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The role of analytic thinking in moral judgements and values

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While individual differences in the willingness and ability to engage analytic processing have long informed research in reasoning and decision making, the implications of such differences have not yet had a strong influence in other domains of psychological research. We claim that analytic thinking is not limited to problems that have a normative basis and, as an extension of this, predict that individual differences in analytic thinking will be influential in determining beliefs and values. Along with assessments of cognitive ability and style, religious beliefs, and moral values, participants judged the wrongness of acts considered disgusting and conventionally immoral, but that do not violate care- or fairness-based moral principles. Differences in *willingness* to engage analytic thinking predicted reduced judgements of wrongness, independent of demographics, political ideology, religiosity, and moral values. Further, we show that those who were higher in cognitive ability were less likely to indicate that purity, patriotism, and respect for traditions and authority are important to their moral thinking. These findings are consistent with a “Reflectionist” view that assumes a role for analytic thought in determining substantive, deeply-held human beliefs and values.

Keywords: Moral judgements; Moral values; Religiosity; Cognitive ability; Cognitive style; Dual-process theories.

Pascal famously wrote that “the heart has its reasons, that reason cannot know,” a pithy expression that admittedly relies on a flirtation with the fallacy of equivocation for its appeal, but which nonetheless remains a classical epigram widely considered a truism. He also wrote, however, that “thought makes the greatness of Man.” The tension between romantic intuitionism

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and cool rationality as contrasting hallmarks of what it is to be truly human preceded Pascal in antiquity and remains with us today.

In perhaps no other domain is this conflict between intuition and rationality more central than in moral judgement. Despite the fact that classical work in morality favoured the dominance of intuition, the first significant contributions to a modern psychological understanding of morality focused on the role of reasoning in the development of moral judgements throughout the life span (e.g., Kohlberg, 1969; Piaget, 1965; Turiel, 1983). An intuitionist backlash against this early work emerged at the turn of the century (e.g., Haidt, 2001; Greene & Haidt, 2002), wherein affective processes were once again thought to be the primary source of moral judgements. The debate continues, however, and the extent to which reflective reasoning processes are formative in moral judgement remains an ongoing point of contention (Cushman, Young, & Hauser, 2006; Greene, 2007, 2012; Greene & Haidt, 2002; Greene, Morelli, Lowenberg, Nystrom, & Cohen, 2008; Greene, Nystrom, Engell, Darley, & Cohen, 2004; Greene, Sommerville, Nystrom, Darley, & Cohen, 2001; Haidt, 2001, 2003, 2007, 2012; Haidt & Kesebir, 2010; Paxton & Greene, 2010; Pizarro & Bloom, 2003; Saunders, 2013). A question that has relevance for these issues, but has not yet been systematically studied, is that concerning whether individuals vary in their propensities to intuit their moral judgements or to reason out their decisions. Under a “Reflectionist” account of moral judgement where reflective reasoning processes are assumed to play an active role in moral judgement, there are grounds, we will argue, to expect that individual differences in analytic thinking will predict variation in moral judgements. An “Intuitionist” account, on the other hand, makes no such prediction.

Intuition and reflection

Humans frequently rely on intuitions during reasoning and decision making, leading to a number of cognitive biases (for reviews, see Baron, 1994; 1998; Evans, 1989; Evans & Over, 1996; Kahneman, Slovic, & Tversky, 1982; Shafir & Tversky, 1995; Stanovich & West, 2000). A great deal of research in psychology has invoked the distinction between fast, spontaneous, intuitive processes (i.e., “Type 1” processes) and slow, controlled, reflective processes (i.e., “Type 2” processes) to explain these results (e.g., Evans, 2008; Evans & Frankish, 2009; Evans & Stanovich, 2013; Kahneman, 2003; Sloman, 1996; Stanovich, 2009a; Thompson, 2013). Essentially, people are purported to reason using slow and resource demanding Type 2 processing as little as possible, and as a result, fail to inhibit and override intuitive responses or tendencies. Moreover, intuitive responses come to mind fluently, causing a “feeling of rightness” which often pre-empts analytic processing (Thompson, Prowse Turner, & Pennycook, 2011; Thompson et al., 2013).

Critically, there is evidence that individual differences exist in analyticity, such that some people are more willing to engage analytic reasoning than others (Stanovich, 2009a). Such differences in analytic cognitive style (ACS) or thinking disposition have been shown to be robust predictors in numerous reasoning and decision making studies in which rationality is either the focus or is explicitly implicated (e.g., Stanovich & West, 1998; 2000; Toplak, West, & Stanovich, 2011). Further, according to Stanovich (2004, 2009a, 2009b), to be fully rational or analytical, one must be both *able* to do the necessary mental operations [i.e., cognitive ability (CA)] and *willing* to think analytically (i.e., cognitive style). Consider the following problem (from Frederick, 2005):

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? ____cents

This problem cues an intuitive response (i.e., 10 cents) that one must override via analytic processing to correctly solve the problem (Frederick, 2005). Although the math required to solve this problem is quite simple, only around a third of a standard university or online sample successfully solve it. This is because the question requires both a *willingness* to rethink the intuitive response and the *ability* to engage sufficient analytic processing to override it. Questions of this type have been demonstrated to have predictive power over and above that of standard measures of CA, assuming that ability is equally assessed in both kinds of testing (Toplak et al., 2011). Although the tendency in past research has been to assess *either* CA (including intelligence, working memory capacity, etc.; e.g., Kanazawa, 2010; Moore, Clark, & Kane, 2008) *or* intuitive versus deliberative thinking disposition (e.g., Bartels, 2008; Paxton, Unger, & Greene, 2012), Stanovich theorises that *both* are key factors in determining the relative influence of analytic processing on behaviour (Stanovich, 2009b).

Although such differences have been shown to be of consequence in reasoning and decision making, less work has focused on whether such CA and style differences have application in a broader sphere of psychological decisions. Moral judgements are of particular interest for an investigation of the relative influence of analytic thinking because they, in contrast to most reasoning and decision making problems typically studied in the dual-process tradition, do not have normatively correct or incorrect answers and are thought to have significant emotional components that attenuate or obviate analytic processing. That is, it is not obvious that one needs to actually think analytically about them. This perhaps explains the ongoing debate in the field concerning the issue of whether moral judgement is a unique class of thought (e.g., Greene & Haidt, 2002; Hauser, 2006; Shenhav & Greene, 2010). Regardless, the non-normative basis of the problems/dilemmas

typically used to investigate moral judgement distinguishes morality research from traditional reasoning and decision-making work. Moral judgement therefore provides a potential litmus test for the pervasiveness of analytic thinking, and by extension, the relevance of individual differences in cognitive style and ability in domains outside of the standard reasoning and decision-making paradigm.

