B.Sc (Hons) Psychology

Final year project

Title: Cognitive reflection task vs abstract reasoning, which is a better predictor of religiosity?

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Dissertation submitted in partial fulfilment of the requirement of Cardiff Metropolitan University for the degree of Bachelor of Science
DECLARATION

I hereby declare that this dissertation is the result of my own independent investigation under the supervision of my tutor. The various sources to which I am indebted are clearly indicated. This dissertation has not been accepted in substance for any other degree and is not being submitted concurrently for any other degree.
Acknowledgements

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Abstract

A growing body of scientific interest has focused on the cognitive processing differences between religious and non-religious believers. It has been well established that an individual’s ability to think analytically has been shown to predict religious beliefs and has been linked to the dual-processing model. More recently, performance on the Cognitive Reflection Task (the most widely used individual difference measure of analytical thinking) has been linked to levels of religiosity. However, to date little research has looked at abstract and deontic reasoning tasks. Performance on abstract reasoning task have been linked to an individual’s ability to think analytically, where as a deontic reasoning makes use of a heuristic (logical) style of thinking. Based on this, this study aims to examine if abstract reasoning is correlated to religious level and if so, what is a better predictor of religion; the CRT or abstract reasoning. To assess this, individuals were required to complete a religious beliefs questionnaire, followed by 5 CRT problem, then they were required to complete 3 abstract and 3 deontic questions. Overall this study found that there was a statistical significance: F (3, 52) = 3.717, P = .017. However, CRT was the only predictor variable of religion that was statistically significant. Although abstract reasoning also revealed a positive relationship with religion it was not statistically significant. Finally, deontic reasoning was found to have a negative relationship with religion and did not show any statistical significance. Thus, this study firstly concludes that, CRT is the significant predictor of religiosity. Secondly, although abstract reasoning has positive relationship with religion, the result showed that abstract reasoning is not a significant predictor of religion.
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CHAPTER ONE
1. Introduction

1.1 Overview of Religion

The belief in a God or gods is a worldwide phenomenon, with approximately 90% of the world’s population believing in a religion (Zuckerman, 2007). With this said, there is still 10% of the world’s population that does not affiliate with any religion. Both belief and disbelief of a religion is subject to change over time and across situations (McCllough, Enders, Brion, Jain, 2005); in 2007 more than 92% of adults polled by Gallup answered ‘yes’ when asked “Do you believe in a God?”, a number which has remained relatively stable since the same question was asked in 1944 where 96% of adults polled answered ‘yes’. However, in the same poll the number of respondents who answered ‘no’ when asked the same question increased from 1% in 1944 to 7% in 2011 (Gallup, 2011). Further to this, figure posted by The Guardian found that 53% of all U.K. adults describe themselves as having no religious affiliation. Not only has a decline in religious affiliations been seen in the U.K., but measurable differences have also been noted throughout central European countries between 1991 and 2015. Both Poland and Hungry have seen a 7% decline in religious individuals (96% - 87% and 63%-56% respectively), with the Czech Republic demonstrating the most dramatic decline of 21% (44%-21%). At present the Czech Republic has one of the highest populations of adults (72%) who describe themselves as atheists or ‘nothing in particular’ (Religious Belief and National Belonging in Central and Eastern Europe, 2018). Despite the decline in the number of religious individuals, religion is still a driving force in people's daily lives. For example, within certain public and private schools throughout the USA and U.K, creationism (the belief that the universe and living organisms originated from specific acts of divine creation, as in the biblical account. Creationism, Definition of Creationism in English by Oxford Dictionaries, 2018) is still being taught. A national survey of high school biology teachers found that 13% of the 926 teachers interviewed said that they ‘explicitly advocated creationism’ by spending at least one hour a week presenting it (Berkman & Plutzner, 2011). Other examples that demonstrate religion to be driving force for behaviour can be observed when considering sexual orientation conversion therapy. For
centuries, religious practitioners have tried to revert unwanted homosexual orientations through different methods (Haldeman, 1994). However, the British Psychological Society have guidelines that state same sex orientation is a not diagnosed illnesses, and they therefore do not require any therapeutic interventions to change them ("BPS", 2018). Despite this, research has found that out of 1300 accredited mental health professionals reviewed, more than 200 had offered some form of conversion therapy (Unhealthy attitudes, 2018). These sorts of observations have resulted in researchers concluding that religious beliefs and disbeliefs are considered to be a complex, multi-determined, psychological and culturally shaped phenomenon, (Gervais & Norenzayan, 2012), that must be grounded in common and, perhaps, foundational cognitive mechanisms (Pennycook, Tranel, Warner, Asp). The idea that religious believers have a common set of cognitive mechanisms and processes that differ from disbelievers (Guthrie, 1993), has been subjected to vast amounts of research which dates back to the early 1920's.

1.2 How have different cognitive mechanisms in religious and non-religious individual been previously researched

The link between intelligence and religion has been an area of interest for psychologists from as early as 1928. Empirical studies (Howells, 1928; Sinclair, 1928) from 1928 right through to the present day have generally followed the same format: recruit individuals and then have them complete a self-rating religiosity questionnaire; on completion of the questionnaire they are then split into two groups depending on their religiosity level. Following this, participants then complete a cognitive ability test that assesses their apparent level of intelligence levels. The scores collected from these measures generally report an inverse relationship between intelligence and religiosity level (Kanzaw, 2010). Some of the earliest studies to have recorded a negative relationship between these two variables were reported by Howells (1928) and Sinclair (1928). Both researchers made use of a self-report questionnaire and tests of intelligence. Following on from these early studies, modern day studies with more refined methodologies and better controls (Gazanch, Ellis & Gotlibovski, 2013; Kanzaw, 2010) have also
found a negative relationship between intelligence and religiosity. Ganzach and Gotlibovski (2013) examined intelligence as a function of change in religiosity and intelligence in 9000 individuals. The results indicated the higher the levels of religiosity, the lower the levels of intelligence. Consistently, findings from a meta-analysis that contained 63 studies looked at the relationship between intelligence and religion within the following populations: pre-college, college and non-college populations (Zuckerman, Silberman & Hall, 2013). It was found 37 out of the 63 studies analysed reported that the more religious an individual is, the lower their score on an intelligence task (Zuckerman, Silberman & Hall, 2013).

