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The Impact of Religious Schema on Critical Thinking Skills

Matthew Kirby
Utah State University

THE IMPACT OF RELIGIOUS SCHEMA ON

CRITICAL THINKING SKILLS

by

Matthew J. Kirby

A thesis submitted in partial fulfillment
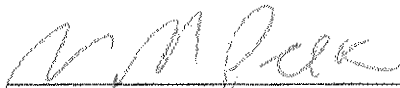of the requirements for the degree

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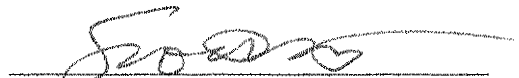Approved:

_____
Gretchen Gimpel Peacock, Ph.D.
Major Professor

_____
Scott Bates, Ph.D.
Committee Member

_____
Norman Jones, Ph.D.
Committee Member

_____
Byron R. Burnham, Ed.D.
Dean of Graduate Studies

UTAH STATE UNIVERSITY
Logan, Utah

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ABSTRACT

The Religious Schema on

Critical Thinking Skills

by

Matthew J. Kirby, Educational Specialist

Utah State University, 2008

Major Professor: Dr. Gretchen Gimpel Peacock
Department: Psychology

The purpose of this study was to examine the relationship between critical

thinking and religious schema as represented by religious orientation. Past research has

included religious belief within the larger construct of paranormal belief, and

demonstrated a correlation between high levels of paranormal belief and poor critical

thinking skills. Studies in the psychology of religion suggested that a more complex

religious measure based on religious orientation was necessary to understand these

correlations. Additionally, schema theory offered a cognitive framework within which to

experimentally test the cause of these correlations. This study found that primed

religious schema did not account for the relationship between paranormal/religious belief

and critical thinking skills. This study did find that poor critical thinking performance

was predicted by higher levels of extrinsic religious orientation.

(58 pages)

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CHAPTER I

INTRODUCTION AND PROBLEM STATEMENT

Critical thinking has been defined as "reasonable, reflective thinking that is focused on deciding what to believe and do" (Norris & Ennis, 1989, p. 1), and is an increasingly important skill in the modern world. Educators, researchers, and legislators have paid much attention to how to increase critical thinking skills in students. Studies have likewise been conducted to determine how numerous factors, such as age, education, and creativity, are related to critical thinking ability (see Follman, 2002 for a review). Because critical thinking helps determine belief, that is, determine whether an idea should be treated as if it were true (Gilbert, 1991), many researchers have focused on how holding different beliefs relates to critical thinking ability.

Additionally, the results of several studies suggest that prior beliefs can impact critical thinking ability (Evans, Barston, & Pollard, 1983; George, 1995; Greenhoot, Semb, Colombo, & Schreiber, 2004; Lawson & Weser, 1990; Lawson & Worsnop, 1992). Specifically, researchers have shown that paranormal belief is negatively correlated with certain critical thinking skills such as inference, induction, and deduction (Alcock & Otis, 1980; Merla-Ramos, 1999; Morgan & Morgan, 1998; Tobacyk & Milford, 1982; Wierzbicki, 1985). Paranormal belief has been defined as belief that is inexplicable given current scientific understanding, or explicable only with major revisions to current scientific understanding, and is incompatible with normative beliefs (Tobacyk & Milford, 1983). By this definition, religious belief has been considered by many to be a paranormal belief. It has been similarly associated with errors in critical

thinking; however differential findings and correlational data are insufficient to draw conclusions regarding causality (Hergovich & Arendasy, 2005; Merla-Ramos; Morgan & Morgan; Roe, 1999).

Some researchers suggest that religious belief can be thought of as a religious schema (Lau, 1989; McIntosh, 1995). Schemata are theoretical cognitive representations of knowledge and memory that impact cognitive processing. When activated or primed by incoming stimuli, they affect subsequent processing for the duration of their activity (Narvaez & Bock, 2002). Schema can therefore be tested experimentally through deliberate priming and observation of their effects. Previous research on critical thinking and belief that did not take schema priming into account would be limited by procedural order. For example, a religious belief scale given prior to a critical thinking task could inadvertently activate religious schema. An approach to religious belief where schema activation is experimentally controlled for can therefore provide a framework within which to gain a better understanding of the relationship between religious belief and critical thinking skills.

The purpose of this study was to determine whether or not an individual's religious schema can account for the observed relationship between religious beliefs and critical thinking skills. It is hoped that the findings of this study will help to better understand aspects of both the psychology of religion, and critical thinking. Critical thinking is an essential skill, and it is important to gain a better understanding of how religious schema impact critical thinking performance.

The following hypotheses and research questions guided this study.

1. Is there a difference in critical thinking ability when religious schema are primed? It was hypothesized that those individuals who have primed religious schema would have poorer critical thinking performance than those individuals who do not have primed religious schema.

2. What predicts critical thinking performance: schema (religious vs. neutral), intrinsic religious orientation, and/or extrinsic religious orientation? It was hypothesized that schema priming would be a stronger predictor of critical thinking performance than intrinsic or extrinsic religious orientation. It was also hypothesized that although religious orientation would have less predictive value for critical thinking than schema priming, higher levels of intrinsic orientation would be a stronger predictor of poor critical thinking skills than extrinsic orientation.