Analytic thinking and religious belief

There is some evidence to support the claim that individual differences in analytic thinking are relevant outside of the domain of reasoning and decision making. Specifically, several recent studies have reported that differences in ACS, in particular, negatively predict the prevalence of religious and paranormal belief, independent of CA (Pennycook, Cheyne, Barr, Koehler, & Fugelsang, 2013a; Pennycook, Cheyne, Koehler, & Fugelsang, 2013b; Pennycook, Cheyne, Seli, Koehler, & Fugelsang, 2012; Shenhav, Rand, & Greene, 2012; also see Gervais & Norenzayan, 2012 and Shenhav et al., 2012 for evidence for a causal relation between analytic thinking and religious belief). These relations also appear to be independent of sex, ethnicity, socio-economic status, income, year in university, university faculty, education (in a non-university sample), political ideology, age, religious engagement (i.e., frequency of religious service attendance, prayer frequency, etc.), various personality variables, and CA (Pennycook, Cheyne, et al., 2012; 2013b; Shenhav et al., 2012). Pennycook, Cheyne, et al. (2012) also reported a model wherein lower analyticity predicted religious beliefs, which, in turn, predicted religious engagement. This research provides evidence that analytic thinking is a direct determinant of religious belief and an indirect determinant of religious behaviour via belief. It is possible, however, that the relation between the propensity for analytic thought and worldviews could be idiosyncratic to supernatural belief. To make a stronger claim about a broader impact of analytic thinking on beliefs and values, it is necessary to investigate other domains of psychological functioning.

Analytic thinking and moral judgements

While the question of whether religion in and of itself makes people more moral remains controversial (e.g., de Waal, 2013; Galen, 2012), there is a long history of scholarship that associates religion with morality (e.g., Darwin, 1860/1859; Durkheim, 1915/1995; see Norenzayan, *in press*; Bloom, 2012 for reviews). In addition, recent research indicates that the religious have different types of moral values than the non-religious, placing more emphasis on values that are thought to bind groups together, such as respect for tradition and authority (Graham & Haidt, 2010; see Discussion for further comment).

Given this connection, moral judgement seems a likely candidate to stand alongside religiosity as a domain in which individual differences in cognitive style and ability are critical. Indeed, present evidence indicates an association between moral judgement and intuitive-analytic thinking disposition (measured by a self-report questionnaire; Bartels, 2008) and working memory capacity (Moore et al., 2008). However, these studies focused specifically on either CA or style, but not both. Moreover, neither study controlled for other factors related to analytic thinking, such as religiosity. As such, a more systematic investigation is necessary. The question of whether individual differences in analytic thinking independently predict moral judgement has important implications for an ongoing debate in the field that parallels the overarching debate between Intuitionists and Reflectionists.

There are currently two dominant theories of moral judgement. The Social Intuitionist model focuses on the role of emotions and intuitions in determining moral judgement (Haidt, 2001; 2007, 2012), positing that moral judgements are constructed almost entirely from intuitive processes, with little if any engagement of explicit reasoning processes. This framework builds on the well-accepted idea that human morality is grounded in adaptive instincts such as empathy, compassion, and shame; the precursors of which have been observed in chimpanzees and elephants (Churchland, 2012; de Waal, 2008; 2013). Social Intuitionist theorists argue that the primary role of analytic reasoning is to convince others, *post hoc*, that one's intuitive moral judgements are justified (Haidt, 2001). People are therefore thought to rarely question and override their moral instincts during judgement. It should be noted, however, that Haidt (2001), for example, does acknowledge that certain exceptional individuals or situations may elicit more active analytic processing. Thus, although individual differences in analyticity may play a small role, amongst philosophers, for example (Haidt, 2001, 2012), the Social Intuitionist model does not assign analytic reasoning processes a prominent role among more representative situations and individuals. As such, from this perspective, one would not expect individual differences in ACS to possess the effect sizes necessary to predict variability in moral judgements.

To demonstrate this point, consider the following vignette (from Haidt, Bjorklund, & Murphy, 2000, see Haidt, 2001):

Julie and Mark are brother and sister. They are travelling together in France on summer vacation from college. One night they are staying alone in a cabin near the beach. They decide that it would be interesting and fun if they tried making love. At the very least it would be a new experience for each of them. Julie was already taking birth control pills, but Mark uses a condom too, just to be safe. They both enjoy making love, but they decide not to do it again. They keep that night as a special secret, which makes them feel even closer to each other. What do you think about that? Was it OK for them to make love?

The vignette makes it clear that no one is hurt and that, if anything, the incest experience has made Julie and Mark closer. Despite these facts, the vast majority of respondents will state that it was morally wrong for Julie and Mark to make love (Haidt, 2001). When pressed to give reasons why the described action is *morally* wrong, participants typically obfuscate and eventually admit that they are not sure why they feel that it is morally wrong, all the while maintaining that it is, in fact, morally wrong (Haidt, 2001; Haidt, et al., 2000).

This and other similar types of vignettes have been used as paradigmatic examples to argue that powerful visceral responses (based on disgust in this case; Russel & Giner-Sorolla, 2011; Giner-Sorolla, 2012) lead directly to a moral judgement with very little explicit justification for, and hence potentially little interference from, analytic reasoning processes (e.g., Greene & Haidt, 2002; Haidt, 2001, 2012). The implication of this is that individuals may rarely reflect on their intuitive disgust-based response. The Social Intuitionist account suggests that individual differences in analytic thought are unlikely to have a strong influence on moral judgements relative to prior moral values and beliefs, particularly as it applies to moral vignettes that elicit a strong disgust-based response.

