution as we favour intuitive thinking over analytic thinking because it requires fewer cognitive resources (e.g., working memory) (Evans, 2008). Actively open-minded thinking has been operationalised as the actively open-minded thinking (AOT) scale (Stanovich & West, 1997), a scale that is used in this paper. AOT positively correlates with analytic thinking, as measured by the Cognitive Reflection Test (Svedholm-Häkkinen & Lindeman, 2018) and education (Haran et al., 2013), but negatively correlates with superstitious thinking (Macpherson & Stanovich, 2007) and religiosity (Pennycook et al., 2014).

The use of religiosity as a thinking disposition follows from the concept that the notion of supernatural entities that can violate laws of physics, for example, by passing through solid objects defies our understanding of the natural world (Shenhav, Rand, & Greene, 2012; Pennycook et al., 2014). These beliefs in such supernatural entities persist despite the ability of science to explain the natural world. The psychological literature has repeatedly found that highly educated people are less likely to be religious (Meisenberg, Rindermann, Patel, & Woodley, 2012; Zuckerman, Silberman, & Hall, 2013). Religiosity negatively correlates with analytic thinking (Pennycook, Cheyne, Barr, Koehler, & Fugelsang, 2015), intelligence (Shenhav, Rand, & Greene, 2012; Zuckerman et al., 2013) and the rational sub-scale of the Rational Experiential Inventory (REI) (Pacini & Epstein, 1999; Abeyta & Routledge, 2018).

The final important thinking dispositions for the scope of this paper are the rational and experiential sub-scales of the Rational Experiential Inventory (REI) (Pacini & Epstein, 1999). The rational sub-scale (REI-R) of the REI is similar to the analytic thinking of the dual-process framework in that both measure rational thinking (Epstein et al., 1996; Evans, 2008). The rational sub-scale measures the ability to think logically and analytically (rational ability) and the reliance on analytic thinking (rational

engagement/favorability) (Björklund & Bäckström, 2008). On the other hand, the second sub-scale, experiential thinking (REI-E) is alike intuitive thinking in that both rely on the lack of analytic thinking (Sladek, Phillips, & Bond, 2006). Specifically, the experiential sub-scale measures the tendency to rely on feelings and intuitions when making decisions (experiential engagement/favorability) and the ability to think intuitively (experiential ability). Like the AOT, the REI is used in this paper as a measure of thinking disposition. The rational sub-scale of the REI positively correlates with education (Monica, 2009) and numeracy (Welsh, Delfabbro, Burns, & Begg, 2014), whilst the experiential sub-scale negatively correlates with education (Monica, 2009) and fluid intelligence (Sirota, Juanchich, & Hagmayer, 2014).

1.4. Present argument and hypotheses

Focusing on cognitive style and thinking dispositions this paper integrates the dual-process framework of judgment and decision making (Stanovich & West, 1998; Osman, 2004) with the individualising and binding moral values as measured by the five moral foundations in the Moral Foundation Questionnaire (MFQ) (Haidt, 2001; Clifford et al., 2015). Thinking dispositions such as actively open-minded thinking, religiosity, and the rational and experiential sub-scales of the REI are then used to investigate whether these thinking dispositions mediate any relationship between cognitive style and the individualising or binding values and/or the five MFQ morality sub-scales.

It is argued that highly analytic (and therefore reflective) individuals will score high on the moral foundations that are concerned with individualising values, namely care and fairness. These moral values positively correlate with analytic thinking (Garvey & Ford, 2014). As such the consideration of vignettes for these moral values requires the capacity for reflective thinking. On the other hand, lowly reflective individuals and those that score high on measures of religiosity will score high on the moral foundations that consider binding moral values such as authority, sanctity and purity as these

foundations are associated with a lesser use of reflective thinking, and a default to the intuitive thinking (Pennycook et al., 2014).

As for the thinking dispositions, rational thinking style in the REI and open-mindedness in the AOT will mediate the relationship between analytic thinking and moral judgments for the individualising moral values in the MFQ. Individuals who engage in rational thinking will be open-minded, as shown by the positive correlation between the AOT and REI (Svedholm-Häkkinen & Lindeman, 2018). These individuals will have a strong indirect relationship through these thinking dispositions between analytic thinking/cognitive reflection and the individualising MFQ sub-scale scores. Conversely, there will be a strong indirect relationship between intuitive thinking and binding MFQ sub-scales scores through religiosity and experiential thinking (REI-E).

2. Method

2.1. Participants

Data was collected from 418 participants recruited through *Amazon Mechanical Turk*™. Eighteen participants were excluded from analysis because they failed one or more of the attention check questions which were placed throughout the procedure or because they failed to complete one or more measures. For the attention check questions, participants were interrupted by asking how they are and then they were asked to type the name of either the city of London, Washington D.C. or the planet Earth (see Appendices). The remaining four hundred participants (251 females; average age = 33.73, SD = 10.42) provided full datasets for analysis. In total all material took approximately 50 minutes to complete. All participants were voluntary and received remuneration. Ethical approval was granted by the Newman University, Research Ethics Committee and was carried out in accordance with the Declaration of Helsinki.

2.1. Materials and procedure

Participants provided demographic information (sex, age, education, and religiosity). Religiosity was recorded on a 5-point Likert scale with *1 = not at all religious* to *5 = I attend service every week*. Cognitive variables and thinking dispositions were assessed, including the Cognitive Reflection Test (CRT - Frederick, 2005; Toplak, West, & Stanovich, 2014), Actively Open-minded Thinking (AOT - Stanovich & West, 1997) scale and Rational Experiential Inventory (REI - Epstein, Pacini, Denes-Raj, & Heier, 1996). Morality was measured with the Moral Foundations Questionnaire (MRQ) (Graham et al., 2011). Details of all materials are presented below.

