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*Journal of Empirical Theology* 22 (2009) 70-87Journal of  
Empirical Theology

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## How Morality and Religiosity Relate to Intelligence: A Case Study of Mathematically Gifted Adolescents

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Received 2 February 2009; accepted 5 March 2009

### Summary

In this article we explore the moral and religious reasoning of mathematically gifted adolescents ( $N = 20$ ) who attend a special boarding school for gifted students in Finland. The sample consists of 11 female and 9 male first-year upper secondary school students ( $M_{age} = 16.25$ ,  $SD_{age} = 0.444$ ). The participants' intelligence and their moral and religious reasoning were measured by means of the following instruments: Wechsler Adult Intelligence Scale III (WAIS-III); Defining Issues Test (DIT); and Religious Judgment Test (RJT) respectively. The research design was correlational and included the following three research questions: (1) How is intelligence related to moral thinking? (2) How is intelligence related to religious thinking? (3) How are moral and religious thinking related to each other? Results regarding the first research question showed that moral reasoning was related to intelligence. However, WAIS-III scores were not positively linked to the DIT scores within this highly gifted sample. Results regarding the second research question showed that the most intelligent young adults were more opposed to the lowest and highest forms of religious reasoning than their less intelligent peers. Results regarding the last research question showed that the level of moral thinking was negatively related to both the lowest and the highest stages of religious judgement, but positively related to the third religious orientation stage (ego autonomy and one-sided self-responsibility).

### Keywords

morality, religiosity, intelligence, mathematically gifted students

### 1 Introduction

We know from earlier empirical research that intelligence tends to correlate with high levels of moral and religious reasoning (Narvaez, 1993; Räsänen, Tirri & Nokelainen, 2006; 2007). However, the relationship between intelligence and morality is a very complex one and needs more detailed study (Tirri & Nokelainen, 2007). Not much research has been done on the relationship between moral judgement and religious judgement (Räsänen et al., 2006).

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DOI: 10.1163/157092509X437224

The existing body of research indicates that religiously conservative subjects tend to score lower on moral reasoning tests (e.g. Defining Issues Test, DIT) than their more liberal peers. According to Rest (1986, p. 131), 'the most striking finding from the literature relating religious measures to moral judgement development is the consistent relationship between DIT *P* index and religious beliefs'.

According to Duriez and Soenens (2006), research has shown that religiously affiliated persons exhibit increased performance for moral reasoning in terms of Lawrence Kohlberg's conventional level (stages 3 and 4) and decreased performance for the post-conventional level (stages 5 and 6). They further argue (2006, p. 76), in their recent empirical study with 1010 participants representing Belgian Dutch-speaking adolescents and adults, that 'although there is no intrinsic relationship between religiosity and morality, the way people process religious contents is predictive of the way they deal with moral issues'. In practice this means that the moral stage of religious community (e.g. whether principled moral reasoning is used or not) affects the level of moral reasoning.

In this article we explore the moral and religious reasoning of mathematically gifted adolescents ( $N = 20$ ) who attend a special school for gifted students. The private and independent boarding school is located in the countryside of Southern Finland. The object of the current study, a mathematics program, is supported by Nokia, the largest IT company in Finland. External financial support ensures that studying and living in this boarding school is almost free for the students.

The mathematics program began in 1994. The school annually selects 20 students according to the 'excursion weekends' entrance examination tests. Students are mathematically gifted 15- to 18-year-olds and they graduate from the senior secondary school in two years instead of the average three years. All the students have taken three well-known tests to measure their general intellectual ability — Wechsler Adult Intelligence Scale (WAIS-III), moral reasoning (DIT) and religious thinking (RJT).

In this study we have formulated the following three research questions: (1) How is intelligence related to moral thinking? (2) How is intelligence related to religious thinking? (3) How are moral and religious thinking related to each other?

The article is organised as follows: First we give an overview of the existing research on the measurement of moral and religious thinking. Second, we describe the sample and our research instruments. Finally we present and discuss the results.

## 2 Theoretical Background

### 2.1 *Research on Moral Thinking*

Most of the studies in the area of moral development are based on the cognitive-developmental theory of Lawrence Kohlberg (e.g. 1969). The Defining Issues Test (DIT) is a well-documented measure of moral judgement that has been used all over the world (Rest, 1986). The index most frequently used is the “*P* index,” which reflects a person’s principled reasoning (stages 5 and 6 in Kohlberg’s theory). Kohlberg’s procedures have been criticised for lack of diversity in the moral dilemmas that have been used in the interviews (Yussen, 1977). The hypothetical dilemmas can also be seen as too abstract and removed from the daily experiences of most people (Straughan, 1975). Recognition of these aspects of hypothetical dilemmas has led educational researchers to study real-life moral problems identified by people (Walker, de Vries & Trevethan, 1987). The research conducted in this area shows that adolescents formulate dilemmas very different from the hypothetical dilemmas used by Kohlberg and his colleagues to assess moral reasoning (Yussen, 1977; Binfet, 1995). Most of the dilemmas formulated by Kohlberg focus on issues of ownership, public welfare, and life and death. In Yussen’s study (1977), the moral dilemma themes formulated by adolescents focused most frequently on interpersonal relations. Colangelo (1982) and Tirri (1996) found the same tendency among gifted adolescents.