In contrast, Greene and colleagues have proposed an alternative model that affords analytic reasoning processes a larger role in determining moral judgement (Greene, 2007, 2012; Greene et al., 2001, 2004, 2008; Paxton & Greene, 2010). Green and colleagues agree with the idea that moral instincts are important insofar as they lead to an initial intuitive output, however, their dual-process model predicts that deliberative processes are used to question and sometimes override these responses. It is worth noting, however, that in contrast to our individual differences approach, Greene's account tends to focus on the difference between *deontological* moral judgements (i.e., those concerning rights and duties) and *utilitarian* or *consequentialist* (i.e., cost-benefit) judgements, with the former relying more on intuitive processing and the latter relying more on analytic processing (Paxton & Greene, 2010). Thus, while this model does not necessarily predict a strong relation between individual differences in analytic processing and moral judgements for the incest vignette presented above, Greene and colleagues do place a larger emphasis on the role of reflective processes in moral judgement. In the case on the disgust-based vignette presented above, a consequentialist would focus on the fact that no one was harmed by the incestuous behaviour – an approach that should be more common among analytic individuals (Paxton & Greene, 2010). Indeed, in a recent study, Paxton et al. (2012) demonstrated that (a) inducing analytic reasoning by giving participants cognitive reflection test (CRT) problems (including the bat and ball problem above; Frederick, 2005) increased utilitarian responding and, perhaps more importantly for present purposes, (b) forcing participants to take

longer to think about the incest vignette (as above) decreased moral wrongness ratings when participants were given a strong argument defending the incestuous behaviour. This research suggests that analytic reasoning *can* affect moral judgement; whether analytic reasoning *spontaneously* influences moral judgement in cases where a particularly visceral emotional response is engendered remains unclear.

Hypothesis

Is analytic thinking sufficiently pervasive for individual differences in the willingness and/or ability to engage deliberative processing to be predictive of behaviour in psychological domains outside of reasoning and decision making? A Reflectionist account that assumes that rationality plays a significant role in all decision making, regardless of domain, predicts that moral judgement, like other forms of judgement, will be influenced by individual differences in CA or style. Moreover, if such individual differences are sufficiently general, the predicted relation between analytic thinking and moral judgement should be independent of individual differences in moral values or principles (Graham et al., 2011; Haidt & Graham, 2007; Haidt & Joseph, 2004), as well as differences in religious belief, political ideology, and demographic variables such as sex and level of education. An Intuitionist account that posits a less prominent role for reflection in moral judgements implies a less active, and perhaps inconsequential, role for individual differences in cognitive style and ability.

Given that disgust is perhaps the strongest exemplar of the role of emotion in moral judgement (Giner-Sorolla, 2012; Haidt, 2001; Russel & Giner-Sorolla, 2011), we conclude that moral vignettes that elicit a strong disgust-based response provide a very strong test of the role of individual differences in moral judgement because such moral vignettes should be particularly sensitive to intuitive processing and resistant to reflective processing. In this hypothesis, there is no implied necessary association between rationality and rejection of the wrongness of vignettes. Rather, the hypothesis is that greater analytic ability and style is related to a greater tendency to reflect upon the details of the vignette and hence, given that the intuitive default is of considerable wrongness, leads to the possibility of reductions in the judgements of wrongness.

METHOD

Participants

Five hundred and seventy participants were recruited through *Mechanical Turk*TM. Twenty-one participants were excluded because they failed

an attention check question presented half way through the procedure.¹ Forty-four were dropped from the sample due to missing data leaving 505 participants (241 females; average age = 30.96, SD = 11.42). Participation was voluntary and participants received remuneration. Following the study, all participants gave permission for their data to be used. Only participants who indicated that they lived in the United States were permitted to do the study². Sessions lasted approximately 30 minutes.

Materials

Cognitive style and ability measures. Cognitive measures are summarised in [Table 1](#). Base-rate conflict problems, the CRT, and the Wordsum were taken from previous research that distinguished ACS and CA (Pennycook, Cheyne, et al., 2012). We added a numeracy test as an additional CA measure.

The key factor that distinguishes ACS and CA measures is the presence of a misleading intuitive response cue. Differences in ACS are more important for problems that cue intuitive responses because one must have the willingness to reflect on an answer that “feels” correct (Thompson et al., 2011; 2013; Toplak et al., 2011). Although ACS measures are not particularly difficult in terms of the mental operations required to correctly solve them, CA is still a prerequisite for optimal performance (Pennycook, Cheyne, et al., 2012). Thus, we included measures that were roughly equivalent in terms of difficulty, but that do not cue misleading intuitive responses. These measures are therefore referred to as CA measures.

Participants received three CRT items and three base-rate problems as “ACS” measures ([Table 1](#)). The CRT is perhaps the most widely used cognitive style measure (see Toplak et al., 2011). Base-rate problems are rooted in Kahneman and Tversky’s (e.g., 1973) heuristics and biases tradition, and have been used as cognitive style measures more recently (Pennycook, Cheyne, et al., 2012, 2013a). The specific base-rate problems that we used have extreme base-rate probabilities (see [Table 1](#)); a factor that increases the probability of conflict detection (Pennycook, Fugelsang, & Koehler, 2012), which is, in turn, related to cognitive style (Pennycook et al., 2013a; for further discussion, see Pennycook, Trippas, Handley, & Thompson, 2013). Indeed, recent evidence suggests that the CRT also elicits conflict detection (De Neys, Rossi, & Houdé, 2013).

¹ Participants were shown a list of activities and asked to write “I read the instructions” in the “other” box if they were, in fact, reading the instructions.

² Participation was restricted to Americans because a significant contingent of Mechanical Turk workers are residents of India (Paolacci, Chandler, & Ipeirotis, 2010) and our measures have not been validated with an Indian sample.