Not only has the relationship between intelligence and religion been an area of interest, but it has also been established that cognitive ability is related to religious beliefs. Bertsch and Pesta (2013) conducted a study that assessed intelligence and cognitive ability (via Elementary Cognitive Tasks, Carroll, 1993). It was found that, religious individuals correlated negatively with both IQ and the Elementary Cognitive Task (Carroll, 1993) whereas those that question religion i.e less religious individuals, correlated positively with both tasks (Bertsch & Pesta, 2013). Similar findings have been reported by Razmyar and Reeve (2013), who confirmed that cognitive ability is inversely correlated to religiosity. In addition, they found that those who scored higher on measures of intelligence (Fredrickson’s cognitive reflection tasks) dismissed the idea of religious beliefs and questioned the idea of religion more than those who scored lower on the tasks, as well as confirming the general assumption that cognitive ability has an effect on religiosity. This literature clearly demonstrates that there is an inverse relationship between cognitive ability and religion. However, contradictory finding have been found that shows a positive relationship between intelligence, and religiosity when controlling for education in underdeveloped Caribbean islands (Meisenberg, Lawless tambert and Wealon 2006).

This relationship between cognitive ability, intelligence and religion can be explained by the way in which people gravitate towards belief systems, that match their level of cognitive complexity (Razmyar & Reeve, 2013). For example, those higher in intelligence have a greater capacity for scientific belief, and have an ability to apply analytical and critical thinking
(Razmyar & Reeve, 2013) to a situation; compared to individuals with reduced intelligence who have less of a capacity for scientific belief and analytical thinking, and are therefore are less likely to identify logical inadequacies in religious explanations (Razmyar & Reeve, 2013), all of which have been linked to cognitive processing systems.

1.3 Cognitive processing systems and beliefs

It’s now well established that religious and non-religious individuals differ in their cognitive abilities, and such differences appear to be linked with dual processing theories. Dual process theories are not only a fundamental part of human thinking (Evan, 2003; Fredrickson, 2005) but they distinguish between two different types of cognitive processes (Penycook, Ross, Koehler, Fungelsang, 2017). Both cognitive processes, type one and type two, have been used to explain differences in thought processes and deviations from normative responses in processing tasks (Evans & Over, 1996; Kahneman, Slovic & Tversky, 1982; Stanovich & West, 2000). For example, type one processing is associated with fast, intuitive and a more heuristic style of processing. This is in comparison to type two which is associated with being slower, deliberative and more analytical in nature (Evans & Stanovich, 2013). The reason behind religious and non-religious individuals often having significantly different beliefs is a complex question that implicates several factors, namely cultural background and family influences, as well as cognitive factors; particularly in relation to cognitive style in religious and paranormal beliefs (Cheyne & Pennycook, 2013). It has previously been highlighted that people differ in their beliefs and entire belief systems because they have different cognitive styles, resulting in such individuals thinking in fundamentally different ways (Cheyne & Pennycook, 2013). Specifically, those who hold less religious beliefs are more likely to engage in type two style of processing. These individuals are more likely to show paranormal disbelief (Cheyne & Pennycook, 2013); (Pennycook, Cheyne, Seli, Koehler & Fungelsang, 2012), have a tendency to be more accepting of science (Gervais, 2015; Shtulman & McCallum, 2014), hold less traditional moral values and judgements (Pennycook, Cheyne, Barr, Koehler & Fungelsang, 2014a; Royzman, Landy & Goodwin, 2014) and are less reliant on smart phones as an external source of information (Barr, Pennycook, Sotlz & Fungelsang, 2015). These findings generate a clear understanding of the
two types of processing systems and how these are an important part of human cognition (Pennycook, Ross, Koehler & Fungelsang, 2017), especially when understanding the impact each system has on the way in which an individual engages in religious beliefs or not.

**1.4 The exploration of cognitive processing systems via IQ and Cognitive reflection tests**

As previously mentioned, cognitive processing systems are a fundamental part of human cognition, and both systems influence cognitive abilities and style (Stanovich & West, 2000) i.e. those who engage in analytical thinking are negatively associated with religious belief (Pennycook, 2014). Further to this, previous research has focused heavily on the use of IQ and other intelligence measures such as the Elementary Cognitive Task (Carroll, 1993) and the Scholastic Assessment Test (Stanovich & West, 2000). However, more recently a newer and much quicker intelligence measure has been introduced, the Cognitive Reflection Test (CRT) (Fredrick, 2005). This test is a three-item task that requires individuals to solve mathematical problems in which the intuitive answers are wrong, and the analytical answers are the correct ones (Welsh, Burns & Delfabbro, 2013). An example of a common CRT task is the bat-and-ball problem; *A bat and ball cost £1.10 in total. The bat costs £1.00 more than the ball. How much does the ball cost?*” The results show that 64.9% (Pennycook, Cheyne, Koehler & Fungelsang, 2015) of all participants asked this question responded with an incorrect response of 10p. This response is a clear example of a type one processing response, which is incorrect. If the ball is 10p then the bat must be £1.10, therefore the total would be £1.20 (Pennycook, Ross, Koehler & Fungelsang, 2017). In order to recognise that this is an incorrect response an individual would need to overcome the initial intuitive response with a more analytical style of processing and recognise that that the ball costs 5p and the bat costs £1.05, therefore, the total would be £1.10. An individual’s performance on a CRT is therefore thought to index and to some degree a willingness to engage in more analytical style of processing (Fredrick, 2005; Toplack, West & Stanovich, 2011; Toplack, Stanovich & West, 2014; Pennycook & Ross, 2016). Thus, those who are more religious are said to engage in more heuristic styles of processing and have been found to perform poorly on a CRT task as they cannot override the initial intuitive response to think more analytically. This is in comparison to an individual with lower levels of religiosity,
therefore strengthening the idea that religious and non-religious individuals make use of separate processing systems.

1.5 Reasoning and the cognitive processing systems

It has now been well established above that dual processing theories play a fundamental role in human thinking; however, they also play a crucial role in human reasoning (Stanovich & West, 2000). Dual processing theories provide a theoretical understanding for two individual difference factors that influence reasoning performance; cognitive ability (i.e intelligence) and cognitive style (i.e willingness to engage in type two processing, Stanovich, 2009). Studies have suggested that individual differences in cognitive style can predict reasoning performance over and above cognitive abilities (Stanovich & West, 2000).