Andreani and Pagnin provided a comprehensive review of the literature in their article (1993). According to these authors, gifted students are presumed to have a privileged position in the maturation of moral thinking because of their precocious intellectual growth. Terman’s (1925) sample of gifted children showed superior maturity in moral development in terms of choosing socially constructive activities and in rating misbehaviour.

In the 1980s Karnes and Brown (1981) made an initial investigation of moral development and the gifted, using Rest’s DIT. Their sample included 233 gifted students (9-15 years of age) who were selected for a gifted program. The results of the DIT were compared to the students’ results in a test that measured their intellectual ability (WISC-R). The empirical results of the study showed a positive correlation between the two tests. According to researchers, intellectually gifted children appear to reach a relatively high stage of moral reasoning earlier than their chronological peers (Karnes & Brown, 1981).

Other studies of moral judgement using DIT *P* indexes have shown that gifted adolescents scored higher than their peers as a group (Tan-Willman &

Gutteridge, 1981; Janos & Robinson, 1985; Narvaez, 1993). However, the data for high-achieving adolescents have indicated that the relationship between apparent academic talent and moral judgement indexes is more complex. According to Narvaez's study, high academic competence is necessary for an unusually high *P* index but does not necessarily predict it. The high achievers can have an average to high moral judgement index, whereas low achievers cannot be high scorers in moral judgement (Narvaez, 1993).

Ikonen-Varila (2000) reported DIT *P* indexes of Finnish 9th graders ( $N = 1631$ ). According to her, the proportion of post-conventional moral reasoning was 22.6 per cent. Ikonen-Varila found a positive connection between academic competence and moral reasoning. Success at school, classified into three groups (satisfactory, moderate, excellent), produced the average DIT *P* indexes of 15.4, 24.2 and 29.7 respectively. She concluded that because cognitive factors regulate moral reasoning in childhood and adolescence, it is natural that school success should be one of the main background factors explaining moral reasoning abilities. Her results support the connection between giftedness and moral reasoning: the more gifted, the more capable of principled moral reasoning.

Tirri and Pehkonen (2002) explored the moral reasoning and scientific argumentation of Finnish adolescents who are gifted in science. These 16 girls and 15 boys (14-15 years of age) participated in a gifted program at the University of Helsinki. The design contained the following research instruments and procedures: (1) Raven's Standard Progressive Matrix (SPM) was used to provide a test comparing students' capacities for observation and clear thinking; (2) moral reasoning was measured by means of DIT; (3) students were asked to write essays on scientific moral dilemmas; (4) researchers interviewed the students. The results show that the average DIT *P* index was 41, representing the average score for a heterogeneous group of 18-year-olds. Scores ranged from 7 to 78, indicating quite high variance ( $SD = 15.8$ ); some students really represented post-conventional moral reasoning, some not at all. An interesting finding was that the correlation between DIT and SPM was close to zero (Tirri & Pehkonen, 2002).

In a recent Finnish study, DIT *P* indexes of 51 academically gifted 9th grade students and their average-ability peers ( $N = 77$ ) were compared (Räsänen et al., 2006). Räsänen and his colleagues investigated the DIT *P* index distribution separately for the male ( $n = 21$ ) and female ( $n = 25$ ) sub-samples. The score average for the gifted males was 35.0 with a standard deviation of 15.5. The lower boundary of 95 per cent confidence interval was 26.7 and the upper boundary 43.3. The DIT *P* indexes ranged from 16 to 79 in the male sub-sample. The score average for the gifted females was 35.9 with

a standard deviation of 15.4. The lower boundary of 95 per cent confidence interval was 29.5 and the upper boundary 42.3. DIT score values range from 15 to 75 in the female sub-sample. These results run parallel with those of an earlier Narváez study (1993). She found that standard deviation increased according to the level of giftedness, concluding that academic competence is a necessary but not sufficient condition for principled thinking.

Räsänen and his colleagues (2006) further classified the DIT scores into four classes on the basis of the quartiles: 1st quartile (25%, DIT score values below 25.0), 2nd quartile (50%, DIT score values from 25.0 to 33.9), 3rd quartile (75%, DIT score values from 34.0 to 44.4) and 4th quartile (100%, DIT score values above 44.4). However, no statistically significant difference between the DIT scores of male and female respondents was found,  $\chi^2(3, n = 41) = 4.733, p = .192$ . The existing body of research shows that the absence of gender differences in the case of gifted students is not unusual. Narváez (1993) did not find significant differences between gifted female and male students: girls had an average *P* index of 28.2 while the boys had an average *P* index of 25.6. Rest (1986) too concludes, on the basis of a meta-analysis of 56 DIT studies, that although females usually gain higher *P* index than males, gender accounts for only 0.9 per cent of the variance. According to him, age and education are 250 times more powerful than gender in explaining the *P* index variance.