TABLE 1
Summary of analytic cognitive style (ACS) and cognitive ability (CA) measures

<i>Name</i>	<i>Category</i>	<i>Example item</i>	
Base-Rate Conflict (De Neys & Glumicic, 2008; Pennycook, Cheyne, et al., 2012)	ACS	In a study 1000 people were tested. Among the participants there were 5 engineers and 995 lawyers. Jack is a randomly chosen participant of this study. Jack is 36 years old. He is not married and is somewhat introverted. He likes to spend his free time reading science fiction and writing computer programs. What is most likely? (a) Jack is a lawyer (b) Jack is an engineer.	Correct answer ³ = Jack is a lawyer. Intuitive answer = Jack is an engineer.
Cognitive reflection test (Frederick, 2005; Toplak et al., 2011)	ACS	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?	Correct answer = 5 Intuitive answer = 10
Numeracy (Schwartz et al., 1997)	CA	In the BIG BUCKS LOTTERY, the chance of winning a \$10 prize is 1%. What is your best guess about how many people would win a \$10 prize if 1000 people each buy a single ticket to BIG BUCKS?	Correct answer = 10 No intuitive answer
Wordsum (Huang & Hauser, 1998; Pennycook, Cheyne, et al., 2012)	CA	Which word comes closest to the meaning of CAPRICE: (a) value, (b) a star, (c) grimace, (d) whim, (e) inducement, (f) don't know	Correct answer = whim No intuitive answer

Participants received 3 numeracy items and 10 Wordsum items as “CA” measures (Table 1). The Wordsum is a widely used verbal intelligence test that was originally developed using items taken from Thorndike’s lengthy vocabulary test (Thorndike, 1942). The Wordsum has been used in 16

³ We refer to the base-rate response as the “correct” answer here because of the extremity of the base-rate probabilities. However, normatively, it is impossible to calculate the correct answer via Bayes theorem for these problems because the individuating information does not contain a numerical value.

General Social Survey's (starting in 1974) and in numerous psychological, sociological, and political science studies as a measure of verbal intelligence (see Malhotra, Krosnick, & Haertel, 2007 for a review). Finally, the numeracy test (Schwartz, Woloshin, Black, & Welch, 1997) was validated by Lipkus, Samsa, and Rimer (2001), who demonstrated that the 3-item numeracy scale was strongly related to an expanded and more difficult 7-item numeracy scale. Indeed, the 3-item and 7-item scales emerged as a single factor, suggesting that both scales loaded on a single construct (labelled "global numeracy" by Lipkus et al., 2001).

It is important to keep in mind that our performance-based measures necessarily require some degree of ability *and* motivation. Our ACS measures have been used to assess reasoning performance in the past. Under Stanovich's individual differences framework (e.g., 2009a), reasoning involves both algorithmic and dispositional factors. Thus, theoretically, it is not possible for a performance based measure to *only* reflect either ability or style, and not, to some degree, both. Having the ability to compute the solution to a problem will not help if one does not have the willingness to think analytically about it. Likewise, having a willingness to think analytically will not be at all beneficial if one does not have the requisite level of CA. This is true of both ACS and CA measures. As a consequence, the measures should be viewed as more reflective of one over the other, but not as purely one or the other. Thus, the ACS and CA labels are used for convenience and are not intended to imply that either is a "pure" measure. As mentioned, the key factor that distinguishes an ACS from a CA measure under our framework is the presence of an incorrect intuitive lure that necessitates an additional level of analytic reasoning (Pennycook, Cheyne, et al., 2012).

We should note, in addition, that our ACS and CA measures are heterogeneous and, as such, should not be considered comprehensive batteries. In lieu of a long and taxing battery of tests, we have elected to take a "matched-task" approach. The CRT, for example, is a math task and therefore relies, to some degree, on numeracy (i.e., a CA). However, the presence of an intuitive lure means that participants must also engage in additional analytic processing to inhibit and override the incorrect response. Thus, the CRT is more strongly reflective of cognitive style than a basic numeracy test because the willingness to engage in this additional analytic processing is crucial to performance (see discussion in Toplak et al., 2011). Our numeracy test, on the other hand, is more reflective of CA because it does not cue an intuitive response and therefore does not require the additional analytic processing that is diagnostic of an ACS. Some degree of analytic disposition is naturally required (i.e., one who is absolutely unwilling to engage analytic thought to solve problems will not do well on the numeracy test), but the degree is theoretically much smaller than for the problems with intuitive lures.

Moral judgements. Participants were given two vignettes describing a disgusting act that is generally viewed as morally wrong (Haidt et al., 2000) and asked to rate how morally wrong each of the scenarios were on a 7-point scale from “1—Not morally wrong at all” to “7—Extremely morally wrong”. The first was the incest scenario shown above. The second was presented as follows:

A man goes to the supermarket once a week and buys a dead chicken. But before cooking the chicken, he has sexual intercourse with it. He then cooks it and eats it in the privacy of his own home.

These two vignettes were chosen because (a) they were designed to specifically exclude any care- or fairness-based violations of moral values, (b) they elicit particularly strong disgust-based intuitive responses, and (c) they elicit emotionally driven responses that are resistant to reasoned persuasion (Haidt, 2001). Thus, presumably, the incest and zoophilia vignettes cue responses that are particularly resistant to modification via analytic reasoning and therefore provide a strong test of our hypothesis.

Moral values/foundations. Although our primary object of inquiry in the current manuscript is moral judgements, previous work has established the importance of moral values/foundations in morality (e.g., Graham et al., 2011; Haidt & Graham, 2007). As such, as an additional control, we opted to include a questionnaire aimed at ascertaining participants' explicit endorsement of various moral principles. Specifically, participants were asked to rate how important 6 *individualising* and 4 *binding* principles were to their moral thinking on a 7-point scale from “1—Irrelevant” to “7—Extremely Important” (Graham et al., 2011; Haidt & Graham, 2007; Haidt & Joseph, 2004). Individualising values included being kind, supporting the autonomy of others, being helpful, being fair, avoiding harm, and supporting the rights of others. Binding values included showing respect for traditions, being patriotic and loyal, showing respect for legitimate authority, and being pure by avoiding carnal pleasures and disgusting things. Items were summed for the binding and individualising subscales for analysis.

Religiosity. The religious belief (R_b ; Pennycook, Cheyne, et al., 2012) scale assessed nine conventional religious beliefs widely held by religious people (ISSP, 1991, 1993): afterlife, heaven, hell, miracles, angels, demons, the soul, Satan, and the effectiveness of prayer. Participants responded on a 6-point scale from “1—Strongly Disagree” to “6—Strongly Agree”. The religious participation (R_p) scale assessed the frequency of participation in religious activities (including religious service attendance, religious study groups,

scripture reading, and proselytisation). Participants responded on the following scale: “1—More than once a week; 2—Once a week; 3—Once or twice a month; 4—A few times a year; 5—Seldom; 6—Never”. Items were summed for analysis.