2.2. Measure of cognitive ability and cognitive style

The Cognitive Reflection Test (CRT) was administered to measure intuitive and analytic cognitive style (Frederick, 2005; Toplak, West, & Stanovich, 2011). Like Pennycook, Cheyne, Seli, Koehler, and Fugelsang, (2012) and Edgcumbe, Thoma, Rivolta, Nitsche, and Fu, (2019) the CRT was used as this is a widely used measure of cognitive ability and cognitive style (hereafter referred to as cognitive ability). The CRT measures cognitive ability based on the notion that there are two processes for making judgments and decisions (Evans, 1984; Stanovich, West, & Toplak, 2011). The first process, called Type 1 intuitive thinking, is thought to have developed early in hominoid evolution (Mithen, 1996; Frankish, 2010). The second process, called Type 2 analytic thinking, is thought to have evolved with the expansion of the prefrontal cortex in early hominoids (Fuster, 2002; Evans, 2003; Osman, 2004).

The original version of the CRT consists of three quasi-mathematical problems with lures (Frederick, 2005). These CRT problems can produce incorrect intuitive answers (e.g., *24 days* for the below example), based on intuitive thinking, correct analytic answers (e.g., *47 days* for the below example)

or entirely incorrect answers (e.g., anything other than the previous two examples). Consider the following as an example of one of the CRT problems:

In a lake, there is 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 the lake?

Since Frederick's (2005) seminal paper on the CRT more CRT problems have been published by other scholars (Toplak et al., 2011; Primi, Morsanyi, Chiesi, Donati, & Hamilton, 2016; Thomson & Oppenheimer, 2016). Toplak produced four CRT items in 2011 (Toplak et al., 2011) which are closely, and positively, correlated with Frederick's original CRT items (Toplak et al., 2014a). For an example of one of Toplak's CRT problems see the following:

Jerry received both the 15th highest and the 15th lowest mark in the class. How many students are in the class?

As the CRT measures both intuitive thinking and analytic thinking it can be scored based on either process of thinking: the percentage of intuitive answers, the percentage of analytic answers (i.e., accuracy), or the percentage of completely incorrect answers (Primi et al., 2016; Thomson & Oppenheimer, 2016). Crucially, by scoring the CRT by the percentage of intuitive, analytic or completely incorrect answers we reduce the potential of scoring either answer by chance, for example, with two possible answers a participant has a 50% chance of responding with either answer. Another consequence of utilizing the potential to score CRT responses by either intuitive or analytic answers is that we can investigate these processes individually, as has been done by Oldrati, Patricelli, Colombo, and Antonietti, 2016, and Edgcumbe et al., 2018. Here the responses to the measures (MFQ morality) for highly intuitive and highly analytic individuals are analysed individually by splitting the dataset by these key processes.

2.3. Measures of thinking disposition

The Actively Open-minded Thinking (AOT) scale (Stanovich & West, 1997), Rational Experiential Inventory (Epstein et al., 1996) and a religiosity scale were administered to measure thinking dispositions. Here thinking dispositions are defined as the tendency toward a particular pattern of thinking, these patterns of thinking can in part predict the unique variance in decision-making (Stanovich, 2009; West et al., 2008). For example, open-minded individuals are more likely to accept and assimilate new information than those that are not open-minded – this information in turn influences decision-making (Haran et al., 2013). These thinking dispositions predict performance on a range of decision-making tasks that include, but is not limited to, syllogistic reasoning (Stanovich & West, 1998; Kokis, Macpherson, Toplak, West, & Stanovich, 2002), base-rate problems (Pennycook, Cheyne, Koehler, & Fugelsang, 2013), temporal discounting (Basile & Toplak, 2015) and the Cognitive Reflection Test (Toplak et al., 2014).

The Actively Open-minded Thinking (AOT) scale is based on the original concept of open-minded thinking from Baron (1993), who aimed to define the key principles of good analytic thinking. This principle suggests that to avoid cognitive bias, specifically confirmation bias (also called myside bias) one must approach a problem from multiple perspectives (Stanovich, West, & Toplak, 2013). Building on Baron's work the original version of the Actively Open-minded Thinking (AOT) scale was developed to operationalise this concept (Stanovich & West, 1997; Sá, West, & Stanovich, 1999). Here the short version of the AOT was administered, consisting of seven items (Haran et al., 2013). All items were scored so that higher scores represent a greater tendency toward open-minded thinking. An example on AOT item is below where responses are scores from 1 (completely disagree) to 7 (completely agree).

Allowing oneself to be convinced by an opposing argument is a sign of good character.

Like the AOT, the REI originally consisted in a long-form format, in this case consisting of fifty-nine items (Epstein et al., 1995). In this paper the short version of the REI was administered which contained ten items (Norris, Pacini & Epstein, 1998). When scored the items are split equally into two

parts to measure two sub-scales: rational thinking (REI-R) and experiential thinking (REI-E). High scores on the rational sub-scale represent a greater tendency toward rational thinking, whilst high scores on the experiential sub-scale denote a greater tendency toward experiential thinking (Pacini & Epstein, 1999). Examples from the rational and experiential sub-scales are below, for both sub-scales participants respond from 1 (definitely not true for myself) to 5 (definitely true for myself).

Rational sub-scale example: I try to avoid situations that require thinking in depth about something.

Experiential sub-scale example: I trust my initial feelings about people.

The religiosity scale had two components. Like in Pennycook et al., (2012) participants stated whether they believed in fourteen conventional components of religious belief that are widely held by religious people (International Social Survey Program (ISSP), 1991, 1993). These were: a single, god, multiple gods, an afterlife, a heaven, a hell, holy scripture, reincarnation, holy place of worship, an immortal soul, karma, prayer, prophecies, miracles, demons and angels. In the second component participants rated their level of religiosity from 1 (not at all religious) to 5 (I attend service every week).