## 2.2 *Research on Religious Thinking*

Studies concerning the relationship between intelligence and religious thinking are far more rare. Religious reasoning can be investigated by means of a new test called the religious judgement test (RJT) that adapts the ideas in DIT. The test, developed by Antti Räsänen and his colleagues (Räsänen et al., 2006; 2007), is based on Oser's theory of religious development (Oser & Gmünder, 1991). Oser's theory is about the way one copes with contingency situations. The concepts of religious judgement and developmental stage are two key constructs in Oser's theory. Religious judgement is some kind of cognitive pattern of religious knowing of reality (Oser, 1980). As individuals interpret their experiences, pray, study religious texts or take part in religious life, they actualise their personal religious consciousness, the system of rules that concern their relationship to the Ultimate. The relationship appears in verbal form in religious judgement. According to the developmental theory of religious judgement (Oser & Gmünder, 1991), individuals produce religious judgements especially when faced with the border or contingency situations of life.

According to Räsänen (2003), the stage concept signifies that developmental stages are qualitatively different and they follow an unchanging sequence in the course of development across the life span. The five developmental stages focus on various forms of relationship between the human and the Ultimate being, to whom Christianity refers as God. Each stage must be seen as a unique depth structure which may have various contents. Oser claims that the stages have universal cross-cultural validity, although the content may vary at specific stages. Usually transition from one stage to the next involves a period of uncertainty. The individuals' relation to God is qualitatively different, depending on their developmental stage.

Oser has differentiated five developmental stages forming a hierarchal sequence (Oser, 1980; Oser & Gmünder, 1991), but he has not presented well-defined age limits for his stages (Räsänen, 2003). Basically, the first stage is most prevalent at the age of 7 to 9 and it disappears entirely by the age of 14 to 15. The second stage of religious thinking is most intensive at the age of 11-12 and then vanishes by the age of 20-25, but it reappears strongly in late adulthood (56-75 years). The third stage is generally not possible until the phase of abstract thinking is reached. According to Oser's empirical studies (1980; Oser & Gmünder, 1991), the third stage is the typical one in youth and young adulthood. The fourth stage is usually placed at middle age, though some people reach it in young adulthood. The fifth stage is hypothetical in that, in empirical studies, no-one has been placed there (Räsänen et al., 2007).

### 3 Method

#### 3.1 Sample

The sample consisted of 11 female and 9 male first-year upper secondary school students at an independent and private boarding school in Finland. The school specialises in mathematics — education and competitions. Participants' age was from 16 to 17 years ( $M = 16.25$ ,  $SD = 0.444$ ). All the measurements were completed during 2008.

#### 3.2 Measurements

An experienced, licensed psychologist measured students' general intelligence (including verbal and performance indexes) by means of the Wechsler Adult Intelligence Scale III (WAIS-III, Wechsler, 1997). In addition, students responded on two scales: the Defining Issues Test (DIT, Rest, 1986) and the Religious Judgment Test (RJT, Räsänen, 2003; Räsänen et al., 2007).

The Wechsler Adult Intelligence Scale III (WAIS-III) is one of the best known intelligence tests worldwide. The test has two main components, Verbal IQ (VIQ) and Performance IQ (PIQ); together they form the general-level full-scale intelligence quotient (FSIQ). In the following analysis, we used the FSIQ score to represent the participant's measured intelligence. For the purpose of the analysis, the FSIQ score (theoretically ranging from 45 to 155) was divided into three classes (1 = 111-120, 2 = 121-130, 3 > 130). The class with the lowest FSIQ was labelled 'C', the middle class 'B' and the highest-achieving class 'A' in line with Terman's studies (1925). We are mainly interested in comparing the performance of the A (FSIQ scores above 130) and C (FSIQ scores below 120) groups.

The Defining Issues Test (DIT) is based on Kohlberg's (1969) research on moral judgement. It contains six dilemmas: (1) Heinz and the drug; (2) Student takeover; (3) Escaped prisoner; (4) The doctor's dilemma; (5) Webster; (6) Newspaper. According to Rest (1986), people at different points of development interpret moral dilemmas differently, define the critical issues of the dilemmas differently and have different intuitions about what is right and fair in a situation. The respondent's task is to consider 12 issues for each dilemma and then indicate which are the most important in deciding what to do. The *P* index ('principled morality') is the most widely used score from the DIT (including *D* index, *M* score, *A* score, *Utiliser* score and *Action Choice* index). According to Rest (1986), it is calculated by counting the number of times Kohlberg's stage 5 and 6 items are chosen as the first, second, third or fourth most important consideration, weighting these ranks by 4, 3, 2 and 1 respectively. The score ranges from zero (lowest) to 95 (highest). Test-retest reliability ranges between .70 and .80 and the DIT typically takes 35-50 minutes to complete (Narváez, 1993). A new version of the test (DIT 2) is also available, but it is shown to correlate positively with the DIT test (.53-.70) (Thoma, Rest, Narváez & Derryberry, 1999). In this study the DIT *P* index, ranging from 0 to 95, was divided into three classes (1 < 40, 2 = 40-49, 3 > 49).