Political ideology. Given the differences between conservatives and liberals in terms of both religiosity (e.g., Pennycook, Cheyne, et al., 2012) and moral views (e.g., Graham, Haidt, & Nosek, 2009), we asked participants to indicate their political ideology on both social and fiscal issues. For this, participants were asked two questions: (1) “On social issues I am” and (2) “On fiscal (economic) issues I am”. A 5-point scale from “1—strongly liberal” to “5—strongly conservative” was used for both questions.

Demographic variables. Participants indicated their sex (Males = 1, Females = 2), age in years (range: 18–69), highest level of education [1 = some high school or less (1%), 2 = high school (10.3%), 3 = technical trade or vocational training (4.6%), 4 = some college, no degree (40.4%), 5 = Bachelor’s degree (31.7%), 6 = Master’s degree (8.3%), 7 = Professional degree (1%), 8 = Doctoral degree (0.8%)], and total family income level from all sources before taxes [1 = less than \$10,000 (8.3%), 2 = \$10,000 to under \$20,000 (10.7%), 3 = \$20,000 to under \$30,000 (13.3%), 4 = \$30,000 to under \$40,000 (10.1%), 5 = \$40,000 to under \$50,000 (12.9%), 6 = \$50,000 to under \$75,000 (18%), 7 = \$75,000 to under \$100,000 (12.7%), 8 = \$100,000 to under \$150,000 (7.5%), 9 = \$150,000 or more (4.2%), 10 = Don’t know (2.4%; excluded from analysis)].

Procedure

The order and placement of the two moral vignettes was counterbalanced. Participants were either presented with the vignettes at the very end of the study ($N = 306$) or immediately following the demographic section at the beginning of the study ($N = 199$). This was done to assess potential effects of the reasoning measures on the moral vignettes (Paxton et al., 2012). Data for the two conditions was combined as the moral judgement analysis reported below was replicated for both orders (see Table 6S in supplementary materials).

Apart from the moral vignettes, the order of presentation was the same for both conditions. Participants filled out demographic information, followed by the ACS and CA measures (given at the beginning to avoid potential fatigue effects), the moral values questionnaire, the religiosity questionnaire, and the political ideology questionnaire. Additional questionnaires that are outside the scope of this study were intermixed in the procedure, including questions on scientific and political issues, religious

knowledge, and paranormal belief. The additional questionnaires followed the religiosity and political ideology questionnaires and are available upon request.

RESULTS

Descriptive statistics for questionnaire and cognitive variables can be found in Table 2S of the supplementary materials. The correlations among the questionnaire and cognitive variables are presented in Table 2. Analytic thinking measures were significantly correlated with all questionnaire variables except individualising morality (including individual rights, fairness, kindness, harm, helpfulness, and autonomy) and fiscal conservatism. Next, we report a number of regression analyses intended to assess the independent relations between analytic thinking and religious belief, moral values, and moral judgements. Collinearity diagnostics were well within acceptable ranges for each of the regressions reported below.

Moral judgement. As predicted by the Reflectionist account, the degree of moral wrongness attributed to both the zoophilia and the incest vignettes were highly negatively correlated with both ACS and CA, and highly positively correlated with both religious belief and moral values that were based on binding principles (Table 2). To test for an independent relation between

TABLE 2
Pearson product-moment correlations among questionnaire and cognitive variables

	1	2	3	4	5	6	7	8	9	10
<i>Analytic thinking</i>										
(1) ACS	–									
(2) CA	.45	–								
<i>Religiosity</i>										
(3) Belief	–.25	–.27	–							
(4) Participation	–.07	–.19	.68	–						
<i>Conservatism</i>										
(5) Social	–.14	–.19	.48	.47	–					
(6) Fiscal	–.03	–.05	.25	.24	.57	–				
<i>Moral values</i>										
(7) Binding	–.26	–.30	.56	.48	.43	.19	–			
(8) Individualising	–.01	–.08	.07	.07	–.17	–.12	.21	–		
<i>Moral judgements</i>										
(9) Zoophilia	–.32	–.29	.45	.34	.33	.17	.48	.07	–	
(10) Incest	–.27	–.28	.49	.33	.31	.17	.46	.01	.66	–

ACS = analytic cognitive style; CA = cognitive ability. Coefficients in bold are significant. $p < .05$. $N = 505$.

TABLE 3
Final step of hierarchical multiple regression analysis predicting moral wrongness of vignettes

	<i>B</i>	<i>SE</i>	β	<i>T</i>	<i>p</i>	<i>r</i>	<i>r_p</i>
Intercept	6.33	1.48		4.28	< .001		
Age	< 0.01	0.01	.01	0.19	.853	.12	.01
Sex	0.96	0.31	.12	3.07	.002	.24	.14
Education	-0.17	0.14	-.05	-1.27	.203	-.10	-.06
Income	0.23	0.07	.13	3.38	.001	.10	.16
Conservation-social	0.22	0.19	.06	1.17	.242	.34	.06
Conservation-fiscal	0.04	0.16	.01	0.27	.789	.18	.01
MV-binding	0.24	0.05	.25	5.25	< .001	.49	.24
MV-individualising	-0.03	0.04	-.04	-0.92	.356	.02	-.04
Religious participation	0.01	0.01	.04	0.72	.473	.35	.03
Religious belief	0.03	0.01	.21	3.62	< .001	.50	.17
CA	-1.81	0.97	-.08	-1.87	.062	-.32	-.09
ACS	-1.98	0.58	-.15	-3.39	.001	-.33	-.16

ACS = analytic cognitive style; CA = cognitive ability. Significant predictors are in bold. *N* = 470.

analytic thinking and the degree to which one views the moral vignettes as morally wrong, we combined the two wrongness ratings and entered the resulting composite as a dependent variable in a multiple regression analysis with demographic variables (age, sex, education, income), political ideology (social and fiscal), individualising and binding moral values, religiosity (beliefs and participation), CA, and ACS as predictors. As is evident from Table 3, the relation between ACS and moral wrongness ratings remains significantly negative such that the degree to which our participants viewed the disgusting vignettes as morally wrong was predicted by ACS independent of all other factors considered. Interestingly, CA, a strong predictor in the bivariate analysis and when entered in the second last step of the regression prior to ACS (CA: $r_p = -0.16$, $p = .001$), became marginal once ACS was entered into the regression ($p = .062$; see Table 3S in supplementary materials for full regression).