CHAPTER II

REVIEW OF LITERATURE

The proposed study draws together three areas of research in cognitive psychology and social psychology. Each area is important to understanding the relationship being investigated, and so the following review of literature will address the relevant findings from research on critical thinking, critical thinking and belief, and religious belief and religious schema.

Critical Thinking

Critical thinking has been defined as the use of directed cognitive skills to obtain the most favorable or desired outcome in a given situation (Halpern, 1998), and as "reasonable, reflective thinking that is focused on deciding what to believe and do," (Norris & Ennis, 1989, p. 1). It involves the applied use of knowledge, inference (deriving conclusions from facts), deductive and inductive reasoning (applying rules of logic), and meta-cognition (awareness and self-regulation of cognitive processes; Bruning, Schraw, Norby, & Ronning, 2004). It utilizes higher order cognitive skills of judgment, analysis, and synthesis (Halpern). It is a skill that is under increasing demand by employers and educators.

Hunt's (1995) analysis of the current workforce and projections for the nature of the future workplace revealed a discrepancy between the qualities of the present pool of employees available for hire, and the qualities that will be expected by an employer in the future. The nature of work is shifting from labor-based tasks to cognitive-based

tasks. Employers will increasingly place greater emphasis on higher education, and seek

individuals possessing cognitive flexibility, with the capacity to handle multiple,

complex problems that require abstract reasoning and critical thinking abilities (Hunt).

Additionally, the dissemination of information through mass media, made increasingly

possible by recent technologies, presented the average individual with a vast amount of

information to critically consider (Douglas, 2000). Hunt concluded that there is a deficit

in average employee critical thinking ability, and that unless measures are taken to foster

critical thinking the population will be unprepared to meet future demand.

Legislators have declared a national need to teach students critical thinking skills

(National Education Goals Panel, 1991; Pithers, 2000). Sternberg (1985) observed that

there has never been "a greater push to teach children to think critically." To this end,

researchers have also examined how different factors correlate and interact with critical

thinking ability (see Follman, 2002 for a review). Research has demonstrated moderate-

to-high correlations between critical thinking and scholastic achievement. Students with

higher critical thinking ability do better on measures of scholastic success such as GPA,

achievement testing, and college entrance exams (Follman). Educators and researchers

have demonstrated that students can be taught to think critically, but that individuals have

difficulty generalizing or transferring thinking skills learned in one domain to other

domains (Halpern, 1998; Kuhn, 1999; Pithers, 2000; Swartz & Perkins, 1990). Given the

importance of critical thinking, it becomes essential to understand those factors that

influence critical thinking.

Critical Thinking and Belief

Researchers have demonstrated that prior knowledge and beliefs affect reasoning ability (Evans et al., 1983; George, 1995; Greenhoot et al., 2004; Lawson & Weser, 1990; Lawson & Worsnop, 1992). When presented with a reasoning task requiring a decision as to whether or not a given conclusion is tenable, individuals typically defer to prior beliefs rather than the evidence provided to make the decision. In other words, individuals tend to maintain those beliefs already held, even in the face of evidence to the contrary.

In a study by Evans and colleagues (1983) participants were given logical arguments and were asked to rate the argument as either valid or invalid. Results indicated that when an invalid argument's conclusion was believable to the subject, they rated that argument as being valid, whereas the validity of arguments with unbelievable conclusions was assessed more accurately. Individuals tended to employ greater logical reasoning when they disagreed with the argument's conclusion and less logical reasoning when the conclusion accorded with their prior beliefs.

Educational researchers have likewise shown that students have greater difficulty learning new material when that material conflicts with prior beliefs (Chambliss, 1994; Kardash & Scholes, 1995). This phenomenon is explained by the concept of belief perseverance, or adherence to a belief to an unreasonable degree, as when the belief lacks evidential support or is shown to be false by contradicting evidence. Such is often the case with paranormal beliefs in extrasensory perception (ESP) and UFOs, or with religious beliefs in God and life after death, that are espoused without empirical evidence

or in spite of evidence to the contrary. Belief perseverance of this nature can appear, at least outwardly, as if the believer lacks critical thinking or reasoning ability. This is perhaps why researchers have turned their attention to the relationship between paranormal belief and critical thinking.

Paranormal believers have been shown to have deficient critical thinking skills by several researchers (Alcock & Otis, 1980; Irwin, 1991; Merla-Ramos, 1999; Morgan & Morgan, 1998; Tobacyk & Milford, 1982; Wierzbicki, 1985). Methodology in each of these studies was relatively consistent (see Table 1). In each case subjects were given scales to measure their paranormal belief, commonly the Paranormal Belief Scale developed by Tobacyk and Milford (1983). This measure contains subscales for different areas of paranormal belief, including traditional religious belief, psi (psychic) belief, witchcraft, superstition, spiritualism, extraordinary life forms, and precognition. Participants also completed a task designed to measure some aspect of critical thinking ability, and the scores on Paranormal Belief Scale and critical thinking measure were then correlated. Alcock and Otis, and Morgan and Morgan all used standardized tests of critical thinking that examined multiple skill areas. Irwin, Merla-Ramos, Tobacyk and Milford, and Wierzbicki used tests of inference and syllogistic reasoning, which did not look at all skill areas involved in critical thinking.