Religious reasoning is explored in this study by means of the RJT (Räsänen, 2003; Räsänen et al., 2007), which is a 26-item multiple-choice questionnaire based on Fritz Oser's (1980) theory of religious judgement (see Appendix). The scale for each item ranges from 1 (totally disagree) to 5 (totally agree). Oser has mainly used hypothetical dilemmas to study the developmental stages, but Räsänen later showed in his empirical studies (Räsänen et al., 2007) that multiple-choice items too can capture individual variance in religious thinking. The five stages of Oser's theory (1980) are as follows: (1) Orientation to religious heteronomy (e.g. item 4, 'God is able to control all the events in the world by sending, for example, storm'); (2) Orientation to

*do ut des* (give so that you may receive, God is an all-powerful being, e.g. item 8, 'Righteous life protects me from God's anger'); (3) Orientation to ego autonomy and one-sided self-responsibility (deism, e.g. item 9, 'free human being acts autonomously without God'); (4) Orientation to mediated autonomy and salvation plan (e.g. item 16, 'even though I am free to make my own decisions, I consider God's advice to humankind when making decisions'); (5) Orientation to religious intersubjectivity and autonomy (e.g. item 18, 'I know that the invisible world of God reverberates in this world in love and forgiveness'). RJT was analysed in terms of the summative scores of five developmental stages in religious judgement. Räsänen and his colleagues (2007) investigated internal scale reliabilities by means of Cronbach's (1970) alpha, using a sample of 413 Finnish adolescents. They reported the following alpha values for the five developmental stages: I  $\alpha = .83$ , II  $\alpha = .88$ , III  $\alpha = .73$ , IV  $\alpha = .88$ , V  $\alpha = .81$ . In the current sample, internal consistency values ranged from .79 to .90 (see Appendix). These alpha levels are adequate if we consider Nunnally's statement: "Increasing reliabilities much beyond .80 is often wasteful of time and funds with the exception of applied settings where important decisions are made with respect to specific test scores' (Nunnally, 245-246).

In addition, the students' gender, school achievement (self-reported 9th grade marks in mathematics, religion, native and foreign languages) and mathematical giftedness (boarding school's entrance examination test) were used as controlling variables in the analysis. The entrance examination test, PSMEES, contains a set of multifaceted mathematical tasks at various competence levels. The score, ranging from -23.5 (minimum) to 50 (maximum), was divided into three classes (1 < 20, 2 = 20-34, 3 > 34.1).

### 3.3 Statistical Analyses

Because of small sample size and uncertainty of linear variable dependencies (Marini, Li & Fan, 1996), we applied non-linear and non-parametric statistical techniques to answer the research questions. *First*, we examined the statistical relationship between controlling variables and dependent variables by means of the Chi square test ( $\chi^2$ ), contingency coefficient ( $C$ ) and non-parametric rank-order correlation ( $r_s$ ). *Second*, considering the three research questions separately, we examined statistical dependencies between the three test scores by means of Bayesian classification and dependency modelling.

Bayesian theory, based on a concept of subjective probability, was initially developed by a British clergyman, Thomas Bayes, in the 18th century and published posthumously (Bayes, 1763). The essential benefits of using Bayesian methods in this study are twofold: they work robustly even with small

samples and allow prediction by means of the model derived from the empirical evidence (Nokelainen, 2008). In this study, Bayesian models were calculated by means of the B-Course computer program (Myllymäki, Silander, Tirri & Uronen, 2002).

Bayesian classification modelling (BCM) resembles linear discriminant analysis (Huberty, 1994) to some extent; but instead of using forward, backward or stepwise search methods for predictor variables, it applies genetic search algorithms. The genetic algorithm approach means that predictor-variable selection is not limited to one (or two or three) specific approaches; instead, many approaches and their combinations are exploited (Cormen, Leiserson & Rivest, 1996).

Bayesian dependency modelling (BDM) predicts the most probable statistical dependency structure between the observed variables. It visualises the result in a form of Bayesian network, allowing the user to probe the model by adjusting the values of all variables and examining the effects on other variables included in the best model (Nokelainen, 2008).