One of the most extensively studied tasks in the psychology of reasoning is Wason’s (1966) selection task, also known as the four-card task. The task involves presenting four cards to an individual and giving them a rule. Participants are only shown one side of these cards, for example, the cards could read ‘A’, ‘D’, ‘4’ and ‘7’. The rule may then state, "If a card has a vowel on one side, then it has an even number on the other". Participants need to look for the cards that could have a falsifying case on them because one false case shows that the rule itself is false, whereas true cases do not prove the rule is true (Manketlow, 1999.p48). Participants would need to check the P card (displaying a vowel), as this card could have either Q (even number) or Not Q (odd number) on the back, and the Not Q (odd number) is what individuals need to find; individuals do not need to check the Not P card, because whatever is on the back would not add up to an instance of P Not Q; the same applies for Q card; and finally, the Not Q card could have either P or Not P on the back, and if it has P then it would also be a falsifying card, thus needing to be turned over (Manketlow, 1999). Typically, less than 10% of subjects make the correct selection of the card ‘A’ (P) and ‘7’ (Q) (falsifying the rule), the most common incorrect choice made by participants are cards ‘A’ (P) and ‘4’ (Not- Q) (confirming the rule) (Stanovich & West, 1998). The ability for an individual to solve problems using analytical
intelligence that is cued by system 2 processing, without the use of social context is linked to both higher levels of intelligence and abstract reasoning (Stanovich & West, 2000).

As a result of the poor performance on the abstract task, the use of real life scenarios was introduced to increase the correct response rate. Cheyne & Holyoak (1985) made use of the postal selection task and found that it was possible to impact performance of selecting the correct response cards with the addition of a rationale for the rule, such as the following: *The rationale for this regulation is to increase profit from personal mail, which is nearly always sealed. Sealed letters are defined as personal and must therefore carry more postage than unsealed letters*. When this rule was included performance significantly increased, compared to when the statement wasn’t included, where performance significantly decreased. This idea was then used in the well know drinking-age tasks, which included the statement *‘if a person is drinking beer, then the person must be over the age of 19 years old’* and included four cards: Coke, 22, 16, beer. Griggs and Cox (1982) surveyed college students with the drinking age tasks and compared the results against Wasons (1966) abstract selection task. The results from this selection task were marked as being superior to that of the abstract selection task (Dominowski, 1995; Evans, 1989; Evans et al., 1993; Griggs & Cox, 1982, 1983; Pollard & Evans, 1987). Thus, deontic problems, such as the drinking-age task which is a rule-based logic problem task will trigger a heretic style of thinking which falls within the domains of the mechanisms of system 1 (Stanovich & West, 2000).

1.6 Rationale

It is evident from previous literature that there is a clear distinction between religious and non-religious individuals in the way they think and reason (Pennycook, Ross, Fungelsang & Koehler, 2015) as a result of two very different processing mechanisms. For example, the ability of non-religious individuals to engage in analytical reasoning, accept science, have an increased performance on intelligence tests (CRT task) and on reasoning tasks has been linked to the system two style of processing that is championed by a slower, more analytical style of thinking (Pennycook et al, 2016; Stanovich & West, 2000). Stanovich and West (2000) have previously
looked at deductive reasoning and stated that the rule-based system two will differentially trigger those of high analytical intelligence and will result in improved responses on almost all reasoning tasks that cue intelligence (Stanovich & West, 2000). This prediction was tested on deductive reasoning tasks only. However, the (arguably) most widely researched reasoning task is Wason’s (1966) abstract reasoning task, and this has yet to be examined. This type of reasoning task had been correlated to intelligence levels and has been linked to system two processing. As previously discussed those who have lower levels of religious beliefs will typically have increased levels of intelligence and perform better on reasoning tasks that cue intelligence. Thus, this study aims to establish if there is a link between performance on abstract reasoning tasks and individual’s religiosity levels, based on Stanovich & West (2000) prediction that rule based system two will trigger those improved responses on reasoning tasks such as Wason’s (1966) abstract task.

Secondly, Stanovich & West (2000) paper makes use of a three hour long cognitive ability and academic aptitude test to measure intelligence. (Stanovich & West, 2000). However, new research has shown reliability differences using Cognitive Reflection tests (Fredrick, 2005), such as those used in Pennycook et al, (2013) study. Cognitive reflection tasks (Fredrick, 2005) is much quicker, and seen to be a more effective predictor of performance on wide range of tasks. Furthermore, the CRT has been reported as having the highest correlation (0.49) with cognitive abilities compared to any other cognitive ability predictor (Toplak, West & Stanovich, 2011). Thus, this study aims to examine the reliability of the CRT by trying to replicate Stanovich & Wests (2000) study who made use of a three hour long cognitive ability measure.

Finally, it has been well established that a) individuals levels of religiosity have been correlated to their levels of intelligence (Stanovich & West, 2000) and b) individual differences in the mere willingness to think analytically has been shown to predict religious (Pennycook et al, 2016). However, what has yet to be explored is whether the CRT or abstract reasoning is a better predictor of a person’s religiosity level, thus the overarching research question for paper is whether CRT or abstract reasoning is a better predictor of religiosity level as both make use of system 2 processing.
There are four hypotheses to this study. Firstly, due to previous findings that have highlighted the correlation between both systems and intelligence (Pennycook et al., 2016; Stanovich & West, 2000; Pennycook, Ross, Koehler & Fungelsang, 2016) those who hold higher levels of religious belief are hypothesised to have decreased performance on the Cognitive Reflection Task, compared to those who hold lower religious beliefs, who are hypothesised to have increased performance on the Cognitive Reflection task. Secondly, those individuals who have higher levels of religiosity are hypothesised to select more incorrect cards on the abstract selection task, compared to those who have lower levels of religiosity who will select more correct response cards on the abstract reasoning tasks. Thirdly, as it has been previously established that deontic problems are a test of logic and not intelligence and makes use of memory-cueing schemas (Manketlow & Over, 1991), this study hypothesizes that performance on the deontic tasks will remain relatively stable for every individual regardless of religiosity or intelligence level. Finally, based on previous research this study hypothesises that either the CRT or abstract reasoning will be a better predictor of religiosity.
CHAPTER TWO
2. METHOD

2.1 Pilot study

Sixteen individuals, who were known to the researchers, were recruited via opportunity sampling to test the suitability of a pilot deontic question. This was to see if a sufficient amount of P and NotQ responses would be generated in order to be included in the study. The question was created and presented to the individuals in a word document. The question was as follows;

‘The Church of Utopia are checking to see that their churches are following the rules regarding who can be married in them. One rule they have to follow is: If a person wishes to be married in a church then they must have been baptised. You have four cards with pieces of information about weddings that have taken place. On one side of the card is where the person got married and on the other side of the card is whether they were baptised or not. However, you can only see one piece of information. You can see the following cards: married in a church, married in a registry office, baptised, not baptised. Which card or cards do you definitely need to turn over to decide whether the Church of Utopia was following the rule or not?’ Participation needed to pick two cards (P and NotQ) to turn over in order to falsify the rule. Each participant was given a randomised order of answers in order to help reduce the chances that the participants would only select the first two cards. Out of a total of 16 P cards and 16 NotQ (the cards that the participants needed to turn over) the participants selected the P cards 94% of the time (Married in church) and Not Q (not baptized) cards 69% of the time. Therefore, based on these results
the question was included in the final study.