Of those six studies, Alcock and Otis (1980), Wierzbicki (1985), and Tobacyk and Milford (1982) found significant global correlations such that higher paranormal belief scores were associated with poor critical thinking or reasoning skills. Irwin (1991), Merla-Ramos (1999), and Morgan and Morgan (1998) did not find the same relationship. Merla-Ramos found that poor reasoning abilities emerged only when the

Table 1

Studies on Belief and Critical Thinking

	Measure	
Study	Belief	Critical thinking
Alcock & Otis (1980)	Belief in Parapschology Scale	Watson-Glaser Critical Thinking Appraisal, and Cornell Critical Thinking Test
Irwin (1991)	Paranormal Belief Scale	Test of Syllogistic Reasoning
Merla-Ramos (1999)	Paranormal Belief Scale, Index of Religiousness, and Age Universal Religious Orientation Scale	Syllogism Questionnaire
Morgan & Morgan (1998)	Paranormal Belief Scale	Watson-Glaser Critical Thinking Appraisal
Tobacyk & Milford (1982)	Irrational Belief Scale	Uncritical Inference Test
Wierzbicki (1985)	Paranormal Belief Scale	Syllogistic Reasoning Test

critical thinking item (logical syllogisms for this study) contained content relevant to paranormal or religious belief. Morgan and Morgan found correlations only on certain dimensions of belief and critical thinking, but high scores on the religious belief scale were correlated with poor performance on evaluation of arguments. Irwin found only high levels of traditional religious belief to be correlated with poor reasoning ability.

It is important to note that experimental procedures differed for both Merla-Ramos (1999) and Morgan and Morgan (1998). In those studies that found global correlations (Alcock & Otis, 1980; Tobacy & Milford, 1982; Wierzbicki, 1985) the rating scales of paranormal belief were given immediately *prior* to the critical thinking items. In Merla-Ramos' study, there was a delay of several days between the rating of paranormal belief and the administration of the critical thinking items. Morgan and

Morgan gave the paranormal belief scale *after* the critical thinking items. These differences in procedure are important and their potential implications will be addressed later in this review. Irwin's study did not fit with this pattern, having administered the Paranormal Belief Scale prior to the reasoning task, but failing to find a relationship between global paranormal belief and reasoning ability. While Irwin, Merla-Ramos, and Morgan and Morgan did not find global correlations, they did identify significant correlations on narrower variables and subscales. Of particular interest to this review are the findings on religious belief as contained within the larger context of paranormal belief.

The inclusion of religious belief within a larger paranormal belief scale has been a source of debate. The traditional religious belief subscale on the Paranormal Belief Scale (Tobacyk & Milford, 1983) comprises four items on life after death, and the existence of God, the devil, heaven, and hell. Some contend that religious belief and paranormal belief share similar key features. Researchers argue that both religious and paranormal beliefs are held in the absence of empirical evidence, and therefore share space at one end of a continuum where beliefs held because of scientific or empirical evidence occupy the opposite pole (Tobacyk & Milford). Others point to research findings related to religious belief and paranormal belief to argue for a distinction (Merla-Ramos, 1999). Irwin's (1991) study found that paranormal believers did not do more poorly on a test of syllogistic reasoning. However, those individuals endorsing high levels of religious belief did significantly more poorly. Irwin suggested that the differential performance of religious believers and paranormal believers indicates that the two beliefs are separate phenomena, and that they should be treated as such in research.

Williams, Taylor, and Hintze (1989) argued that religion and religious beliefs are multidimensional, and therefore cannot be understood as a unitary construct measured by a single subscale on the Paranormal Belief Scale (Tobacyk & Milford, 1983). They conducted a correlational study comparing Tobacyk and Milford's paranormal belief scale (including the original religious belief dimension as well as added dimensions of belief in science and astrology), with Allport and Ross' (1967) Religious Orientation Scale, a more complex measure of religious orientation. Their findings suggested that when religious belief is broken into extrinsic, intrinsic, indiscriminate, and nonreligious orientations, a much more dynamic relationship with paranormal belief emerges.

Results from the Williams and colleagues' (1989) study showed that this religious orientation was highly related to belief in religion, science, and the paranormal. Intrinsically oriented individuals, those who have internalized their beliefs and attempt to follow them completely, are significantly lower than all other groups in belief in science, superstition, extraordinary life forms and astrology, but high in belief in religion, witchcraft, and precognition. On the paranormal belief scale, the items referencing witchcraft deal with the existence of black magic and witches. As Williams and colleagues explained, these have a place in the Judeo-Christian tradition as powers antithetical to God, so belief in their existence is not unexpected among religious intrinsics. Extrinsically oriented individuals, those for whom religion serves an external function and lacks internalization, reported inverse levels of belief on these same factors (low belief in religion, witchcraft, and precognition, and high belief in science, extraordinary life-forms, superstition and astrology). Given these findings it is important

that any research attempting to understand religion must do so with consideration of its multidimensional nature.