## 4 Results

### 4.1 Overall Results of WAIS-III, DIT and RJT

Participants' VIQ and PIQ scores were as follows: ( $M_{VIQ} = 125.35$ ,  $SD_{VIQ} = 6.393$ ) ( $M_{PIQ} = 123.85$ ,  $SD_{PIQ} = 8.561$ ). We conclude that the sample consists of highly intelligent young adults, as most of the participants ( $n = 17$ , 85%) were above the 'slightly better than average' level (111-20 points) in FSIQ ( $M_{FSIQ} = 126.20$ ,  $SD_{FSIQ} = 5.908$ ).

The DIT *P* index represents the relative importance that participants ascribe to stage 5 and 6 items of Kohlberg's theory (level 3, post-conventional: 'social contract orientation' and 'universal ethical principles'). Participants completed the DIT within 15-50 minutes ( $M = 36.25$ ,  $SD = 13.463$ ). According to Narvaéz (1993) the resultant *P* index, 41.65 ( $SD = 12.041$ ), is above the normal senior high level ( $M = 31.80$ ,  $SD = 13.500$ ) and more resembles a typical college student's *P* index ( $M = 42.30$ ,  $SD = 13.200$ ).

RJT results showed that mathematically gifted adolescents scored highest on the last three stages of Oser's theory: (1) Orientation to religious heteronomy ( $M = 2.00$ ,  $SD = .750$ ); (2) Orientation to reciprocity ( $M = 1.75$ ,  $SD = .720$ ); (3) Orientation to ego autonomy and one-sided self-responsibility ( $M = 3.01$ ,  $SD = 1.230$ ); (4) Orientation to mediated autonomy and salvation plan ( $M = 2.22$ ,  $SD = 1.056$ ); (5) Orientation to religious intersubjectivity and autonomy ( $M = 2.66$ ,  $SD = 1.139$ ).

Results of statistical analyses controlling gender for the WAIS-III, DIT and RJT scores showed that there was only one statistically significant difference: males in the sample ( $n = 9$ ) had higher WAIS-III scores than females ( $n = 11$ ),  $\chi^2(2, n = 20) = 6.147, p = .046$ . However, this finding is not very significant scientifically, as the related contingency coefficient is .49 ( $C_{\max} = .71$ ).

Next, we checked self-reported school achievement (9th grade marks in mathematics, religion, native and foreign languages) for the WAIS-III, DIT and RJT scores. Results showed a strong positive correlation for both mathematics and foreign language grades (Cohen, 1988) with the WAIS-III score at  $r_s(20) = .62, p = .003$  and  $r_s(20) = .54, p = .015$  respectively.

Mathematical giftedness was measured in this study by means of the boarding school's entrance examination test (PSMEES). Student scores ranged from 10.7 to 43.0 ( $M = 28.24, SD = 8.972$ ). Not surprisingly, mathematical giftedness showed a strong positive correlation with the WAIS-III score,  $r_s(19) = .57, p = .011$ .

Controlling three test scores for gender showed, as expected (e.g. Weschler, 1997; Rest, 1986; Räsänen, 2003), that they are not producing gender-biased results. It was also no surprise that students' mathematical ability, measured by means of the 9th grade mark and supervised test, correlated positively with the WAIS-III FSIQ score. Further, the result showing no statistically significant correlation between the 9th grade religion mark and RJT scores was not unexpected, as it replicates Räsänen's earlier finding (Räsänen et al., 2007) in terms of several larger samples (reported correlations ranged from -.04 to .21).

#### 4.2 RQ 1: How is Intelligence Related to Moral Thinking?

Our hypothesis regarding the first research question is that intelligence and moral thinking are positively related concepts. We expect to find, however — in parallel with Narvaéz (1993) — that an above-average level of intelligence is not a positive predictor of an above-average level of moral reasoning.

Non-parametric correlational analysis showed that there was no linear statistical dependency between the DIT  $P$  index and WAIS-III FSIQ scores in this sample. Further, BCM indicated, with a 60 per cent classification accuracy, that none of the A group students would achieve the highest  $P$  indexes in the sample; on the other hand, some of the C group students achieved the highest DIT scores in this sample. Our finding supports Narvaéz's conclusion (1993, p. 277) that 'intellectual accomplishment is necessary but not sufficient for a high score in moral judgement'. When making practical recommendations, however, we should bear in mind that the sample consists of highly gifted young adults who scored exceptionally high on *both* tests measuring intelligence and moral thinking.