2.2 Participants

A mix of fifty-six undergraduate students from a university in South Wales and individuals who were known to the researcher were used in the study. Those individuals recruited from the university were done so via the university’s participant panel in exchange for two course credits. Those who were known to the researchers were recruited via opportunity sampling. The participants had an age range of 18 to 50 years of age (mean age 22 years). All participants were of varying religiosity levels (as measured by a religiosity belief scale as used in Pennycook, Ross, Fungelsang & Koehler (2015) study) and levels of intelligence (measured by 5 CRT questions, see appendix C). Participants were categorised into high and low religiosity groups based on their mean religiosity score; participants that had a score between 1-3 were categorized into the high religiosity group, and those who scored between 4-5 were placed in the low religiosity group.

2.3 Design

A multiple regression was used as the method of analysis. There were two predictor variables in this study. The first predictor variable was the CRT scores, which consisted of two groups; high CRT (scores between 3-5) and low CRT (scores between 1-3). The second predictor variable was selection task type which consisted of two levels; abstract and deontic reasoning. The criterion variable for the regression was religiosity level.

2.4 Materials

2.4.1 religiosity questionnaire

A religiosity belief scale was administered (Pennycook, Ross, Koehler, Fungelsang, 2015) which includes 8 statements which related to the individual’s religious beliefs, and one question which related to the type of God a person believes in. The eight statements that were measuring
conventional religious beliefs were based on; afterlife, heaven, hell, miracles, angels, demons, devil/Satan and God. Participants had to indicate their levels of agreement/disagreement with regards each statement about conventional religious beliefs by following a five-point Likert scale: 1) Strongly disagree, 2) Agree, 3) I don’t know, 4) Disagree, 5) Strongly disagree. The question that assessed the type of God an individual belief in was a seven-point scale: 1) A personal God, 2) God as an impersonal force, 3) A God who created everything, but does not intervene in human affairs, 4) Don’t know whether or not any Gods exist, 5) Don’t know whether any Gods exist, and no one else does either, 6) I don’t believe in Gods of any sort, 7) I believe that Gods do not exist. This scale is said to have excellent internal consistency (Pennycook, Ross, Koehler, Fungelsang, 2017) Cronbach’s a = 0.94. Cronbach’s alpha measures reliability/internal consistency i.e. how well the test measured levels of religiosity.

2.4.2 intelligence (cognitive style) measure

A PowerPoint presentation was used to display five CRT questions. The CRT questions are math’s-based problems that are intended to cue an incorrect intuitive response. An example of a CRT question used was: ‘In a lake, there is a patch of lily pads. Every day, the patch doubles in size. If it takes 48 days for the patch to cover the entire lake, how long would it take for the patch to cover half of the lake?’ Participants were to record their answers on the answer sheet provided (see Appendix C for a list of full CRT problems)

2.4.3 Reasoning ability

A second PowerPoint Presentation was used to display a mix of abstract and deontic reasoning questions. The reasoning questions were presented in the following order: one abstract task followed by a deontic task. Each task was presented on a different slide. On each slide was either the abstract or deontic problem along with the four-possible answer. An example of an abstract task was: ‘If a card has a vowel on one side, then it has an even number on the other side. which cards need to be turned over to determine this statement to be true or not? A, D, 7, D’ and an example of a deontic question was: ‘The Church of Utopia are checking to see that their churches are following the rules regarding who can be married in them. One rule they have
to follow is: if a person wishes to be married in a church then they must have been baptised. You have four cards with pieces of information about weddings that have taken place. On one side of the card is where the person got married and on the other side of the card is whether they were baptised or not. However, you can only see one piece of information. You can see the following cards: Married in a church, married in a registry office, baptised, not baptised Which card or cards do you definitely need to turn over to decide whether the Church of Utopia was following the rule or not?”. Participants were told to space bar in order to move to the next questions (See appendix E for all reasoning tasks). Although the order of the slides remained the same, for all 56 participants, the order in which the four possible answer cards were presented on each slide changed for each participant. The order of the questions, and the randomisation in which the cards were presented were implemented to reduce the possibility that participants would answer without a great deal of thinking.

2.5 Procedure

Participants completed the study in an isolated room, with few visual and auditory distractors within a laboratory within the University. Each participant was provided with a participant information sheet (See appendix A), and a consent form (See appendix B) before completing the study. Participants were to read the participant information sheet and if they wanted to proceed they were to sign the consent form. On completion of the consent form, participants were told that they had half an hour to complete the religiosity questionnaire, CRT questions and reasoning questions, before being handed the religiosity questionnaire which assessed their religiosity levels. Next, participants were presented with a PowerPoint presentation which contained five CRT questions, along with an answer sheet (See appendix D). Participants were instructed to record their answers on the answer sheet. A second PowerPoint was then presented containing a mix of abstract and deontic question. Participants were instructed to circle the answers on the answer sheet provided (See appendix F). The whole study took between 15-30 minutes to complete. On completion of the study, all participant was thanked for taking their time to complete the study and was assured that they would receive their course credits.
2.6 Method of analysis

All of the data was entered, analysed and manipulated using SPSS. A multiple regression was then carried in order to assess which of the predictor variables i.e. the CRT, abstract and deontic reasoning was a better predictor of the criterion variable i.e. religiosity.

A descriptive statistics table was produced that contained the number of times that each card was selected in order to check that the correct cards were being selected, and to allow for comparison of the newly created deontic task (religion based deontic task) to previously established deontic tasks (drinking-age task).

The method of analysis used to analyse the data was a multiple regression, correlating each of the 3 predictor variable predictors to the single criterion variable; the level of religiosity. The regression was used in order to see if any of the predictor variables could predict levels of religiosity, and if so which was a better predictor of religiosity.
CHAPTER THREE
3 RESULTS

3.1 selection task scores

Table 1 shows a breakdown of the number of cards selected for each selection task for both the high and low religiosity groups. This table of selection task scores is used as an easy comparison when looking for differences in the section task, particularly for the abstract task in which a clear difference is expected between the groups.