2.4. Measure of morality

The Moral Foundation Questionnaire (MFQ) was administered to measure morality (Graham et al., 2011; Davies, Sibley, & Liu, 2014). The MFQ was developed to fill the need for a scientific and systematic theory of morality. The development of this measure followed an examination of the virtues and areas of moral regulation that were in common in the evolutionary psychology and the anthropology literature (Haidt & Graham, 2007; Graham et al., 2011). These areas of common morality include both individualizing moral values - harm/care and fairness/reciprocity, and binding moral values - loyalty/in-group, authority/respect, and purity/sanctity, as such these morals constituted the five sub-scales of the MFQ. The long form of the MFQ was administered in this paper which consisted of sixteen contextualized items that were scored for relevance in part 1 and thirty-two items that were

scored for agreement or disagreement in part 2. In part 1 participants respond to the moral relevance of each item from 0 (not at all relevant) to 5 (extremely relevant) and in part 2 they respond by making a moral judgment from 0 (strongly disagree) to 5 (strongly agree). Items six (part 1) and twenty-two (part 2) were to catch participants who were not paying attention (see Appendices). Examples of each of the 5 sub-scales are:

Part 1 instruction: When you decide whether something is right or wrong, to what extent are the following considerations relevant to your thinking? Please rate each statement ...

Part 2 instruction: Please read the following sentences and indicate your agreement or disagreement...

Harm/Care: Whether or not someone cared for someone weak or vulnerable.

Fairness/Reciprocity: Whether or not someone was denied his or her rights.

Loyalty/In-group: Whether or not someone did something to betray his or her group.

Authority/Respect: Respect for authority is something all children need to learn.

Purity/Sanctity: I would call some acts wrong on the grounds that they are unnatural.

2.5. Demographic variables

Sex (male, female, or do not wish to say), age in years (range: 18 – 72), religiosity (yes or no), and range of religiosity (5-point Likert scale: 1 = not at all religious (n = 181), 2 = religious but not active (n = 49), 3 = somewhat religious (n = 59), 4 = very religious (n = 52), and 5 = attend service every week (n = 59); total not religious (n = 181), total religious (n = 219)) were all recorded. With respect to religiosity the sample for this paper were 45% religious and 54% non-religious. In comparison to the percentage of the non-religious populations, as of 2014, for Spain, the United States, Germany, and South Korea are 7.8%, 4.5%, 9.9%, and 29.7% respectively (Keysar, 2015).

3. Results and discussion

3.1. MANOVAs

There were no missing values or outliers in the accuracy scores for the Cognitive Reflection Test, Actively Open-minded Thinking Scale, Rational Experiential Inventory or the Moral Foundations Questionnaire. The assumptions of each analysis were examined at analysis. Unless otherwise stated there were no violations of assumptions.

The first MANOVA examined the effect of cognitive reflection (high and low) on the morality as measured by the MFQ. Between-subjects factor was CRT accuracy (high or low). Dependent variables were the sub-scales of the MFQ: harm/care, fairness/reciprocity, loyalty/in-group, authority/respect, and purity/sanctity. The Box's test results showed that equality of covariance had been violated ($p = 0.01$) so a Pillai's trace was used. Using Pillai's Trace there was a significant main effect of cognitive reflection on MFQ morality, Pillai's Trace = 0.06, $F(5, 394) = 5.40$, $p = 0.01$, partial $\eta^2 = 0.06$. MFQ morality was higher in the individuals with low cognitive reflection for most of the MFQ sub-scales.

Follow-up ANOVAs revealed that there were main effects of cognitive reflection on the following MFQ sub-scales: loyalty/in-group, $F(1, 398) = 14.33$, $p = 0.01$, partial $\eta^2 = 0.03$, authority/respect, $F(1, 398) = 22.58$, $p = 0.01$, partial $\eta^2 = 0.05$, and purity/sanctity, $F(1, 398) = 20.04$, $p = 0.01$, partial $\eta^2 = 0.05$. The loyalty/in-group, authority/respect and purity/sanctity MFQ sub-scales were higher in low reflective individual than high reflective individuals. There were no main effects of cognitive reflection on the MFQ fairness/reciprocity sub-scale, $F(1, 398) = 0.16$, $p = 0.70$, partial $\eta^2 = 0.01$, and the MFQ harm/care sub-scale, $F(1, 398) = 3.70$, $p = 0.056$, partial $\eta^2 = 0.01$. The relevant summary for means and standard error of the means are presented in Figure 1. See Appendices Table 1 further details.

The contrasts revealed that morality for the MFQ loyalty/in-group sub-scale was higher in low reflective individuals ($M = 17.93$, $SD = 5.88$) compared to individuals with high levels of cognitive reflection ($M = 15.86$, $SD = 4.95$), $F(1, 398) = 14.33$, $p = 0.01$, 95% CI [1.00, 3.13].

For morality as measured by the MFQ authority/respect sub-scale the contrasts revealed higher scores in low reflective individuals ($M = 19.26$, $SD = 5.47$) compared to individuals with high levels of cognitive reflection who had low score ($M = 16.63$, $SD = 5.60$), $F(1, 398) = 22.58$, $p = 0.01$, 95% CI [1.54, 3.72].

For morality as measured by the MFQ purity/sanctity sub-scale the contrasts revealed higher scores in low reflective individuals ($M = 18.23$, $SD = 6.82$) compared to individuals with high levels of cognitive reflection who had low score ($M = 15.06$, $SD = 7.33$), $F(1, 398) = 20.04$, $p = 0.01$, 95% CI [1.77, 4.56].

[Figure 1 here]

Fig. 1. Moral Foundation Questionnaire sub-scales by high and low Cognitive Reflection. There were significant differences between the high and low cognitive reflection groups for all MFQ sub-scales, except for MFQ Fairness/Reciprocity. Abbreviations: Moral Foundation Questionnaire (MFQ), Cognitive Reflection Test (CRT), Fairness (Fair.), Reciprocity (Recip.), Loyalty (Loy.), Authority (Auth.), Respect (Resp.), Purity (Pur.), and Sanctity (San.). Error bars denote standard errors from the mean. Significant levels denote $p < .05$.

Next, a MANOVA examined the effect of religiosity (religious or non-religious) on morality as measured by the MFQ. Between-subjects factor was religiosity (religious or non-religious). Dependent variables were the sub-scales of the MFQ: harm/care, fairness/reciprocity, loyalty/in-group, authority/respect, and purity/sanctity. The Box's test results showed that equality of covariance had been violated ($p = 0.01$) so a Pillai's trace was used. Using Pillai's Trace there was a significant main effect of religiosity on MFQ morality, Pillai's Trace = 0.37, $F(5, 394) = 46.50$, $p = 0.01$, partial $\eta^2 = 0.37$. MFQ morality for loyalty/in-group, authority/respect, and purity/sanctity was higher in religious participants compared to non-religious participants. Whilst MFQ morality for the harm/care and fairness/reciprocity sub-scales were higher for the non-religious participants than religious participants.