Of those studies dealing with paranormal belief and critical thinking, only Merla-Ramos (1999) treated religious belief with the complexity suggested by Williams and colleagues (1989). Morgan and Morgan (1998) found that traditional religious belief correlated negatively with the ability to evaluate arguments, but used only the religious belief dimension of the Paranormal Belief Scale (Tobacyk & Milford, 1983). In contrast, Merla-Ramos' (1999) study compared performance on logical syllogisms with a paranormal belief scale but also utilized the Index of Religiousness (Zuckerman, Kasl & Ostfeld, 1984) and the Age Universal Religious Orientation Scale (Gorsuch & McPherson, 1989). In line with research on the effects of prior beliefs on critical thinking (Evans et al., 1983), subjects performed more poorly on items with content relevant to their reported beliefs. Subjects who rated themselves highly on religious belief scales performed more poorly than nonbelievers when the item contained content relevant to religious belief, indicating that individuals with religious beliefs are differentially critical of information as it relates to prior belief.

Although previous research has demonstrated a correlational relationship between religious belief and poor critical thinking ability, none of the research conducted in this area has demonstrated a causal relationship. Additionally, some researchers have failed to replicate previous findings, indicating that the relationship being examined is still not well understood. Roe (1999) found no difference between the abilities of paranormal believers and nonbelievers to critically evaluate the competence of experimental studies,

and Hergovich and Arendasy (2005) found no difference when comparing paranormal believers to nonbelievers on two tests of critical thinking.

Future research should attempt to isolate and experimentally address the relationship between critical thinking and religious belief, taking into account the multidimensional nature of religious orientation. Cognitive schemata offer a potential means by which this relationship can be examined.

Religious Belief and Religious Schema

Researchers have suggested that religion and religious belief can be conceptualized as a cognitive schema (Lau, 1989; McIntosh, 1995). Schemata are structures of knowledge and memory. They are conceptual representations of an individual's accumulated experience (Bruning et al., 2004). In other words, one could have a schema for a bird, called a memory object or concept, a schema for a zoo environment, called a cognitive field, or a schema for the actual experience of enjoying that same zoo, known as a script. The largest schemata, called mental models, contain and affect numerous smaller schemata within them (Dutke, 1996; Johnson-Laird, 1983).

Each schema consists of slots and corresponding values for each slot. A bird schema might include slots for physical features and size, among others. The slot for physical features would include values for what are typical characteristics of birds, such as feathers and wings. Thus, when we encounter a bird, we recognize it as such because it matches acceptably with our schema for bird (Anderson, 2000).

Our perception is filtered through our schemata as we attempt to understand what it is that we experience. Our schemata can actually shape our perception and our

memory in order to force something to fit within our framework, functioning as "interpreters of stimuli" (Narvaez & Bock, 2002, p. 298), and thereby become the basis of our memory by affecting how information from our environment is processed, interpreted, organized, stored, and retrieved (Rumelhart, 1981; Rumelhart & Ortony, 1977), with interpreting comprising perhaps the strongest role. Schemas are hierarchical in organization (Anderson, 2000; Derry, 1996), and the largest of these, mental models, have tremendous influence over subordinate schemas and affect how we function and interact with our environment on a more global scale.

McIntosh (1995) has suggested that religion and religious belief function in the same way as a large schema, or mental model, providing an extensive framework by which experiences are interpreted. More specifically, McIntosh (1995) suggested that a religious schema construct can be represented by an intrinsic religious orientation as delineated by Allport and Ross (1967). Donahue (1985) referred to intrinsic religiousness as "a meaning endowing framework in terms of which all of life is understood" (p. 400), functions that McIntosh sees as evidence for having a developed religious schema.

Researchers have conducted studies supporting the existence of religious schemata. In a study on values (Lau, 1989) religious believers and nonbelievers rated the importance of schema-relevant values (e.g., being moral and nonegoistic), and values that were not schema-relevant (e.g., academic achievement). Individuals classified as religious believers endorsed values relevant to religious schema significantly more highly than nonbelievers. Moreover, the differences on schema-relevant values disappeared when statistically controlling for religious belief. Spencer and McIntosh (1990) found

that individuals with religious schema had significantly faster response times than individuals without religious schema when asked whether a religious adjective described them.

Further evidence validating both the presence of cognitive religious representations and the intrinsic/extrinsic framework has emerged from research using the Implicit Associations Test (IAT) methodology. In the IAT methodology, participants are presented with simple stimuli, such as words on a computer screen, and are asked to classify it into one of two categories as quickly as possible (Fazio & Olsen, 2003). By this method, researchers are able to access what are implicit, rather than explicit associations. Wenger and Yarbrough (2005) compared explicit identification with religious orientation on a rating scale to implicit identification with religious orientation in an IAT study and found consistency between the two. The orientation endorsed by participants on the religious orientation scale matched the orientation revealed in their implicit identification, indicating that an intrinsic/extrinsic orientation is a construct internal to the individual. Therefore, when an individual completes the Age Universal Religious Orientation Scale, their responses can be viewed as evidence for a true religious motivation, and not as a manifestation of another process, such as the social desirability or expectation of a particular response. These three studies (Lau, 1989; Spencer & McIntosh, 1990; Wenger & Yarbrough) imply that a cognitive representation exists within religious believers that affects the way they process stimuli.