Table 1. Break down of the number of times a card was selected for each religiosity group

<table>
<thead>
<tr>
<th></th>
<th>Low religiosity</th>
<th></th>
<th>High religiosity</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>P % NotP % Q % NotQ %</td>
<td></td>
<td>P % NotP % Q % NotQ %</td>
<td></td>
</tr>
<tr>
<td>Number/letter</td>
<td>17 73.9 2 8.6 13 56.5 8 34.7</td>
<td></td>
<td>25 75.7 1 3 18 54 9 27</td>
<td></td>
</tr>
<tr>
<td>Word</td>
<td>19 82.6 3 13 17 79.9 5 21.7</td>
<td></td>
<td>28 84.8 6 18 25 75 2 6</td>
<td></td>
</tr>
<tr>
<td>Emoji</td>
<td>20 86.9 3 13 14 60.8 8 34.7</td>
<td></td>
<td>27 81.8 5 15 23 69 4 12</td>
<td></td>
</tr>
<tr>
<td>Religion</td>
<td>19 82.6 3 13 10 43.4 13 56.5</td>
<td></td>
<td>17 51.5 3 9 16 48 18 54</td>
<td></td>
</tr>
<tr>
<td>sport</td>
<td>11 47.8 13 56.5 21 91.3 9 39.1</td>
<td></td>
<td>15 45.4 16 48 27 81 13 39</td>
<td></td>
</tr>
<tr>
<td>Drinking</td>
<td>19 82.6 3 13 12 53.1 7 30.4</td>
<td></td>
<td>28 84.8 2 6 15 45 10 30</td>
<td></td>
</tr>
</tbody>
</table>

% represents the percentage that the card was chosen. For Low religiosity the percentage was calculated out of a total of 23 and 33 for high religiosity.

This study made use of the pollard (Evans, Barston & Pollard, 1983) index to score each card bases on the following principle; +1 if they select the correct card, and -1 if they select an incorrect card. The total scored ranged from -2 to +2

From Table 1 it can be concluded that for both the low and high religiosity groups individuals performed extremely well at identifying the correct P card, whereas performance was below
average for selection of the NotQ card for the low religiosity group, and selection levels was lower again for the higher religious group. However, when looking at the ‘sports’ task in which the correct responses were NotP and Q both groups performed at an average level when selecting the NotP card but performed extremely well when selecting the Q card. In addition, for every task where the correct cards were p and NotQ, individuals from both groups had a higher selection rate for the incorrect Q card than the correct NotQ card. With the exception of the religion task, where those in the low religion group selected the correct NotQ card more than incorrect Q card. Finally, overall it seems that the card selection results are much more consistent for the abstract task than for the deontic task.

### 3.2 Mean scored of CRT

Table 2 presents the total number of correct CRT problems for both religiosity group, where each correct answer was awarded one point.

**Table 2: Total CRT scored for each religiosity group**

<table>
<thead>
<tr>
<th>Religiosity</th>
<th>High religiosity</th>
<th>Low religiosity</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sum of total CRT scores</td>
<td>19</td>
<td>37</td>
<td>56</td>
</tr>
</tbody>
</table>

From Table 2 it is clear to see that lower religiosity group outperformed the higher religiosity group on correctly answering the CRT problems.

### 3.3 Pearson’s correlation

Pearson’s correlation is being used to assess if there is a relationship between the predictor variables and religiosity. In particular, to see if the new measure of intelligence, CRT had a similar relationship with religiosity as previous measures of intelligence.

Table 3. *Pearson’s correlation coefficients for the relationship between religiosity and the 3*
predictor variables \((N = 56)\)

<table>
<thead>
<tr>
<th></th>
<th>Religious</th>
<th>Abstract</th>
<th>Deontic</th>
<th>CRT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Religious</td>
<td>-</td>
<td>.276</td>
<td>.087</td>
<td>.387</td>
</tr>
<tr>
<td>Abstract</td>
<td>.276</td>
<td>-</td>
<td>.259</td>
<td>.449</td>
</tr>
<tr>
<td>Deontic</td>
<td>.087</td>
<td>.259</td>
<td>-</td>
<td>.476</td>
</tr>
<tr>
<td>CRT</td>
<td>.387</td>
<td>.449</td>
<td>.476</td>
<td>-</td>
</tr>
</tbody>
</table>

Table 3 shows the Pearson’s correlation that was carried out to examine the relationship between religiosity level and the predictor variables. From Table 3 it can be seen that CRT had the strongest, significant, positive relationship with religiosity, followed by abstract reasoning that had a weaker, significant, positive relationship with religiosity, and finally deontic reasoning had a very weak, non-significant relationship with religiosity.

### 3.4 Multiple regression assumptions

A multiple regression analysis was carried out in order to assess whether performance on the CRT and abstract reasoning could predict religiosity levels, and if so which was a better predictor. Before the multiple regression was run, the data was examined to see if it satisfied the assumptions needed for a multiple regression analysis. Firstly, a histogram (see appendix H) revealed that the residuals were of a normal distribution. Secondly, a scatter plots (see appendix H) revealed a linearity relationship and no heteroscedasticity of residuals. Thirdly, independence of residuals was determined by inspection of Durbin-Watson statistics which were determined satisfactory. Fourthly, an inspection of Cook’s D statistics showed that there were no multivariate outliers. Finally, a multicollinearity statistic was used, and it revealed that all tolerance values are greater than 0.1, therefore, there were no issues with multicollinearity with this data set.
3.5 Multiple regression

The multiple regression analysis between religion and the three predictor variables was $R = .420$. R squared for the overall model was 17.7% with the standard error of estimate at 1.05. Overall the results were statistically significant: $F (3, 52) = 3.71, p = .017$. The contribution of each predictor variable is shown Table 3.

Table 4. Beta coefficients and associated t and p values for religiosity.

<table>
<thead>
<tr>
<th></th>
<th>Standardised Beta Coefficient</th>
<th>t</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>CRT</td>
<td>.329</td>
<td>2.513</td>
<td>.017</td>
</tr>
<tr>
<td>Deontic</td>
<td>-.232</td>
<td>-.933</td>
<td>.355</td>
</tr>
<tr>
<td>Abstract</td>
<td>.276</td>
<td>.965</td>
<td>.340</td>
</tr>
</tbody>
</table>

It can be seen from Table 4 that CRT was the only significant predictor variable of religion that was statistically significant. Although abstract reasoning also revealed a positive relationship with religion it was not statistically significant. Finally, deontic reasoning had a negative relationship with religion and did not show any statistical significance.