Moral values. One of the more striking findings presented in Table 2 is the strongly negative correlation between our analytic thinking measures and binding moral values. There was no such correlation between individualising moral values and ACS or CA. This pattern of results is potentially strong support for the claim that individual differences in analytic thinking have relevance for morality. A similar multiple regression analysis was carried out as above, but with binding morality as the dependent variable and demographic variables, religiosity (including beliefs and participation),

TABLE 4
Final step of hierarchical multiple regression analysis predicting binding moral values

	<i>B</i>	<i>SE</i>	β	<i>T</i>	<i>p</i>	<i>r</i>	<i>r_p</i>
Intercept	7.47	1.45		5.17	< .001		
Age	−0.02	0.01	−.05	−1.28	.202	.10	−.06
Sex	−0.44	0.32	−.05	−1.40	.165	.09	−.06
Education	−0.13	0.14	−.04	−0.94	.348	−.10	−.04
Income	0.13	0.07	.07	1.88	.061	.01	.09
Conservation–social	0.92	0.18	.25	5.00	< .001	.43	.23
Conservation–fiscal	−0.16	0.15	−.05	−1.06	.291	.20	−.05
MV–individualising	0.21	0.03	.23	6.24	< .001	.20	.28
Religious participation	0.02	0.01	.14	2.71	.007	.47	.13
Religious belief	0.04	0.01	.31	5.56	< .001	.55	.25
CA	−3.07	0.95	−.14	−3.23	.001	−.29	−.15
ACS	−1.05	0.58	−.07	−1.82	.069	−.25	−.08

ACS = analytic cognitive style; CA = cognitive ability. Significant predictors are in bold. *N* = 475.

social and fiscal conservatism, views on individualising morality, CA, and ACS as predictors. As above, the predictors were put in groups and entered in steps. The final step of the regression is presented in Table 4 (for the full regression see Table 4S in supplementary materials).

As is evident from Table 4, lower levels of CA predicted the strength of binding moral intuitions independent of demographic variables, religiosity, political ideology, and individualising moral values. ACS was a marginally significant predictor in the final step of the regression (*p* = .069), although it was a significant predictor when entered independently of CA (ACS: *r_p* = −0.14, *p* = .003). Thus, in contrast to (specific) moral judgements, CA emerges as the stronger predictor of binding moral values.

Religiosity. As a replication and extension of previous research (e.g., Gervais & Norenzayan, 2012; Pennycook, Cheyne, et al., 2012; Shenhav et al., 2012), we also tested whether religious belief was independently predicted by ACS while controlling for moral factors. Hierarchical multiple regression analyses were carried out with religious belief as the dependent variable and demographic variables, religious participation, individualising and binding moral values, social and fiscal conservatism, CA, and ACS as predictors. The predictors were put in groups and entered in steps. The final step of the regression is presented in Table 5 (for the full regression see Table 5S in supplementary materials).

Higher levels of ACS predicted religious belief independent of all demographic, political, and moral variables (Table 5). CA did not remain a significant predictor in the final step of the regression. Indeed, CA was not a

TABLE 5
Final step of hierarchical multiple regression analysis predicting religious belief

	<i>B</i>	<i>SE</i>	β	<i>T</i>	<i>p</i>	<i>r</i>	<i>r_p</i>
Intercept	-19.96	9.92		-2.01	.045		
Age	0.55	0.09	.19	6.15	< .001	.33	.28
Sex	10.47	2.06	.15	5.09	< .001	.24	.23
Education	-1.43	0.91	-.05	-1.57	.118	-.04	-.07
Income	0.47	0.46	.03	1.03	.303	-.01	.05
Re	0.66	0.05	.47	13.07	< .001	.67	.52
Conservation-social	3.43	1.25	.11	2.74	.006	.49	.13
Conservation-fiscal	0.82	1.03	.03	0.79	.428	.26	.04
MV-binding	-0.07	0.23	-.01	-0.31	.758	.05	-.01
MV-individualising	1.68	0.30	.20	5.56	< .001	.55	.25
CA	-3.72	6.44	-.02	-0.58	.563	-.26	-.03
ACS	-12.24	3.84	-.11	-3.19	.002	-.24	-.15

ACS = analytic cognitive style; CA = cognitive ability. Significant predictors are in bold. *N* = 475.

significant predictor even when it was introduced as a separate level prior to ACS (CA: $r_p = -0.09$, $p = .062$; see Table 5S in supplementary materials), indicating that the correlation between CA and religious belief was mediated by more than just ACS. To determine which group of variables mediated the relation between CA and religious belief, CA was entered as the first variable in the same regression. CA becomes non-significant when ACS (CA: $r_p = -0.06$, $p = .196$) or moral intuitions (CA: $r_p = -0.09$, $p = .062$) are taken into account, but not demographic variables, religious participation, and political ideology (CA: $r_p = -0.14$, $p = .003$).

DISCUSSION

Given the overall failure of participants to sufficiently question their intuitions when given reasoning problems to solve over the past four decades of research in reasoning and decision making (Baron, 1994, 1998; Evans, 1989; Evans & Over, 1996; Kahneman et al., 1982; Shafir & Tversky, 1995; Stanovich & West, 2000), one might be forgiven for being surprised if people *ever* question their intuitions via analytic processing in cases where analytic thinking is not clearly prompted. Our results, however, reveal that individual differences in the willingness and/or ability to engage analytic reasoning processes predicts individual differences in moral judgements, moral values, and religious belief. ACS emerged as a significant predictor of religious belief and moral judgements involving the strong affective component of disgust, and CA emerged as a significant predictor of binding moral values. Moreover, each of these relations is independent of demographic variables and

political ideology. These results provide compelling evidence that the individual differences that have informed research in reasoning and decision making are important factors in other psychological domains traditionally considered central to the human condition: morality and religion. Further, our findings are consistent with a Reflectionist account of judgement wherein analytic reasoning processes play an active role in decision making in general, albeit differentially between individuals and, likely, situations. Finally, it is important to keep in mind that these results are correlational and, as a consequence, the causal direction is unspecified. Nonetheless, our interpretation corresponds with experimental work demonstrating that moral judgement is effected by time pressure (Suter & Hertwig, 2011) and cognitive load (Greene et al., 2008; Trémolière, De Neys, & Bonnefon, 2012), two factors thought to minimise the ability to engage analytic reasoning processes (e.g., De Neys, 2006; Evans & Curtis-Holmes, 2005). Whereas our individual differences approach suggests that analytic thinking *spontaneously* effects moral judgements and values, these experimental studies demonstrate a reduction in analytic thinking *can* effect moral judgement and thus speak to causal directionality.