Follow-up ANOVAs revealed that there were main effects of religiosity on MFQ harm/care, $F(1, 398) = 27.26$, $p = 0.01$, partial $\eta^2 = 0.06$, MFQ fairness/reciprocity, $F(1, 398) = 41.55$, $p = 0.01$, partial $\eta^2 = 0.10$, MFQ loyalty, $F(1, 398) = 52.36$, $p = 0.01$, partial $\eta^2 = 0.11$, MFQ authority/respect, $F(1, 398) = 42.55$, $p = 0.01$, partial $\eta^2 = 0.10$, and MFQ purity/sanctity, $F(1, 398) = 144.76$, $p = 0.01$, partial $\eta^2 = 0.26$. In religious participants morality as measured by the MFQ loyalty/in-group, MFQ authority/respect, and MFQ purity/sanctity was higher compared to non-religious participants. For the MFQ harm/care and MFQ fairness/reciprocity morality was higher for non-religious than religious participants. The relevant summary for means and standard error of the means are presented in Figure 2. See Appendices Table 2 further details.

The contrasts revealed that morality for the MFQ harm/care sub-scale were higher in non-religious participants ($M = 24.70$, $SD = 2.86$) compared to religious participants ($M = 22.60$, $SD = 4.74$), $F(1, 398) = 27.26$, $p = 0.01$, 95% CI [1.31, 2.90].

The contrasts revealed that morality for the MFQ fairness/reciprocity sub-scale were higher in non-religious participants ($M = 24.43$, $SD = 2.93$) compared to religious participants ($M = 22.00$, $SD = 4.30$), $F(1, 398) = 41.55$, $p = 0.01$, 95% CI [1.70, 3.17].

The contrasts revealed that morality for the MFQ loyalty/in-group sub-scale were higher in religious participants ($M = 18.60$, $SD = 5.10$) compared to non-religious participants ($M = 14.80$, $SD = 5.36$), $F(1, 398) = 52.36$, $p = 0.01$, 95% CI [-4.82, -2.76].

For morality as measured by the MFQ authority/respect sub-scale the contrasts revealed that there were higher scores in religious ($M = 19.55$, $SD = 5.33$) compared to non-religious participants ($M = 16.00$, $SD = 5.50$), $F(1, 398) = 42.55$, $p = 0.01$, 95% CI [-4.62, -2.48].

For morality as measured by the MFQ purity/sanctity sub-scale the contrasts revealed higher morality in religious participants ($M = 20.02$, $SD = 6.21$) compared to non-religious participants ($M = 12.50$, $SD = 6.21$), $F(1, 398) = 144.76$, $p = 0.01$, 95% CI [-8.75, -6.30].

[Figure 2]

Fig. 2. Moral Foundation Questionnaire sub-scales by religiosity (religious and non-religious). There were significant differences between the religious and non-religious groups for all MFQ sub-scales, except for MFQ Harm/Care and MFQ Fairness/Reciprocity. Abbreviations: Moral Foundation Questionnaire (MFQ), Fairness (Fair.), Reciprocity (Recip.), Loyalty (Loy.), Authority (Auth.), Respect (Resp.), Purity (Pur.), and Sanctity (San.). Error bars denote standard errors from the mean. Significant levels denote $p < .05$.

The final MANOVA examined the effect of intuitive thinking (as measured by the CRT) on MFQ morality. Between-subject factors was the percentage of intuitive thinking scores on the CRT (high or low). Dependent variables were the sub-scales of the MFQ: harm/care, fairness/reciprocity, loyalty/in-group, authority/respect, and purity/sanctity. The Box's test results showed a violation of the equality of covariance ($p = 0.02$) so a Pillai's trace was used. Using Pillai's Trace there was a main effect of intuitive thinking on MFQ morality, Pillai's Trace = 0.96, $F(5, 394) = 3.47$, $p = 0.01$, partial $\eta^2 = 0.04$.

MFQ morality was higher for all sub-scales for highly intuitive participants than lowly intuitive participants.

Follow-up ANOVAs revealed that there were main effects of intuitive thinking on MFQ loyalty, $F(1, 398) = 8.11, p = 0.01$, partial $\eta^2 = 0.02$, MFQ authority/respect, $F(1, 398) = 12.67, p = 0.01$, partial $\eta^2 = 0.03$, and MFQ purity/sanctity, $F(1, 398) = 14.80, p = 0.01$, partial $\eta^2 = 0.03$. There were higher MFQ morality scores for all sub-scale in highly intuitive thinkers than lowly intuitive thinkers except for the MFQ fairness/reciprocity and MFQ harm/care sub-scales. There were no main effects of intuitive thinking on MFQ fairness/reciprocity, $F(1, 398) = 0.03, p = 0.85$, partial $\eta^2 = 0.01$ and MFQ harm/care, $F(1, 398) = 1.90, p = 0.17$, partial $\eta^2 = 0.01$. The relevant summary for means and standard error of the means are presented in Figure 3. See Appendices Table 3 further details.

The contrasts revealed that morality for the MFQ loyalty/in-group sub-scale were higher in intuitive thinkers ($M = 17.91, SD = 5.87$) compared to low intuitive thinkers ($M = 16.30, SD = 5.24$), $F(1, 398) = 8.11, p = 0.01$, 95% CI [-2.72, -0.50].

For morality as measured by the MFQ authority/respect sub-scale the contrasts revealed that there were higher scores in intuitive thinkers ($M = 19.25, SD = 5.40$) compared to low intuitive thinkers ($M = 17.20, SD = 5.72$), $F(1, 398) = 12.67, p = 0.01$, 95% CI [-3.20, -0.92].

For morality as measured by the MFQ purity/sanctity sub-scale the contrasts revealed higher morality in intuitive thinkers ($M = 18.43, SD = 7.07$) compared to low intuitive thinkers ($M = 15.60, SD = 7.16$), $F(1, 398) = 14.80, p = 0.01$, 95% CI [-4.27, -1.38].