3.6 Summary

To summaries, overall the results were statistically significant. However, CRT was the only positive, significant predictor of religiosity. Both abstract and deontic reasoning were not significant predictors, however, abstract reasoning has a positive relationship with religiosity, unlike deontic reasoning.
CHAPTER FOUR
4. DISCUSSION

4.1 Summary of finding

The present study aimed to investigate three main lines of interest. Firstly, investigate if there was a link between an individual’s performance on abstract reasoning tasks and their level of religious beliefs. Secondly, to examine the reliability of the CRT by trying to replicate Stanovich and West’s (2000) findings and, thirdly, to establish whether CRT or abstract reasoning is a better predictor of an individual’s level of religious belief. This study had four hypotheses, and all were supported by the outcomes of the current studies results, aside from one. The results from this study indicated that CRT was able to replicate the findings from Stanovich and West’s (2000) study which reported a statistically significant relationship between the Scholastic Assessment test and selection tasks reasoning problems. In addition, this study found that those who held higher levels of religious beliefs had decreased performance levels on the CRT, therefore supporting the first hypothesis. Interestingly, this study failed to find a statistically significant relationship between abstract reasoning and an individual’s level of religiosity. However, results from the descriptive statistic table supports the second hypothesis which stated that those individuals with lower levels of religiosity had increased correct card selection for both the P and NotQ on the abstract reasoning tasks, compared to those with higher levels of religiosity. In contrast, the results from the descriptive statistics table do not support the third hypothesis, that hypothesised the card selection for the deontic tasks will remain relatively stable regardless of religiosity level. Finally, due to the results indicated that only the CRT is a statistical predictor of religiosity, whereas abstract reasoning is not, the final hypothesis is supported.

4.2 Interpretations of results with limitations

The first aim of this study was to examine the reliability to the CRT by trying to replicate Stanovich & West’s (2000) study, who made use of a three hour long cognitive ability measure in the form of a Scholastic Assessment test. As a result of the CRT having the highest correlation with cognitive abilities compared to any other cognitive ability predictor, it was hypothesised
that CRT would be a reliable test method. By making use of effect size, it was found that Stanovich & West’s (2000) Scholastic Assessment test has a correlation coefficient of .394 whereas this study, using CRT as the intelligence measure had a correlation coefficient of .449. Therefore, there was a small effect size between the two variables. Based on the small effect size it can be assumed that the first hypothesis was supported, and that CRT is indeed a reliable replicator of the Scholastic Assessment test (Stanovich & West, 2000). The results from this study provides further support to the theory that CRT is a being a superior intelligence measure for predicting various cognitive abilities.

However, although these findings provide support for this studies hypothesis, the use of CRT as an intelligence measure can be further evaluated. Given that CRT is closely related to, and relies heavily on, a numerical ability; the question inevitably arises as to how much of the CRT’s success can be explained by assuming that it is a test of numerical ability as opposed to overall intelligence. This notion is supported by Welsh, Burns & Delfabbro (2013) who’s study concluded that the predictive power of the CRT can largely be explained by numerical ability alone. Furthermore, as it has been established that CRT requires a certain level of numerical ability from the individual; it therefore seems obvious that those who possess prior knowledge and/or experience of how to understand this type of mathematical ability would outperform those who have little knowledge in this area. Therefore, this casts doubt on how many of the individuals in this study had a certain prior level of mathematical ability, as opposed to isolating (and therefore measuring) intelligence alone.

Furthermore, due to the widespread publication of various CRT questions over the past few years, it would be naïve to assume that all participants had not been exposed to such material prior to taking part in the study. This, in combination with the idea of prior mathematical skill discussed above, can impact the results from studies using this method. Recent research that utilised the CRT as a cognitive measure found that 51.4% of their participants declared that they had previously been exposed to at least 1 problem of CRT. According to Welsh, Burns & Delfabbro (2013), the validity of the CRT depends on the participants being unaware of its objective, something which cannot be guaranteed by the researcher. Therefore, once the
participants are aware of the logic behind these questions, whether it be via prior experience and/or skill with these type of mathematical problems, or through prior exposure then the CRT material, then the CRT is essentially invalidated as an effective measure of cognitive reflection for that participant. This has been further supported by the British Psychological Society who state that widespread public disclosure of psychological tests material can cause irreparable harm to their validity ("BPS", 2018. Thus, when considering the results of the CRT it is important to understand that due to a lack of pre-screening there is no way to be sure whether those in the lower religiosity group only scored higher as a result of being exposed to the CRT questions prior to the study or have prior experience with solving such problems. Based on these limitations, for future research, it is suggested that the researcher change the surface problem of the CRT, thus negating the issue with potential prior exposure. Furthermore, a pre-screening test could be implemented to establish how many of the participants have been exposed to the CRT questions before, or those who have experience dealing with similar types of mathematical problems. Further to this, a revised 6 item CRT that has been proposed by Primi, Morsang, Chiesi, Donati & Hamilton, (2015), could be implemented, thus reducing the chances that individuals will achieve higher scored based on the fact they are familiar with the.

The second aim of this study was to examine if there was a link between abstract reasoning (which makes use of type 2 processing) and an individual’s religiosity level. Although not statistically significant, the result still supported one of the hypotheses proposed in this study; those with higher levels of religiosity will select more incorrect cards on the abstract task compared to those with lower levels of religiosity. Not only did these findings support the hypothesis, but these findings are also in-line with Stanovich and West’s (2000) results that stated; system two will differentially trigger those of high analytical intelligence (those with lower levels of religiosity) and will result in improved responses on almost all reasoning tasks that solicit intelligence, and indeed this was the case. Furthermore, this study made use of deontic reasoning tasks, one of which is a long standing deontic task (drinking-age problem). A second deontic problem which was created by Perham & Oaksford (2005), required individuals to select the NotP and Q card. The results from the present study are consistent with the results
from Perham and Oaksford’s (2005) study that found that the NotP and Q cards were selected more frequently. Finally, for the purpose of this study, a religious based deontic problem was created; thus, allowing for a comparison to be made between the high and low religiosity groups, and against the other two deontic problems. Although the newly created religious deontic task devised for this study generated more correct card responses than the long-standing drinking-age problem, it is of interest to note the difference in response rate between the high and low religiosity groups for the religion based deontic tasks. This difference was that Individuals in the low religiosity group had increased correct card selection responses, compared to the high religiosity group. A potential explanation for these findings could be that the higher religiosity group sought to confirm the rule to be true based on their beliefs, as opposed to falsifying the rule like the lower religiosity group appeared to do. Overall, the results from the deontic task did not support the hypothesis that individual’s performance will remain relatively stable regardless of levels of religiosity, as this is a test of logic and was therefore expected based on previous investigation by Stanovich and West (2000).