Critics point out that McIntosh (1995) is using schemata too broadly (Paloutzian, & Smith, 1995). In particular they indicate that unlike McIntosh's "always on" conceptualization, schemata are activated and deactivated according to need and

environmental encounters. Thus, the religion schema would be activated only if the individual were presented with enough relevant stimuli. In light of spreading activation theory, this is not necessarily the case. There is substantial evidence that memory structures are organized in a propositional network of related concepts (Anderson, 2000). According to this cognitive model of spreading activation, schemata that are semantically related will activate or prime one another when either or the other becomes activated. The bird from the previous example might prime the schema for worm, as the two are often linked together (as in "The early bird gets the worm"). This secondary activation is not directional, and so highly interconnected schemata are more likely to become activated as they can be triggered by numerous semantic links (Anderson). A large schema, such as one for religion, would be highly connected, and therefore easily primed. So it may not be that the religious schema is "always on," but more accurately, the religious schema is frequently primed.

Randolf-Seng and Nielsen (2007) used primed religious representations to test honesty. Participants in this study unscrambled sentences that contained religious, sports-related, or neutral words. They were then given an unrelated task with the opportunity and incentive to cheat on that task. Results showed that participants with primed religious representations, whether of intrinsic orientation or not, cheated less than those without primed religious representations. These results support the hypothesis that the priming or activation of religious schema can influence behavior. These results show that religious schema offer a method for experimentally treating the effects of religious belief.

These findings are also salient to the differing procedures implemented by researchers of critical thinking and paranormal belief. Those studies in which the participants were given the paranormal belief scale immediately prior to the critical-thinking task showed the largest correlations between paranormal belief and poor critical thinking. The remaining two studies either had a significant amount of time between the administration of the belief scale and critical-thinking items, allowing for deactivation of schemata, or reversed the presentation of the scales mitigating the effects of priming. Thus, it is possible that the differing outcomes can be attributed to the activation or lack of activation of relevant schemata brought on by procedural variability. Future research should attempt to control for this possibility, however, schema activation is not the only process offering an approach to understanding previous findings.

Another possible explanation for the poorer critical thinking performance among paranormal and religious believers is the concept of stereotype threat first introduced by Steele and Aronson (1995). Stereotype threat can occur when an individual from a particular social group faces a task about which there exist stereotypes relevant to the performance of members of the social group to which they belong. Steele and Aronson looked at the intellectual performance of African Americans, and found that when African American students were aware of the diagnostic nature of an intellectual task, they performance more poorly. The authors concluded that the negative stereotypes about African Americans' cognitive or academic abilities threatened the participants and adversely affected their performance. Subsequent studies have identified the deleterious influence of stereotype threats related to age, sex, socioeconomic status, among other social groups (see Smith, 2004, for a review). With regard to paranormal or religious

believers, it is possible that the process of stereotype threat impacted critical thinking performance if the participants were aware of negative stereotypes. A rating scale examining paranormal or religious belief followed by a test of critical thinking could potentially threaten participants if they believed that a stereotype of believers as noncritical thinkers existed.

Conclusion

Past research has indicated a possible relationship between religious belief and critical thinking, but procedural problems and inadequate measurement have produced inconclusive results. Cognitive psychology suggests a framework in which religious schemata might be used experimentally to demonstrate whether the active presence of religious belief causes deficits in critical thinking skills. A multidimensional approach to critical thinking and religious belief is suggested by past research. Measures of critical thinking should include multiple skill areas, and measures of religious belief should take into account the dynamic nature of religious orientation.

CHAPTER III

METHODS

Participants

Participants were 55 undergraduate students enrolled in introductory psychology classes at Utah State University. Participants represented 20 different college majors, with the highest percentage reported in psychology (23.6%). Ages ranged from 18 to 51, with a mean age of 21.86. Of the sample pool, 45.5% were female. Because the focus of this study was on understanding the relationship between critical-thinking performance and religious schema, questions about participants' religious beliefs and practices were important for understanding the sample population. When examining religious characteristics, the sample was rather homogenous. Nearly 75% of participants reported an affiliation with The Church of Jesus Christ of Latter-day Saints (LDS), and the same percentage of participants reported attending some type of religious education in the past. Sixty-five percent reported that they see themselves practicing their present religion for the rest of their lives, and just over half the sample reported that they view their religious beliefs as more correct than the beliefs of other religions. See Tables 2, 3, and 4 for complete demographic information.

Materials

Two passages were developed for this study: a religious passage and a neutral passage. In order to develop the religious passage, which was intended to elicit the activation of a religious schema, several different articles and essays from various

Table 2

Demographic Characteristics Frequencies

Variable	Neutral passage group		Religious passage group		Total sample	
	n	%	*n*	%	*n*	%
Gender						
Male	12	44.4	17	60.7	29	52.7
Female	14	51.9	11	39.3	25	45.5
Religious affiliation						
None	3	11.1	4	14.3	7	12.7
LDS	21	77.8	20	71.4	41	74.5
Catholic	1	3.7	1	3.6	2	3.6
Protestant	1	3.7	3	10.7	4	7.2
Attend religious classes (current)						
Yes	16	59.3	14	50	30	54.5
No	7	25.9	10	35.7	17	30.9
Attend religious classes (past)						
Yes	21	77.8	20	71.4	41	74.5
No	1	3.7	3	10.7	4	7.3