[Figure 3 here]

Fig. 3. Moral Foundation Questionnaire sub-scales by high and low Intuitive Cognitive Reflection.

There were significant differences between the high and low intuitive cognitive reflection groups for all MFQ sub-scales, except for MFQ Fairness/Reciprocity. Abbreviations: Moral Foundation Questionnaire (MFQ), Intuitive Cognitive Reflection Test (In. CRT), Fairness (Fair.), Reciprocity (Recip.), Loyalty (Loy.), Authority (Auth.), Respect (Resp.), Purity (Pur.), and Sanctity (San.). Error bars denote standard errors from the mean. Significant levels denote $p < .05$.

3.2. Multiple Mediation Models

A series of multiple mediation model analyses were then carried out to investigate the effect of cognitive reflection on the five morality sub-scales of the MFQ: harm/care and fairness/reciprocity, loyalty/in-group, authority/respectability, and purity/sanctity. Mediators were the thinking dispositions – religiosity, actively open-minded thinking (AOT), rational experiential inventory – rational sub-scale (REI-R) and rational experiential inventory – experiential sub-scale (REI-E).

The first multiple mediation model analysis was conducted to examine the effect of cognitive reflection (CRT) on morality (MFQ harm/care sub-scale). Mediators were thinking dispositions (religiosity, AOT, REI-R and REI-E). There was no significant direct effect of cognitive reflection on MRQ harm/care morality, $b = -1.30$, $t = -1.90$, $p = 0.06$, CI [-2.60, 0.05] (Figure 4 supplementary material).

Next, the second multiple mediation model analysis was conducted to examine the effect of cognitive reflection (CRT) on morality (MFQ fairness/reciprocity sub-scale). Mediators were thinking dispositions (religiosity, AOT, REI-R and REI-E). There was no significant direct effect of cognitive reflection on MRQ fairness/reciprocity morality, $b = -0.16$, $t = -0.25$, $p = 0.80$, CI [-1.40, 1.10] (Figure 5 supplementary material).

The third multiple mediation model analysis was examined the effect of cognitive reflection (CRT) on morality (MFQ loyalty/in-group sub-scale). Mediators were thinking dispositions (religiosity, AOT, REI-R and REI-E). There was a significant direct effect of cognitive reflection on MRQ loyalty/in-group morality, $b = -1.62$, $t = -2.05$, $p = 0.04$, CI [-3.17, -0.07]. As cognitive reflection in the CRT went up morality as measured by the MFQ loyalty/in-group sub-scale decreased (Figure 6 supplementary material).

There was a significant indirect effect of cognitive reflection (CRT) on MFQ loyalty/in-group through religiosity, $b = -0.53$, $t = -2.25$, $p = 0.02$ BCa CI [-1.00, -0.07]. Religiosity explained 1% of the variance in the relationship between cognitive reflection and MFQ harm/care. As cognitive reflection went up religiosity decreased.

There was a significant indirect effect of cognitive reflection (CRT) on MFQ loyalty/in-group through actively open-minded thinking (AOT), $b = 0.94$, $t = 6.10$, $p = 0.01$, BCa CI [4.50, 8.76]. Actively open-mindedness explained 10% of the variance in the relationship between cognitive reflection and MFQ loyalty/in-group. As cognitive reflection went up so did actively open-minded thinking.

There was a significant indirect effect of cognitive reflection (CRT) on MFQ loyalty/in-group through the REI-R sub-scale, $b = 0.57$, $t = 2.22$, $p = 0.02$, BCa CI [0.06, 1.10]. REI-R explained 1% of the variance in the relationship between cognitive reflection and MFQ loyalty/in-group. As cognitive reflection increased REI-R increased.

Next, there was no significant indirect effect of cognitive reflection (CRT) on MRQ loyalty/in-group through the REI-E sub-scale, $b = 0.05$, $t = 0.20$, $p = 0.84$, BCa CI [-0.50, 0.60].

The fourth multiple mediation model analysis was conducted to examine the effect of cognitive reflection (CRT) on morality (MFQ authority/respectability sub-scale). Mediators were thinking dispositions (religiosity, AOT, REI-R and REI-E). There was a significant direct effect of cognitive reflection on MRQ authority/respectability morality, $b = -2.82$, $t = -3.57$, $p = 0.01$, CI [-4.40, -1.27]. As cognitive reflection in the CRT went up morality as measured by the MFQ authority/respectability sub-scale decreased (Figure 7 supplementary material).

There was a significant indirect effect of cognitive reflection (CRT) on MFQ authority/respectability through religiosity, $b = -0.53$, $t = -2.25$, $p = 0.02$ BCa CI [-1.00, -0.07]. Religiosity explained 1% of the variance in the relationship between cognitive reflection and MFQ authority/respectability. As cognitive reflection went up religiosity decreased.

There was a significant indirect effect of cognitive reflection (CRT) on MFQ authority/respectability through actively open-minded thinking (AOT), $b = 0.94$, $t = 6.10$, $p = < 0.01$, BCa CI [4.50, 8.76]. Actively open-mindedness explained 8% of the variance in the relationship between cognitive reflection and MFQ authority/respectability. As cognitive reflection went up so did actively open-minded thinking.

There was a significant indirect effect of cognitive reflection (CRT) on MFQ authority/respectability through the REI-R sub-scale, $b = 0.57$, $t = 2.22$, $p = 0.02$, BCa CI [0.06, 1.10]. REI-R explained 1% of the variance in the relationship between cognitive reflection and MFQ authority/respectability. As cognitive reflection increased REI-R increased.

Next, there was no significant indirect effect of cognitive reflection (CRT) on MRQ authority/respectability through the REI-E sub-scale, $b = 0.05$, $t = 0.20$, $p = 0.84$, BCa CI [-0.50, 0.60].

The final multiple mediation model analysis was conducted to examine the effect of cognitive reflection (CRT) on morality (MFQ purity/sanctity sub-scale). Mediators were thinking dispositions (religiosity, AOT, REI-R and REI-E). There was a significant direct effect of cognitive reflection on MRQ purity/sanctity morality, $b = -3.14$, $t = -3.64$, $p = 0.01$, CI [-4.83, -1.44]. As cognitive reflection in the CRT went up morality as measured by the MFQ purity/sanctity sub-scale decreased (Figure 8 supplementary material).