Why does analyticity yield lower judgements of wrongness?

Participants who were better able to override intuitive responses cued by reasoning problems rated disgust-based moral vignettes as less morally wrong relative to their less analytical counterparts. The magnitude of the zero-order correlations between our ACS measures and the moral judgements are similar to the magnitude of the correlations typically found *among* cognitive style measures (e.g., Pennycook, Cheyne, et al., 2012; Toplak et al., 2011). This is a rather striking finding given that we deliberately selected vignettes that cue particularly visceral emotional responses that have been shown to be resistant to change via reasoned persuasion (Haidt, 2001; Haidt et al., 2000). Given that intuitive responses elicit strong feelings of rightness which typically pre-empt analytic reasoning (Thompson et al., 2011), one might expect the influence of deliberative processing to be low even for the most analytic individuals. How can this pattern of results be explained?

Recent research in reasoning has suggested that, apart from fluency and feelings of rightness, one of the strongest cues for analytic processing is response conflict (e.g., De Neys, 2012; De Neys & Franssens, 2009; De Neys & Glumicic, 2008; De Neys, Vartanian, & Goel, 2008; Pennycook et al., 2013a; Pennycook, Fugelsang, et al., 2012, Pennycook et al., 2013). Further, Thompson et al. (2013) demonstrated that the presence of response conflict for base-rate problems selectively decreased feelings of rightness and increased the probability of analytic engagement. Is there a response conflict implicit in disgust-based moral vignettes? Haidt's (2001) explanation of the

judgement process under the Social Intuitionist model assumes that these vignettes cue an intuition (disgust) which typically leads directly to a judgement. Haidt does suggest, however, that conflicting intuitions may cause reasoning processes to be called upon, albeit in other types of situations, such as role-playing. However, since the vignettes make it very clear that no one or thing is harmed or manipulated against their will, it may be possible that the lack of individualising-based moral value violation cues a competing consequentialist intuition (or set of intuitions) that conflict with the disgust-based intuition, leading to analytic processing. In other words, some participants might employ analytic processing to resolve the conflicting intuitions that the scenario is disgusting but that no harm has occurred. We expect that the extent of this analytic processing would, in turn, be partially determined by individual differences, as is the case for typical reasoning problems.

A closely related, but distinct, possibility is that the vignettes cue a conflict between a disgust-based intuitive response and an alternative consequentialist response from an early or shallow form of analytic processing, which then leads to deeper analytic processing (which is, in turn, modulated by cognitive style). This framework is more consistent with Greene et al.'s (2001, 2004, 2008; Paxton et al., 2012) dual-process model of moral judgement. Indeed, unlike the Social Intuitionist model, Greene's model includes a conflict monitor module for this expressed purpose. However, further research is necessary to explore these issues more directly as the present data does not discriminate between these two intriguing possibilities.

Regardless, our findings have implications for an ongoing debate concerning the domain specificity of morality. Hauser (2006), for example, contends that humans have a "moral organ" that is analogous to our faculty for language (see also, Huebner, Dwyer, & Hauser, 2009; Mikhail, 2007). In contrast to this "universal moral grammar" approach, Greene and Haidt (2002) reference neuroimaging studies to show that activation patterns during moral judgment are similar to, and reflective of, other non-moral cognitive processes. Others have questioned whether the human moral faculty is properly modular (Dupoux & Jacob, 2007). Our data, along with prior individual differences work (e.g., Bartels, 2008; Moore et al., 2008), suggest that higher order, domain general cognitive processes spontaneously influence moral judgement. While this clearly does not rule out the possibility that initial intuitive responses are engendered by low-level modular sources that are specifically moral, it indicates that the ultimate outcome of the moral judgement process is influenced by domain general cognitive functions.

Analytic thinking and moral values

Moral values or "foundations" are considered the roots of various types of "moralities" found throughout the world (Haidt & Graham, 2007).

According to Moral Foundations Theory, there are at least five distinct intuitive systems that are linked to reported moral values: Harm/Care, Fairness/Reciprocity, Ingroup/Loyalty, Authority/Respect, and Purity/Sancity (Graham et al., 2011; Haidt & Graham, 2007; Haidt & Joseph, 2004). Although the degree of acceptance differs, the first two, Harm/Care and Fairness/Reciprocity, are generally accepted as important to one's moral thinking in Western society (Graham et al., 2011). In contrast, there is a great deal of variance in the acceptance of Ingroup/Loyalty, Authority/Respect, and Purity/Sancity values, both between cultures and within Western society (Graham et al., 2011). Specifically, liberals tend to reject the latter moral foundations whereas conservatives accept them, sometimes to a greater degree than Harm and Fairness values (Graham et al., 2009).

Moral Foundations Theory explains these differences primarily by appealing to cultural differences rather than cognitive factors. For example, liberals are thought to subscribe primarily to Harm and Fairness because they live in a "moral world" where the individual is the locus of moral value, whereas conservatives do not prioritise individualising foundations because their moral world involves binding people together via Ingroup, Authority, and Purity values (Graham et al., 2011). While it should be noted that Graham et al. suggest that their Moral Foundations Theory "allows for intuitive or emotional bases of moral judgements as well as more deliberate reasoning processes", they have not incorporated these processes in their model to date (p. 368). Rather, the authors focus on culture and environment to explain individual differences. In contrast to this approach, our data show that differences in acceptance of "binding" moral principles are independently predicted by differences in CA; those who have more reflective ability were less likely to view binding values as important to their moral thinking. While this is clear support for our Reflectionist account of judgement, it is unclear precisely *why* increased CA is associated with a rejection of binding moral values. It might make sense for the more intelligent among us to focus on the individual and forego values that bind them with others (who are presumably less intelligent). However, there was no difference in individualising moral values as a function of CA or style, which makes this explanation appear less likely (although it certainly does not rule it out).