Table 3

Demographic Characteristics Means

Variable	Neutral passage group		Religious passage group		Total sample	
	n	%	*n*	%	*n*	%
Age	26	21.27	25	22.48	51	21.86
Years of current religious courses	16	6.19	14	3.79	29	4.55
Years of past religious courses	20	7.5	18	4.44	38	6.05

Table 4

Response Percentages for Religious Commitment Questions

Variable	Neutral passage group		Religious passage group		Total sample	
	n	%	n	%	n	%
I consider myself to be an active participant in my religious.						
Not true of me	5	18.5	3	10.7	8	14.5
Somewhat true of me	0	0	2	7.1	2	3.6
True of me	6	22.2	3	10.7	9	16.4
Very true of me	12	44.4	17	60.7	29	52.7
I see myself practicing my present religious for the rest of my life.						
Not true of me	2	7.4	0	0	2	3.6
Somewhat true of me	2	7.4	2	7.1	4	7.3
True of me	4	14.8	2	7.1	6	10.9
Very true of me	15	55.6	21	75	36	65.5
I believe that my religious beliefs are more correct than the beliefs of other religions.						
Not true of me	2	7.4	0	0	2	3.6
Somewhat true of me	3	11.1	5	17.9	8	14.5
True of me	5	18.5	3	10.7	8	14.5
Very true of me	13	48.1	16	57.1	29	52.7

periodicals and websites on a range of topics salient to religious beliefs were reviewed.

These topics included the Eucharist, personal salvation, and controversial subjects such

as stem-cell research, abortion, same-sex marriage, and intelligent design. Each passage

was weighed by the primary investigator and supervising faculty member for its content

and the response it was likely to elicit. Passages deemed likely to elicit an affective

response in participants were discarded in favor of passages deemed likely to elicit a

cognitive response. Also, passages containing content specific to a particular

denomination were discarded in favor of denomination-neutral material. Based on these

criteria, a passage on intelligent design was selected for use in this study (see Appendix A). In order to develop the neutral passage sources were again drawn from periodicals. Articles considered included factual information on such topics as climate change, the United States economy, and the reproductive cycle of salmon. These passages were reviewed and eliminated by the primary investigator and a supervising faculty member based on the topic's potential relevance or connection to religious issues. The article on salmon was chosen based on these criteria (see Appendix B).

The Cornell Critical Thinking Test (CCTT), Level X (Ennis, Millman, & Tomko, 1985), a test used in previous research on critical thinking and paranormal belief was used to evaluate critical thinking. This is a 52-item test designed for 4th through 14th graders, which included the target population. The aspects of critical thinking measured were: induction (judging whether facts support a hypothesis), deduction (deciding if a conclusion follows from the premises), observation (attending to what is said, by whom it is said, and under what circumstances), credibility (judging which statement is more believable), and assumptions (identifying what is assumed in an argument). The test produced a global critical-thinking score, as well as scores for the subscale skills. In this test, respondents were presented with statements, and chose the appropriate response from three choices. The test manual reported internal consistency estimates for Level X of the CCTT as ranging from .67 to .90, and convergent validity with the Watson Glaser Critical Thinking Appraisal (Watson & Glaser, 1980) as ranging from $r = .41$ to .49 for a sample of high school students (Ennis et al.). Frisby (1992) reported that individuals with higher levels of education scored significantly higher on the CCTT than did individuals with lower levels of education. The form of the CCTT used in this study was

computerized, and required 45 minutes to complete. The scores on five skill areas (total correct, induction, deduction, credibility, and assumptions) were generated only in percentage correct by the scoring software, and those were the scores used for analysis.

The measure of religious orientation for this study was the Age Universal Religious Orientation Scale (Gorsuch & Venable, 1983). This scale includes two separate subscales: extrinsic religious orientation (E), which is an orientation towards the protective and social or group aspects of religious practice; and intrinsic religious orientation (I), which is an orientation toward a deeply held personal belief in a religion. Nineteen of the 20 items are scored on a 5-point Likert scale (1 = *strong disagreement*; 5 = *strong agreement*), while the remaining question regarding church attendance is scored by attendance (1 = "a few times a year or less"; 5 = "more than once a week"). Higher scores on each of the subscales indicate a greater intrinsic and/or extrinsic religious orientation, with a range in score of 9 to 45 for the intrinsic scale, and 11 to 55 for the extrinsic scale. Internal consistency reliability coefficients for an adult sample of Protestant Christians ($N = 101$) were $\alpha = .66$ for the E subscale, and $\alpha = .73$ for the I subscale, with an I to E correlation of $r = -.39$. Alpha coefficients in a follow-up sample of fifth- and seventh-grade students ($N = 230$) were .75 and .68 for the E and I subscales, respectively, with an I to E correlation of $r = -.28$. The Age Universal Religious Orientation Scale is a pencil-and-paper measure that required 20-30 minutes to complete.

Participants also completed a demographic questionnaire that gathered information about their sex, age, college major, and religious affiliation, followed by a series of questions on the participant's level of religious education and participation (see

Appendix D). On a 4-point Likert acale, ("very true of me," "true of me," "somewhat true of me," "not true of me") participants indicated whether they considered themselves active in their religion, whether they saw themselves practicing their present religion for the rest of their lives, and whether they saw their religion as "more correct" than other religions.