There was a significant indirect effect of cognitive reflection (CRT) on MFQ purity/sanctity through religiosity, $b = -0.53$, $t = -2.25$, $p = 0.02$ BCa CI [-1.00, -0.07]. Religiosity explained 1% of the variance in the relationship between cognitive reflection and MFQ purity/sanctity. As cognitive reflection went up religiosity decreased.

There was a significant indirect effect of cognitive reflection (CRT) on MFQ purity/sanctity through actively open-minded thinking (AOT), $b = 0.94$, $t = 6.10$, $p < 0.01$, BCa CI [4.50, 8.76]. Actively open-mindedness explained 8% of the variance in the relationship between cognitive reflection and MFQ purity/sanctity. As cognitive reflection went up so did actively open-minded thinking.

There was a significant indirect effect of cognitive reflection (CRT) on MFQ purity/sanctity through the REI-R sub-scale, $b = 0.57$, $t = 2.22$, $p = 0.02$, BCa CI [0.06, 1.10]. REI-R explained 1% of the variance in the relationship between cognitive reflection and MFQ purity/sanctity. As cognitive reflection increased REI-R increased.

Next, there was no significant indirect effect of cognitive reflection (CRT) on MRQ purity/sanctity through the REI-E sub-scale, $b = 0.05$, $t = 0.21$, $p = 0.84$, BCa CI [-0.50, 0.60].

3.3. Discussion

The present research provides evidence that intuitive and analytic cognitive styles, defined as the propensity to engage in either intuitive or analytic thinking, predicts moral judgments for both individualizing and binding moral values. Participants who engaged in intuitive thinking scored highly on the moral foundation sub-scales that are concerned with binding moral values, namely loyalty/in-group, authority/respectability and purity/sanctity. Moreover, religiosity directly predicted moral judgments for the same moral foundations. Religious participants scored higher on the binding foundations for loyalty/in-group, authority/respectability and purity/sanctity. Whilst non-religious participants scored higher for the individualizing moral values - harm/care and fairness/reciprocity. The mediator analyses results indicated that the thinking dispositions, in particular, AOT, religiosity and REI-R explained some of the relationship between cognitive style and moral judgments.

The present results regarding the relationship between cognitive style and moral judgments can be explained by whether an individual is a highly intuitive or highly analytic thinker. The highly intuitive thinkers only scored highly on the moral foundations that were concerned with binding moral values. It can be argued that out of the five foundations in the MFQ (Haidt & Joseph, 2004), these three foundations are conceptually linked to the focus on differences between groups, authority and disgust (i.e., purity) (Garvey & Ford, 2014). These binding moral values are unpinned by evolutionary ancient processes such as disgust sensitivity (Lahti & Weinstein, 2005) and ingroup partiality (Hamilton, 1964) which evolved during early hominoid evolution. It was during this time that the capacity for intuitive thinking evolved as evidenced by the use of heuristics and biases in non-human primates of which we share a common ancestor (Hayden, Heilbrunner, Nair, & Platt, 2008; Kralik et al., 2012). For example, both humans (Miu & Crisan, 2011) and bonobos (*Pan paniscus*) (Krupenye et al., 2015) are subject to the framing effect of information when making a judgment. These findings support the hypothesis set forward by Garvey and Ford (2014) who hypothesised and found moderate results for binding morality being positively related to the evolutionary old intuitive thinking.

Importantly, the second crucial result of this paper was that religiosity is positively correlated with binding moral values. This is explained by the strong link between intuitive thinking and religiosity (Gervais & Norenzayan, 2012; Shenhav, Rand & Greene, 2012). Many studies have found that highly religious individuals rely on intuitive thinking more than analytic thinking (Razmyar & Reeve, 2013; Bahcekapili & Yilmaz, 2017). In early hominoid evolution as we developed the capacity for intuitive thinking we could attempt to explain the natural world by jumping to conclusions through the use of this evolutionary ancient thinking process (Evans, 2003). For instance, if a crop failed we could assume that a deity had been displeased by something that we had done. This type of intuitive thinking likely gave way to the development of religious belief systems.

Interestingly, the remaining two foundations are associated with individualizing moral values (). In this paper analytic thinkers scored highly on the foundations for care and fairness. The association between analytic processing and individualizing morality in this paper supports the findings of Garvey and Ford (2014) who also found that analytic thinking was a strong predictor for individualizing morality. The findings here are explained by the evolutionary younger process of analytic thinking (Evans, 2003; 2008). It was in the interest of our ancestors to care for the sick and treat each other fair in much the same way that chimpanzees do today (van Leeuwen, Cronin, Haun, Mundry, & Bodamer, 2012). After caring for a sick member of the group that member may then reciprocate with the same behavior in the future. Basic degrees of care such as protecting the sick from predators (Boesch, 1991) or sharing food and drink (Silk, 1979; Ueno & Matsuzawa, 2004) would have been present in our early ancestors as it is for non-human primates. As the pre-frontal cortices evolved and the capacity for higher order analytic functioning developed the degree to which care and fairness could be extended changed. Humans with the capacity for analytic thinking could now think about how to treat a sick member of their group by reflecting on a care plan.

Moreover, evidence was found for the mediation of the relationship between cognitive style and morality through thinking dispositions. Actively open-minded thinking, religiosity and rational thinking

style (REI-R) all mediated the relationship for all MFQ foundations (Haidt & Joseph, 2004). This provides some evidence that when making a moral judgment we should consider the impact of individual differences in thinking dispositions. It goes some way to explaining why most of our moral values are culturally universal (Barrett et al., 2016). Consider the case of the death penalty (also called capital punishment) as a topical example of morally relativism (Mooney & Lee, 2000; Mooney & Schuldt, 2008). In most countries the death penalty is considered to be morally wrong (Radelet & Akers, 1996; Radelet & Borg, 2000). However, in some states in the United States, for example Oklahoma (Cochran, Chamlin, & Seth, 1994) and Texas (Sorensen, Wrinkle, Brewer, & Marquart, 1999) the death penalty is the highest form of punishment. Crucially, actively open-minded individuals (Pennycook, Cheyne, Koehler, & Fugelsang, 2019) and analytic thinkers (Deppe et al., 2015) alike are less likely to condone the death penalty. Conversely, highly religious people who are often politically conservative agree with the death penalty (Unnever & Cullen, 2006; Miller & Hayward, 2008).