Previous research has suggested that both the CRT and abstract reasoning makes use of system 2 processing (Stanovich & West, 2000; Pennycook, Ross, Koehler & Fungelsang, 2016) which has subsequently been linked to an individual’s religiosity level. Furthermore, in Stanovich & West’s (2000) study, which made use of deductive reasoning, and concluded that any individual that utilises system 2 processing should be of a higher analytical intelligence and will therefore have improved responses on almost all reasoning tasks that cue intelligence. Based on these previous findings, this study aimed to examine whether the CRT or abstract reasoning would be a better predictor an individual’s level of religiosity, as both make use of system 2 processing. Interestingly, the results from this study reported that the CRT was the only significant predictor of religiosity. These findings provide support for not only an extensive history of studies that indicate that intelligence is a significant predictor of religiosity (Howells, 1982; Sinclair, 1982; Kanzaw, 2010; Ganzanch, Ellis & Gotlibovski, 2013), but more importantly, they support for a growing body of research that has made use of the CRT as an intelligence measure to predict levels of religiosity, as was seen in Pennycook, Ross, Koehler & Fungelsang (2016).
With this said, evidence has been found that shows a positive relationship between intelligence and religiosity when controlling for education in underdeveloped Caribbean islands (Meisenberg, Lawless tambert and Wealon 2006). These findings could suggest that inverse IQ–religiosity relationship is moderated by the degree to which scientific world view is available within society (Meisenberg, Lawless tambert and Wealon 2006). Therefore, these contradictory findings help to encourage continued research on the relationships between intelligence and religiosity and the effect that society has on these variables.

Although the CRT produced significant results, as predicted, the abstract reasoning task did not produce significant results, which is inconsistent with previous findings (Stanovich & West, 2000; Pennycook, Ross, Koehler & Fungelsang, 2016). A possible explanation for the lack of significance in the results could be attributed to a methodical flaw within this study. That is, the sample size being extremely disproportionate to the previous studies sample size. The sample size for this study was fifty-six participants, whereas Stanovich & West (2000) had a sample size of 175 participants and 527 participants for experiments one and two respectively, and Pennycook, Ross, Koehler & Fungelsang (2016) had a sample size of 1067 participant for their study and made use of a meta-analysis containing a sample size of 15078 participants. Therefore, it can be said that this study failed to find significant results for the abstract reasoning task (as was predicted) due to the low sample size which resulted in the null hypothesis being unchallenged therefore producing inconsistent and inconclusive results (Cohen, 1962), therefore a larger sample size may prove to be beneficial. However, although no significance was found, the results showed a positive relationship between religiosity and correct card selection, which can be said to fall in line with findings that Stanovich & West (2000) mentioned. Thus, by highlighting the limitation with the sample size I could prove useful to have a pre-screening tool to determine the required sample size for an appropriate power.

4.3 Further limitations

Further limitation found within this study include the way in which the religiosity questionnaire, CRT and reasoning tasks were administered. Previous studies such Pennycook, Ross, Koelher &
Fungelsang (2016) have argued that running the religious beliefs questionnaire in a separate session to the CRT and reasoning task is the purest way to test whether there is a genuine association between the variables, however this study administered one immediately after the other, thus resulting in a methodological difference, one of which could help explain the unexpected results. However, the order in which the variables were undertaken by participants was in keeping with previous literature. It has been argued that running the beliefs questionnaire after analytical inducing tasks, resulted in the individual’s religious beliefs being suppressed (Pennycook, Ross, Koehler & Fungelsang, 2016). This has led to the conclusion that the order of tasks, rather than the duration between, have more of an impact on the result. Therefore, for future research, this study would suggest repeating the order in which the variables were administered but administer the beliefs questionnaire in a separate session to the other two variables.

Another methodological flaw, which has been briefly mentioned, is the sample size. Based on previous literature, it would seem fitting that a larger sample size would potentially lead to significant results on both the CRT and abstract reasoning variables. In doing so, research would then be able to begin to reach definitive conclusion as to whether the CRT or abstract reasoning (which both make use of system two processing) is a better predictor of religiosity.

Finally, this study did not control for specific religions and sexes, thus for future research is may be useful to profile differences between genders within specific religions and see if differences exist on performance both on the CRT and abstract reasoning task.

4.4 Conclusion

In summary, although the results of this current study found that abstract reasoning was not a significant predictor of religiosity, it did fall within the domains of previous literature by highlighting that abstract reasoning has a positive relationship with religion. However, this study does find support for previous literature by findings CRT is a significant predictor of religiosity level. This study suggests that with a larger sample size, the addition of an updated version of the CRT tasks, and perhaps controlling for educational background, it may be
possible to produce statistically significant results between reasoning and religiosity (as was first expected) therefore allowing future research to examine whether the CRT or abstract reasoning is a better predictor or religiosity.
5. REFERENCES


Kahneman, D., & Tversky, A. (1973). On the psychology of prediction. Psychological review,


Shenhav, A., Rand, D., & Greene, J. (2012). Divine intuition: Cognitive style influences belief in


6. APPENDICES

Appendix A: Participant information sheet

Title of project: Impact of religiosity on reasoning performance

Participant Information sheet.

The study
The aim of this study is to gain an insight into the processing differences between religious and non-religious and how this impacts upon an abstract reasoning task and deontic selection task. This will be assessed by the completion of a religiosity belief questionnaire, followed by a Cognitive Reflection Task (CRT) and then an abstract reasoning and deontic selection task.

What would happen if you agree to take part in this study?
If you agree to take part in this study you will be given a consent form to complete before beginning the study. On completion of the consent form you will firstly be given a religiosity questionnaire to complete to assess your level of religiosity. Next you will be presented with six Cognitive Reflection Tasks to complete and record your answers. On completion of the CRT task, you will be given a mix of six abstract and deontic reasoning tasks to complete, and again you will need to record your answers on the answer sheet provided.