In a recent study, Napier and Luguri (2013) demonstrated that putting people in an abstract (as opposed to concrete) mind-set increased valuations of individualising principles and decreased valuations of binding principles. Following research indicating that people typically focus on core features that are consistent across situations when in an abstract mind-set (Trope & Liberman, 2010), the authors suggested that individualising moral values are differentially affected by abstract mind-sets because they are more "core" than the potentially "second-order" binding values. Presumably, it is obvious to everyone that being kind, for example, is important morally because such

core values are intuitively plausible. To evaluate whether non-core values such as purity or respect for tradition are specifically *moral* values, on the other hand, presumably requires one to represent and understand morality as an abstract concept. This process may also cause participants to weight second-order binding values against core individualising values, not unlike for a moral dilemma. It is possible, then, that participants who are less able to represent abstract concepts mentally (i.e., those with lower CA) are more likely to confuse the feelings that arise from being prompted about binding values to indicate a degree of moral importance. This hypothesis is consistent with research indicating that cognitive load decreases valuations of binding values among conservatives, but has no effect on individualising values (Wright & Baril, 2011). However, further research is required to further test and elucidate these possibilities. It is also important for these results to be replicated in other sub-cultures and, indeed, in other cultures; the current sample was limited to American participants and, given the strong influence that culture has on moral values (see Haidt, 2012), our results should not be generalised beyond the United States in the absence of evidence for such generalisation.

Religious belief and morality

Distrust of atheists and the non-religious is widespread (Edgell, Gerteis, & Hartmann, 2006; Gervais & Norenzayan, 2013; Gervais, Shariff, & Norenzayan, 2011). Further, nearly half of those surveyed in a 2002 Pew poll indicated that belief in God is a necessary prerequisite for moral behaviour (cited in Gervais & Norenzayan, 2013). In contrast, research on the intersection between morality and religion shows a complex relation that differs from the basic presumption that religiosity unilaterally promotes morality (for a recent review, see Bloom, 2012). Specifically, while religious people typically give more money to both religious and secular charities relative to the non-religious (e.g., Brooks, 2006; Putnam & Campbell, 2010, but see Galen, 2012), societies that are less religious, such as Sweden and Denmark, are typically better off with respect to several objective criterion linked to morality, such as murder and suicide rates, teen pregnancy, the extent of sexually transmitted diseases, and so on (Paul, 2005; Zuckerman, 2008). To accommodate these seemingly disparate findings, Bloom (2012) has suggested that religious beliefs actually play very little role in moral behaviour; rather, religious affiliation and participation are the key to explaining the positive relation between religiosity and charitableness. Indeed, as Bloom points out, Sweden and Denmark may score low in terms of religious belief, but religious participation and community involvement are relatively high (Zuckerman, 2008). Under this explanation, it is the binding role of the community that explains the association between religiosity and moral behaviour (see also Graham & Haidt, 2010).

Consistent with the idea that religiosity is related to morality because it binds people together, there was a strong positive correlation between binding moral principles and religiosity in the current study. There was no such correlation between individualising moral principles and religiosity (Table 2). However, religious belief *and* participation independently correlated with binding moral values (Table 4), suggesting that moral principles like purity and having respect for tradition do not arise solely out of religious participation. If anything, the relation was stronger for religious belief than it was for religious participation. Thus, it would appear that religious belief does, in fact, promote binding moral *principles* (or vice versa) independent of religious involvement. Religious involvement, in contrast, is the component of religiosity that likely leads to increased moral *behaviour* (Bloom, 2012; Galen, 2012).

CONCLUSION

Our data indicates that differences in analytic style and ability are significant predictors of both religiosity and morality, at least as measured here. This finding is not only important for the study of morality but also has broader implications for psychological inquiry in general. Although dual-process models appear to have application in a number of psychological domains, such as reasoning (e.g., Evans, 2008; Kahneman, 2003; Sloman, 1996; Stanovich, 2009a) and social cognition (e.g., Chaiken & Trope, 1999), insights on individual differences in cognitive style and ability that have emerged from the reasoning and decision making literature have not been systematically applied elsewhere. Given the research on cognitive motivation and preference for deliberative thinking, as measured by self-report scales such as the Need for Cognition scale (Cacioppo, Petty, Feinstein, & Jarvis, 1996) and the Rational-Experiential Inventory (Pacini & Epstein, 1999), it is clear that the willingness and ability to engage analytic reasoning processes to override a salient intuitive response converges with existing hypotheses and research in social cognition. Our data show the value of both measuring cognitive style directly via performance (as opposed to self-report) and simultaneously taking differences in CA or intelligence into account. We have discussed several novel insights that have arose from this approach and have suggested exciting new possibilities for future research.

Haidt has argued that moral disputes between liberals and conservatives are sometimes intrinsically irresolvable because the respective sides of the debate are operating with overlapping but different moral precepts (Graham et al., 2009). The present research is consistent with this view and provides evidence of cognitive individual differences among individuals accepting, rejecting, and applying specific moral values. The present findings indicate that individuals with a more analytic style of cognitive processing hold weaker religious beliefs, are less religiously engaged, less socially (but not

fiscally) conservative, and less likely to judge disgust-based vignettes as morally wrong. These results obviously lead to further interesting conceptual and empirical questions concerning why and how higher CA individuals are more likely to reject principles of binding morality. This present model is also generally consistent with the dual-process approach of Greene and colleagues in postulating that differences in the balance between analytic and intuitionist thinking is associated with different moral decisions, and the individual difference component of our dual process model offers a fundamental cognitive basis for the intractable nature of moral disagreements among different social groups.

More generally, these data speak to debates about the pervasiveness of analytic thought in normal cognitive processing (i.e., between Intuitionists and Reflectionists, using our labels). Specifically, while researchers in the field of reasoning and decision making tend to emphasise how reflectively questioning intuitions via analytic processing is important in determining behaviour (e.g., Evans, 2009; Kahneman, 2003, 2011; Stanovich, 2004), others have downplayed analytic reasoning, choosing instead to focus on the simple heuristics that are used when making judgements (Dijksterhuis, 2004; Gigerenzer, 2007; Gigerenzer & Kruglanski, 2011). Our data suggest that a tendency to think analytically does make a difference in moral values and religious belief. We presume that individuals who spend valuable cognitive resources to engage deliberative thought in these domains likely do so in other life domains as well. We hope that our work here will inspire others to continue the effort to systematically explore the purview of influence exerted by analyticity in our beliefs and behaviours.

Supplementary material

Supplementary content is available via the ‘Supplementary’ tab on the article’s online page (<http://dx.doi.org/10.1080/13506285.YEAR.865000>).

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