3.4. Future directions

Future studies might consider the different evolutionary origins of individualizing and binding moral values, they might examine why there is evidence from analytic and intuitive thinking for binding moral being evolutionary ancient whilst individualizing moral values are evolutionary young. They might also examine the association between these moral values with other thinking dispositions, for example need for cognition (Cacioppo, Petty, Feinstein, & Jarvis, 1996), and individual differences such as in working memory (Nee et al., 2012). Finally, they might examine whether classical moral dilemmas, for instance the trolley problem (Lanteri, Chelini, & Rizzello, 2008), are influenced by the engagement with cognitive styles and thinking dispositions. More highly analytic thinkers might choose to make moral judgments that are consistent with utilitarianism (Baron et al., 2015).

4. Conclusions

It should be noted that although the findings of this paper are clear in that individuals who engage in analytic and intuitive thinking styles make different moral judgments with regards to the binding moral values, individualizing moral values and the moral foundations in the MFQ we all engage in both analytic and intuitive thinking (Evans, 2012). We engage intuitive thinking when we are short of time or low in cognitive resources (such as working memory), these are often times in which we need to make a moral judgment in a hurry. Crucially, for the focus of this paper participants were not in a hurry to engage in intuitive thinking, they instead opted to make judgments that were consistent with intuitive thinking. These results are consistent with the simple but, in the author's opinion, profound idea that intuitive thinkers and religious participants alike often make the same moral judgments as a result of the evolutionary ancient origin of intuition and religiosity. Even when two individuals who opt to engage in analytic thinking make a moral judgment thinking dispositions such as religiosity and open-mindedness influence our judgments. When we make moral judgments, we should be aware of our own dispositions towards particular thinking patterns.

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Appendices

Attention check questions

1. How are you? Just a quick attention check. Please type the name of the capital city of the United States below. (Hint: it starts with a W and ends with DC)
2. How are you? Just a quick attention check. Please type the name of the capital city of the United Kingdom below. (Hint it starts with a L and ends with a N)
3. How are you? Just a quick attention check. Please type the name of the plant we are on. (Hint it starts with an E and ends with a H)

Moral Foundation Questionnaire (MFQ) by Graham, Haidt & Nosek, 2008) The MFQ was downloaded from www.moralfoundations.org

Part 1. When you decide whether something is right or wrong, to what extent are the following considerations relevant to your thinking? Please rate each statement using this scale:

[0] = not at all relevant (This consideration has nothing to do with my judgments of right and wrong)

[1] = not very relevant

[2] = slightly relevant

[3] = somewhat relevant

[4] = very relevant

[5] = extremely relevant (This is one of the most important factors when I judge right and wrong)

- _____ 1. Whether or not someone suffered emotionally
- _____ 2. Whether or not some people were treated differently than others
- _____ 3. Whether or not someone's action showed love for his or her country
- _____ 4. Whether or not someone showed a lack of respect for authority
- _____ 5. Whether or not someone violated standards of purity and decency
- _____ 6. Whether or not someone was good at math
- _____ 7. Whether or not someone cared for someone weak or vulnerable
- _____ 8. Whether or not someone acted unfairly
- _____ 9. Whether or not someone did something to betray his or her group
- _____ 10. Whether or not someone conformed to the traditions of society
- _____ 11. Whether or not someone did something disgusting
- _____ 12. Whether or not someone was cruel

- _____ 13. Whether or not someone was denied his or her rights
- _____ 14. Whether or not someone showed a lack of loyalty
- _____ 15. Whether or not an action caused chaos or disorder
- _____ 16. Whether or not someone acted in a way that God would approve of

Part 2. Please read the following sentences and indicate your agreement or disagreement:

[0]	[1]	[2]	[3]	[4]	[5]
Strongly	Moderately	Slightly	Slightly	Moderately	Strongly
disagree	disagree	disagree	agree	agree	agree
- _____ 17. Compassion for those who are suffering is the most crucial virtue.
- _____ 18. When the government makes laws, the number one principle should be ensuring that everyone is treated fairly.
- _____ 19. I am proud of my country's history.
- _____ 20. Respect for authority is something all children need to learn.
- _____ 21. People should not do things that are disgusting, even if no one is harmed.
- _____ 22. It is better to do good than to do bad.
- _____ 23. One of the worst things a person could do is hurt a defenseless animal.
- _____ 24. Justice is the most important requirement for a society.
- _____ 25. People should be loyal to their family members, even when they have done something wrong.
- _____ 26. Men and women each have different roles to play in society.
- _____ 27. I would call some acts wrong on the grounds that they are unnatural.
- _____ 28. It can never be right to kill a human being.
- _____ 29. I think it's morally wrong that rich children inherit a lot of money while poor children inherit nothing.
- _____ 30. It is more important to be a team player than to express oneself.
- _____ 31. If I were a soldier and disagreed with my commanding officer's orders, I would obey anyway because that is my duty.
- _____ 32. Chastity is an important and valuable virtue.

To score the MFQ yourself, you can copy your answers into the grid below. Then add up the 6 numbers in each of the five columns and write each total in the box at the bottom of the column. The box then shows your score on each of 5 psychological "foundations" of morality. Scores run

from 0-30 for each foundation. (Questions 6 and 22 are just used to catch people who are not paying attention. They don't count toward your scores).