Procedures

A convenience sample of participants was recruited in person or by notice posted to course websites, and volunteers were offered extra credit or course credit for participation. Participants came in groups to a classroom computer lab on the campus of Utah State University. When participants arrived they were given an informed consent form. Following the provision of consent, the researcher then handed each participant one of the reading passages. In handing out the reading passage, the researcher alternated between the two passage conditions, so participants were randomly assigned a passage based on the order of their arrival. Of the sample population, 28 received the Religious Passage, and 27 received the Neutral Passage. Participants were then asked to answer simple questions with written responses regarding the content of the passage to insure that they had read the passage and to promote schema activation (see Appendix C). Responses to the questions on the religious passage were checked qualitatively, as they were the questions designed to elicit activation. Answers on the neutral passage were not checked, as those questions were not designed to elicit activation. Two participants in the sample did not answer the questions on the religious passage, so it is unknown whether they read and understood the material. On the question of agreement with the

message of the passage, 53.8% of participants did not agree with the passage content. On the question of whether the passage was at odds with their religious beliefs, 80% of participants indicated that it was. Answers to the questions on whether they agreed with the passage suggested that participants read and understood the passage, so both affirmative and negative answers could possibly indicate schema activation.

Participants then completed the computerized Cornell Critical Thinking Test-X (CCTT-X). Following the completion of the CCTT-X, participants completed the Age Universal Religious Orientation Scale, followed by the demographic questionnaire. The order of procedures was intended to mitigate the potential effects of schema activation.

CHAPTER IV

RESULTS

Preliminary Analyses

The participants in this study had a mean Total Correct score on the CCTT-X of 47.75 (SD = 8.38), for 68.13% correct, with a Total Score range of 21 to 63. This matches closely with the scores from a normative sample of college freshmen reported by the test manual (N = 634, mean Total Correct = 46.7, SD = 6.9). For this study, critical thinking skill results were reported in percentage correct for Induction (M = 65.31%), Deduction (M = 75.27%), Credibility (M = 58.55%), and Assumptions (M = 63.82%).

On the Age Universal Religious Orientation Scale, participants in this study had a mean I score of 33.11 (SD = 9.66), with a range of 10 to 44. On the E scale, participants had a mean score of 26.89 (SD = 5.66), with a range of 15 to 38 (see Figure 1). Overall, this indicated that the sample for this study was on average more intrinsically oriented than extrinsically oriented.

Research Question #1

To answer the first research question (Is there a difference in critical thinking ability when religious schema are primed?) independent t tests were conducted to evaluate the hypothesis that participants who had religious representations primed through exposure to the religious passage would perform more poorly on the CCTT-X than those without primed representations. Five t tests were conducted (see Table 5), each with a different CCTT-X score (total correct, induction, deduction, credibility, and
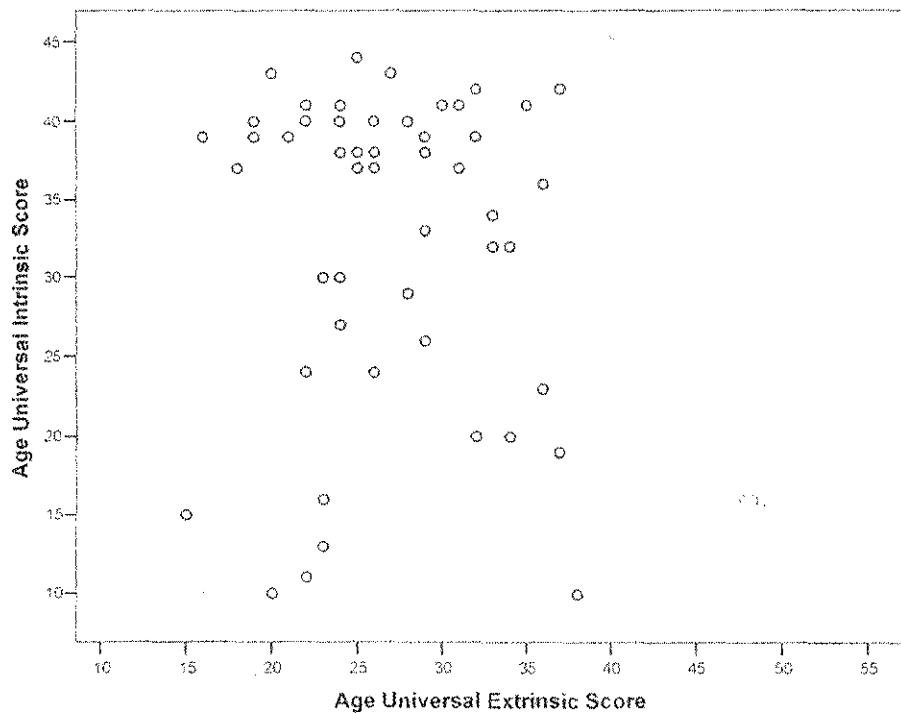
Figure 1. Scatterplot for the Age Universal Intrinsic and Extrinsic scores.