#### 4.3 RQ 2: *How is Intelligence Related to Religious Thinking?*

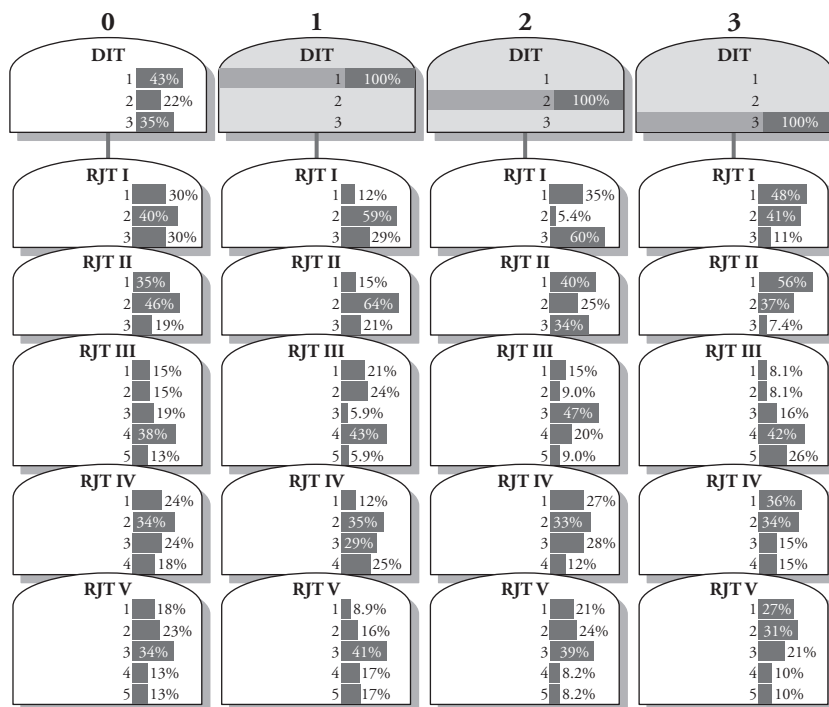
Our hypothesis regarding the second research question is that intelligence and religious thinking are positively related concepts, since Oser's theory builds on cognitive thinking skills. Furthermore, we expect to find a preference among the most gifted adolescents for the more autonomous stages of religious thinking.

The results of the Chi square test showed that the young adults in the A group (FSIQ above 130) were not associated with the lowest stage of religious judgment (I Orientation to religious heteronomy) to the same extent as the B and C group students,  $\chi^2(4, n = 20) = 9.938, p = .041$ . The scientific significance of this finding is strong, as the related contingency coefficient ( $C = .61$ ) is close to the theoretical maximum approximation of .82. According to Räsänen (2003), the first stage is the most prevalent at the ages of 7 to 9 and it should disappear by the age of 14 to 15 years. As the age of the students in the sample was from 16 to 17 years, we conclude that this finding is related to intellectual maturity (physical vs. intellectual age).

The BCM showed, with 65 per cent classification accuracy, that the A group's views were the most non-religious and the C group's the most religious on all five RJT scales in the sample. This finding suggests that students with at least slightly above-average intelligence — that is, whose FSIQ scores are above 111 points (all three groups in this sample) — are capable of religious reasoning at the highest stages (IV Orientation to mediated autonomy and salvation plan, V Orientation to religious intersubjectivity and autonomy) *if* they wish to do so.

The BDM resulted in a model that is presented in figure 1. The initial value distributions — that is, without making any prediction with the three FSIQ value classes — are shown in the left-hand column. When A group members are selected (FSIQ value prediction is set to 'A'), we see from the 'A' column that the highest-scoring young adolescents in WAIS-III totally disagree with the first and second religious orientation stage statements. Columns 'B' and 'C' show that their lower-scoring peers are not so strongly opposed to those two stages. Finally, results show clearly that members of the lowest-achieving group C locate themselves more in the two highest religious orientation stages than their higher-achieving peers in the A and B groups. This is evident as, in the bottom row of figure 1 ('RJT V'), summative percentages of the two most positive response options (4 'Agree' and 5 'Strongly agree') decrease from the right end of the row (C group, 32.0%) towards the left (B group, 22%; A group, 6.2%).

**Figure 1: Bayesian dependency model of moral and religious judgment. 0 = None of the Wechsler Adult Intelligence Scale III (WAIS-III) full-scale IQ (FSIQ) values are fixed and thus no prediction is made about the behaviour of the Religious Judgment Test (RJT) values in the model. A = FSIQ value is fixed to represent the A group (scores < 121) and the model shows the student's corresponding responses on the five RJT scales (RJT I = Orientation to religious heteronomy, RJT II = Orientation to reciprocity, RJT III = Orientation to ego autonomy and one-sided self-responsibility, RJT IV = Orientation to mediated autonomy and salvation plan, RJT V = Orientation to religious intersubjectivity and autonomy). B = FSIQ value is fixed to represent the B group (scores 121-130). C = FSIQ value is fixed to represent the A group (scores > 130).**



4.4 RQ 3: How are Moral and Religious Thinking Related to each Other?

Our hypothesis regarding the third research question is that moral and religious thinking are related to each other since they both build on cognitive judgement skills. However, we expect them not to be reduced to cognitive skills only.