Question #	Your Response	Question #	Your Response	Question #	Your Response	Question #	Your Response	Question #	Your Response
1		2		3		4		5	
7		8		9		10		11	
12		13		14		15		16	
17		18		19		20		21	
23		24		25		26		27	
28		29		30		31		32	

Harm /
Care

Fairness /
Reciprocity

In-group/
Loyalty

Authority /
Respect

Purity /
Sanctity

Tables and Figures

Table 1

Moral Foundation Questionnaire raw data (Means (Standard Deviations) for high (n=197) and low (n=203) reflective (CRT) participants

	Low CRT	High CRT	Total
MFQ sub-scale			
Harm/Care	23.92 (4.32)	23.13 (3.93)	23.53 (4.15)
Fairness/Reciprocity	23.16 (3.90)	23.01 (4.00)	23.10 (3.93)
Loyalty/In-group	17.93 (5.88)	15.86 (4.95)	16.91 (5.54)
Authority/Respect	19.26 (5.47)	16.63 (5.60)	17.97 (5.68)
Purity/Sanctity	18.23 (6.82)	15.06 (7.33)	16.67 (7.25)

Abbreviations: Cognitive Reflection Test (CRT), Moral Foundation Questionnaire (MFQ).

Table 2

Moral Foundation Questionnaire raw data (Means (Standard Deviations) for religious (n=222) and non-religious (n=178) participants

	Religious	Non-religious	Total
MFQ sub-scale			
Harm/Care	22.60 (4.74)	24.70 (2.86)	23.53 (4.15)
Fairness/Reciprocity	22.00 (4.30)	24.43 (2.93)	23.10 (3.93)
Loyalty/In-group	18.60 (5.10)	14.80 (5.36)	16.91 (5.54)
Authority/Respect	19.55 (5.33)	16.00 (5.50)	18.00 (5.70)
Purity/Sanctity	20.02 (6.21)	12.50 (6.21)	16.67 (7.25)

Abbreviations: Cognitive Reflection Test (CRT), Moral Foundation Questionnaire (MFQ).

Table 3

Moral Foundation Questionnaire raw data (Means (Standard Deviations) for high (n=151) and low (n=259) intuitive thinking (intuitive CRT) participants

	Low in. CRT	High in. CRT	Total
MFQ sub-scale			
Harm/Care	23.31 (4.00)	23.90 (4.37)	23.53 (4.15)
Fairness/Reciprocity	23.06 (3.95)	23.13 (3.90)	23.10 (3.93)
Loyalty/In-group	16.30 (5.24)	17.91 (5.87)	16.91 (5.54)
Authority/Respect	17.20 (5.72)	19.25 (5.40)	18.00 (5.70)
Purity/Sanctity	15.60 (7.16)	18.43 (7.07)	16.67 (7.25)

Abbreviations: Intuitive thinking for the Cognitive Reflection Test (in. CRT), Moral Foundation Questionnaire (MFQ).

Figure 4

Fig. 4. Moderated, multiple mediations model of the relationship between Cognitive reflection (CRT accuracy) and morality as measures by the MFQ harm/care sub-scale. Each pathway includes unstandardized path coefficients of the direct relationship of one variable to another. Significance levels are identified as: * $p < .05$ ** $p < .01$, *** $p < .001$

Figure 5

Fig. 5. Moderated, multiple mediations model of the relationship between Cognitive reflection (CRT accuracy) and morality as measures by the MFQ fairness/reciprocity sub-scale. Each pathway includes unstandardized path coefficients of the direct relationship of one variable to another. Significance levels are identified as: * $p < .05$ ** $p < .01$, *** $p < .001$

Figure 6

Fig. 6. Moderated, multiple mediations model of the relationship between Cognitive reflection (CRT accuracy) and morality as measures by the MFQ loyalty/in-group sub-scale. Each pathway includes unstandardized path coefficients of the direct relationship of one variable to another. Significance levels are identified as: * $p < .05$ ** $p < .01$, *** $p < .001$

Figure 7

Fig. 7. Moderated, multiple mediations model of the relationship between Cognitive reflection (CRT accuracy) and morality as measures by the MFQ authority/respect sub-scale. Each pathway includes unstandardized path coefficients of the direct relationship of one variable to another. Significance levels are identified as: * $p < .05$ ** $p < .01$, *** $p < .001$

Figure 8

Fig. 8. Moderated, multiple mediations model of the relationship between Cognitive reflection (CRT accuracy) and morality as measures by the MFQ purity/sanctity sub-scale. Each pathway includes unstandardized path coefficients of the direct relationship of one variable to another. Significance levels are identified as: * $p < .05$ ** $p < .01$, *** $p < .001$

Figures

Figure 1

Figure 2

Figure 3

Captions for figures

Fig. 1. Moral Foundation Questionnaire sub-scales by high and low Cognitive Reflection. There were significant differences between the high and low cognitive reflection groups for all MFQ sub-scales, except for MFQ Fairness/Reciprocity. Abbreviations: Moral Foundation Questionnaire (MFQ), Cognitive Reflection Test (CRT), Fairness (Fair.), Reciprocity (Recip.), Loyalty (Loy.), Authority (Auth.), Respect (Resp.), Purity (Pur.), and Sanctity (San.). Error bars denote standard errors from the mean. Significant levels denote $p < .05$.

Fig. 2. Moral Foundation Questionnaire sub-scales by religiosity (religious and non-religious). There were significant differences between the religious and non-religious groups for all MFQ sub-scales, except for MFQ Harm/Care and MFQ Fairness/Reciprocity. Abbreviations: Moral Foundation Questionnaire (MFQ), Fairness (Fair.), Reciprocity (Recip.), Loyalty (Loy.), Authority (Auth.), Respect (Resp.), Purity (Pur.), and Sanctity (San.). Error bars denote standard errors from the mean. Significant levels denote $p < .05$.

Fig. 3. Moral Foundation Questionnaire sub-scales by high and low Intuitive Cognitive Reflection. There were significant differences between the high and low intuitive cognitive reflection groups for all MFQ sub-scales, except for MFQ Fairness/Reciprocity. Abbreviations: Moral Foundation Questionnaire (MFQ), Intuitive Cognitive Reflection Test (In. CRT), Fairness (Fair.), Reciprocity (Recip.), Loyalty (Loy.), Authority (Auth.), Respect (Resp.), Purity (Pur.), and Sanctity (San.). Error bars denote standard errors from the mean. Significant levels denote $p < .05$.