Exclusion criteria
Those who complete the consent form will be able to take part in the study.

Potential risk
There is extremely low minimal risks in taking part in the study, however, the main risk identified are;

i. Distress when completing the abstract reasoning task, deontic selection task and CRT tasks.

ii. The participants becoming bored and not giving their undivided attention to the tasks, leading to unreliable results.

If any aspect of the study makes you distressed, please contact my supervisor Nick Perham (nperham@cardiffmet.ac.uk). Further support may be obtained from https://www.samaritans.org/.

Potential benefit
There is unlikely to be any direct benefit to you. However, the data will be reported in my Project and possibly in a publication.

Withdrawal, anonymity and confidentiality.
All results will remain anonymous at all times as no identifying information will be taken. Results will be kept confidential as only my supervisor and I will see the data. All results obtained will be kept on a password locked computer with only access being granted to the researcher and project supervisor.
If you have any questions about this study, please contact:

nperham@cardiffmet.ac.uk
Appendix B: Participant consent form

Participant consent form

Reference Number:
Participant name or Study ID Number:
Title of project: Impact of religiosity on reasoning performance
Name of researcher: Kyle Martin McGovern

Participant to complete this section: Please initial each box

1. I confirm that I have read and understand the information sheet for the above study. I have had the opportunity to consider the Information, ask questions and have had these answered satisfactory.

2. I understand that my participation is voluntary and that I am free to withdraw up to two weeks after taking part in the study, without giving any reason.

3. I agree to take part in the given study.

___________________________________________________       _______________
Signature of Participant                                                                               Date

___________________________________________________       _______________
Name of person taking consent                                                                 Date

___________________________________________________
Signature of person taking consent.
Appendix C: the CRT PowerPoint

Press the space bar once you are ready to start, and to progress to the next slide.

If three elves can wrap six toys in half an hour, how many elves are needed to wrap twenty toys in one hour?

Write your answer on the line titled 'Elves'

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

Write your answer on the line titled 'Students'
In an athletics team, tall members are three times more likely to win a medal than short members. This year, the team has won 60 medals so far. How many of these have been won by short athletes?

Write your answer on the line titled ‘Athletes’

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?

Write your answer on the line titled ‘Bat and Ball’

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

Write your answer on the line titled ‘Lily pad’
Appendix D: the CRT answer sheet

Student number__________________

CRT answer sheet: please write your answers on the lines provided

Elves: _______________________________

Students: ______________________________

Athletes: ______________________________

Bat and Ball__________________________

Lily pads: ______________________________
Appendix E: Reasoning PowerPoint

You are about to be presented with six different reasoning tasks. Read each one carefully and answer the questions on the answer sheet provided. Once you have answered the question press enter to proceed to the next question.

If a card has a vowel on one side, then it has an even number on the other side. Which cards need to be turned over to determine this statement to be true or not?

A, D, 4, 7

Please circle your answers on the answer sheet provided.

The Church of Utopia are checking to see that their churches are following the rules regarding who can be married in them.

One rule they have to follow is:

If a person wishes to be married in a church then they must have been baptized.

You have four cards with pieces of information about weddings that have taken place. On one side of the card is where the person got married and on the other side of the card is whether they were baptized or not. However, you can only see one piece of information.

You can see the following cards:

married in a church, married in a registry office, baptized, not baptized

Which card or cards do you definitely need to turn over to decide whether the Church of Utopia was following the rule or not?

Please circle your answers on the answer sheet provided.
If a card has a name of a yellow fruit on the one side then it has a month starting with ‘J’ on the other. Which cards need to be turned over to determine this statement to be true or not?

Banana, Orange, January, December

Please circle your answers on the answer sheet provided.

You are the manager of your local team and are in the final of the cup. You are confident about your team's commitment and ability but have reservations about the referee. In the past this particular referee has made some incorrect decisions concerning injuries to players. Players have been made to leave the pitch when they did not need to. Obviously if your player are made to leave the pitch when they shouldn’t it weakens your team. As a result you ask a member of your staff to record the referee’s decisions. If the referee has not been fair you can have a word with the match official. A rule the referee is supposed to follow is:

IF THERE IS A BLOOD INJURY THEN THE PLAYER MUST LEAVE THE PITCH

On the next slide you will be briefly presented with the piece of information you can see from the four forms. After viewing all four pieces together you will see each piece individually. During this time you will be asked whether you think you must ask for the other pieces of information to determine whether the referee has been weakening your team unnecessarily.

If you think you must ask for the other information then circle 'Y'. If you do not think you must ask for the other information then circle 'N'.

BLOOD
Do you think you must ask whether the player left the pitch? Yes or no?

ANKLE
Do you think you must ask whether the player left the pitch? Yes or no?

LEAVE
Do you think you must ask what injury the player had? Yes or no?

STAY
Do you think you must ask what injury the player had? Yes or no?

Please circle Yes or No on the answer sheet provided.
If a card has a face with a winking eye on the one side then it has a thumbs up on the other. Which cards need to be turned over to determine this card to be true or not?

Please circle your answers on the answer sheet provided.

You are a police officer on duty
You have information about four people in a bar

If a person is drinking beer then the person must be over 18 years of age

Which card or cards do you definitely need to turn over to determine whether people are following the rule?

Beer, Coke, 16, 22

Please circle your answers on the answer sheet provided.
Appendix F: Reasoning answer sheet

Student number__________________

Reasoning questions answer sheet:
Question 1: A, D, 4, 7 (Please circle your answers)

Question 2: married in a church, married in a registry office, baptized, not baptized (Please circles your answers)

Question 3: Banana, orange, January, December (Please circle your answers)

Question 4: Please circle Yes or no
BLOOD
Do you think you must ask whether the player left the pitch? Yes or no?
ANKLE
Do you think you must ask whether the player left the pitch? Yes or no?
LEAVE
Do you think you must ask what injury the player had? Yes or no?
STAY
Do you think you must ask what injury the player had? Yes or no?

Question 5: Please circle your answers

Question 6: Beer, coke, 16, 22 (Please circle your answers)
Appendix G: A histogram revealing that the residuals were or normal distribution.

Appendix H: A scatterplot revealing a linearity relationship and no heteroscedasticity of residuals.
7. DECLARATION OF WORD COUNT

- Abstract: 273
- Introduction: 3203
- Method: 1531
- Results: 991
- Discussion: 2334

Total (excluding abstract): 8059

Singed

Date

_______20.4.18_______