Moral thinking showed a weak negative correlation to the two first and two last stages of religious judgement (I, II, IV and V respectively) and a strong positive correlation to the third stage (Orientation to ego autonomy

and one-sided self-responsibility),  $\chi^2(16, n = 20) = 27.570, p = .036$ . The finding is plausible according to Räsänen (2003), as this stage requires abstract thinking skills and is typical in youth and young adulthood.

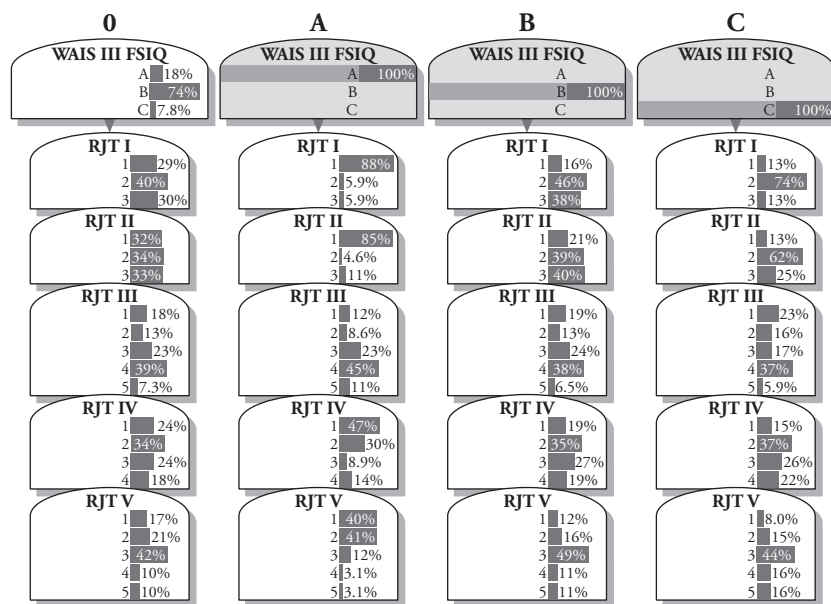
BDM resulted in a model that is depicted in figure 2. The initial value distributions — that is, without making any prediction with the three DIT value classes — are shown in the left-hand column. When the DIT value prediction is set to one, we see how the participants who scored lowest in the DIT have responded to the five RJT scales. The analysis shows that they are not as absolute in their opposition to the first two religious orientations as the other two groups. On the other hand, they have stronger opinions than their peers on the last two religious orientations. The previously presented result of strong positive dependency between moral thinking and the third religious orientation is also explicit in the figure, since the negative response frequencies (1 'Totally disagree' and 2 'Disagree') tend to decrease as the DIT score increases (45.0%, 24.0%, 16.2% respectively). The students who scored highest in the moral thinking test are profiled as belonging to the third religious orientation stage in this sample, and the students who scored lowest are profiled into the fourth and fifth religious orientation stages. The middle-level moral thinkers have a non-linear relationship (multimodality issue) to their religious thinking: some absolutely deny the first two stages of religious orientation, like the members of the highest-scoring DIT group, while some have the most sympathetic feelings for the first two stages in this sample. Our conclusion is that as the level of moral thinking increases, preference for the third stage of religious orientation — ego autonomy and one-sided self-responsibility — increases together with the avoidance of the other four religious orientation stages.

## 5 Discussion

The first hypothesis on the relationship between intelligence and moral thinking yielded the expected results: moral reasoning was related to intelligence. However, WAIS-III scores were not positively connected to the DIT scores within this highly gifted sample.

Regarding the first research question, DIT *P* index did not correlate with WAIS-III FSIQ. This finding disagrees with the conclusion by Sanders et al. (1995, p. 502) that '[t]he DIT is simply another way of measuring verbal ability', but supports the finding by Thoma et al. (1999, p. 325) that 'DIT scores describe a latent variable that is distinct from verbal ability'. Results showed that females and males scored equal DIT *P* indexes. This finding supports Narváez's (1993) earlier findings of gender interdependency of the test.

**Figure 2: Bayesian dependency model of moral and religious judgment.** 0 = None of the Defining Issues Test (DIT) values are fixed and, thus, no prediction is made about the behaviour of the Religious Judgment Test (RJT) values in the model. 1 = DIT value is fixed to represent the lowest scoring group (*P* index < 40) and the model shows the student's corresponding responses on the five RJT scales (RJT I = Orientation to religious heteronomy, RJT II = Orientation to reciprocity, RJT III = Orientation to ego autonomy and one-sided self-responsibility, RJT IV = Orientation to mediated autonomy and salvation plan, RJT V = Orientation to religious intersubjectivity and autonomy). 2 = DIT value is fixed to represent the middle-scoring group (*P* index 40-49). 3 = DIT value is fixed to represent the highest-scoring group (*P* index > 49).



Another interesting finding was that, while calculating the DIT *P* indexes, we noticed that some of the items were religiously coloured — for example: ‘Whether only God should decide when a person’s life should end’ (The doctor’s dilemma, item 9.); ‘Whether the Christian commandment to love your fellow man applies to this case’ (The Websters dilemma, item 11); ‘If someone is in need, shouldn’t he be helped regardless of what you get back from him?’ (The Websters dilemma, item 12). We also learned that these items were selected to represent Kohlberg’s stage 4 of moral reasoning by the DIT authors. In practice this means that if respondents choose to use one or more of these items, their DIT *P* index will be lower than if they use the items representing Kohlberg’s stages 5 and 6. To demonstrate this we selected two female participants, ‘Leena’

and 'Suvi', from the sample, with similar FSIQ scores (122 and 118 respectively). Leena had selected all three abovementioned stage 4 items in the DIT, whereas Suvi had used none of them. Should Leena have selected 'correct' items representing stages 5 or 6 instead, her *P* index would have increased from .38 to .53, resembling Suvi's *P* index (.50). This finding indicates that the use of Christian ethics is not perceived as principled morality in Kohlberg's procedures.

The second hypothesis on the relationship between intelligence and religious thinking was partly affirmed: the most intelligent young adults were more opposed to the lowest and highest forms of religious reasoning than their less intelligent peers. This might be an indication of atheism among the most intelligent participants. Furthermore, the least intelligent participants in the sample (the C group) were more religiously oriented than their peers. This result is intelligible as, according to Räsänen (2003), the first stage is most prevalent at the age of 7 to 9 and should disappear by the age of 14 to 15 years. As the age of the students in the sample ranged from 16 to 17 years, we conclude that religious judgement is to some extent related to intellectual maturity (physical vs. intellectual age).

The third hypothesis was affirmed: the level of moral thinking was negatively related to both the lowest and the highest stages of religious judgement, but positively related to the third religious orientation stage (ego autonomy and one-sided self-responsibility). This finding is plausible, as Räsänen (2003) states that this stage requires abstract thinking skills and is typical of youth and young adulthood.

Whether we use traditional frequentistic parametric (or non-parametric) methods or any non-parametric approach, like neural networks (self-organising maps), fuzzy logic, minimum description length calculation or Bayesian methods, the *power* (Murphy & Myers, 1998) of the study remains a relevant question: how do we know for sure that if we reject our null hypothesis ( $H_0$ ) it is false, too, in the real world? Traditional power analysis is impossible with statistical techniques based on the concept of subjective (i.e. non-frequentistic) probability. The justification is simple: the Bayesian statistics that we have applied in this article do not include the concepts of statistical significance, alpha (type I) or beta (type II) error levels (Hooijink & Klugkist, 2007). Our conclusion is that the current results should be interpreted with caution. We need to collect a larger sample for a further study of topics presented in this article.

Another interesting issue for further investigation would be a longitudinal comparison of DIT *P* index development with the two other measures, as earlier studies (e.g. Rest, 1986) have shown that DIT scores tend to increase with age.

Our study has important implications for religious and moral education. Teachers and psychologists should be informed about the theories and measurement techniques used to measure moral and religious thinking. These issues should also be discussed with secondary school students in both religious and non-religious schools. This kind of education would promote intelligent belief and a critical attitude towards testing for the measurement of intelligence, morality and religiosity.

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## Appendix

Religious Judgment Test factors and items (alpha values in parenthesis).

### *I Orientation to religious heteronomy (.79)*

- v32 God either protects or abandons.
- v40 If I do not fulfil God's will, my relationship to Him will break down.
- v41 God directly influences human beings by awarding and punishing.

### *II Orientation to do ut des (.90)*

- v29 Adherence to the religious rules helps me to relate well with God.
- v34 I can influence God by praying.
- v36 God sends afflictions, and after surviving them I can have God's love.
- v38 Proper behaviour protects me from God's anger.

### *III Orientation to ego autonomy and one-sided self-responsibility (.81)*

- v18 A free human being acts autonomously without God.
- v20 My life in this world does not rest on a consideration of God, who is outside this world.
- v21 I think God is somewhere else, not participating in occurrences in this world.
- v22 My life in this world and the transcendent world of God do not intersect.

### *IV Orientation to mediated autonomy and salvation plan (.79)*

- v28 God has plans for this world and they come true through human beings.
- v31 God needs human beings to realise His will in this world.
- v35 The existence of the world requires that God exist.
- v37 I am free to make decisions in my life, but within the limits of God's instructions and directions.

### *V Orientation to religious intersubjectivity and autonomy (.82)*

- v19 A deeply religious individual is in every way committed to God and to love for one's neighbour.
- v26 I know that the invisible world of God is manifested in this world in love and forgiveness.
- v27 I believe that many things in this world reflect God's invisible world.
- v39 I consider that God is always present in interpersonal involvement.