Table 5

CCTT-X Scores by Religious Passage

Skill area	Neutral passage		Religious passage		t	p	Cohen's d
	M	SD	M	SD			
Total correct	45.89	8.29	49.54	8.21	1.64	.11	-.44
Induction	64.44	16.20	66.14	19.76	.35	.73	-.09
Deduction	71.79	14.94	78.62	12.91	1.82	.08	-.49
Credibility	54.57	14.12	62.40	12.88	2.15	.04	-.58
Assumptions	59.63	18.29	67.86	17.29	1.71	.09	-.46

assumptions) as the dependent variable. The tests were only significant for the critical

thinking skill of Credibility, $t(53) = 2.15$, $p = .036$, but the results were counter to the

research hypothesis. Those in the religious passage condition ($M = 62.4$, $SD = 12.88$)

scored higher, indicating greater critical thinking skills in the area of credibility than those in the neutral passage ($M = 54.57$, $SD = 14.12$) with a medium mean difference effect size of .58. The mean difference effect sizes for four of the remaining critical thinking skill areas were small. For Induction, the mean difference effect size was not clinically meaningful. In all cases participants in the religious passage condition scored higher, indicating better critical thinking skills, than participants in the neutral passage condition. The direction of these relationships was not anticipated.

Research Questions #2

To answer the second research question (Do primed religious schema, intrinsic religious orientation, or extrinsic religious orientation predict critical thinking performance?), linear regression analyses were conducted to evaluate whether primed religious schema, intrinsic religious orientation, and extrinsic religious orientation predict critical thinking performance. Five regressions were conducted, each with a different CCTT-X score (total correct, induction, deduction, credibility, and assumptions) as the dependent variable (see Table 6). The linear combination of passage condition and intrinsic and extrinsic religious orientations was significantly related to the skill areas of Deduction and Assumptions. For Deduction, 26% of the variance was accounted for, and for Assumptions, 27% of the variance was accounted for by these variables. For both of these critical-thinking skills, the extrinsic religious orientation score proved to be the only statistically significant individual predictor, with higher levels of extrinsic religious orientation predictive of poor critical thinking performance.

Table 6

Linear Regressions on the CCTT-X

Independent variable and predictors	R	R^2	F	p	β	p
CCTT-X total correct	.31	.096	1.80	.16		
Passage condition					-.24	.09
Age-universal intrinsic					-.03	.81
Age-unviersal extrinsic					-.22	.11
CCTT-X induction	.18	.031	.55	.65		
Passage condition					-.08	.57
Age-universal intrinsic					-.15	.30
Age-universal extrinsic					-.10	.48
CCTT-X deduction	.51	.26	.60	.001		
Passage condition					-.24	.06
Age-universal intrinsic					-.17	.17
Age-unviersal extrinsic					-.41	.001
CCTT-X credibility	.30	.09	1.63	.20		
Passage condition					-.30	.04
Age-universal intrinsic					-.07	.59
Age-unviersal extrinsic					.04	.77
CCTT-X assumption	.52	.27	6.18	.001		
Passage condition					-.23	.06
Age-universal intrinsic					.12	.33
Age-unviersal extrinsic					-.44	.001

CHAPTER V

DISCUSSION

The purpose of this study was to gain a better understanding of the observed relationship between critical thinking and religious belief. Results from previous research on whether a relationship exists between religious belief and critical thinking are inconclusive (Hergovich & Arendasy, 2005; Merla-Ramos, 1999; Morgan & Morgan, 1998; Roe, 1999), and it was posited that the priming of religious representations or schema through procedural order effects could account for the discrepant findings in previous studies. The present study attempted to control for such order effects by comparing the critical thinking performance of those with active religious schema to those without active religious schema, and by examining how schema activation and religious orientation contribute to critical thinking skills.

The results of this study support some of the previous findings on the relationship between critical thinking and religious belief. Participants who endorsed higher levels of religious orientation performed more poorly on a test of critical thinking than those with lower levels of religious orientation. But these results did not support the research hypotheses, in that the schema activation as represented by passage condition was not a significant predictor of performance. In fact, those participants with primed religious schema exhibited greater critical-thinking skills than those without primed religious schema. In addition, higher levels of extrinsic religious orientation, but not passage condition, were predictive of poorer performance on certain critical-thinking skills, namely deductive reasoning and identification of assumptions in an argument. Also,

results did not support the relationship posited in the research hypotheses between religious schema, as represented by intrinsic religious orientation, and critical thinking skills.

The results of this study do indicate the stereotype threat may be an unlikely explanation for previous findings on the relationship between critical thinking performance and paranormal/religious belief. Participants in this study were informed that the procedures involved a test of critical thinking prior to participation. Likewise, participants in the religious passage condition could have conceivably concluded that their religious beliefs were a factor in the experiment prior to completing the CCTT-X. If those participants with religious beliefs felt threatened by any negative stereotypes about the critical thinking abilities of religious believers, we would expect their subsequent critical thinking performance to be impaired, not improved. But participants in the religious passage condition performed better than those in the neutral passage condition, indicating that stereotype threat could not be considered a causal agent in poorer critical thinking performance.

The relationship between extrinsic religious orientation and critical thinking ability might be attributable to the participants' individual approaches to the adoption of belief. If critical thinking is "reasonable, reflective thinking that is focused on deciding what to believe and do" (Norris & Ennis, 1989, p. 1), then those with poorer critical thinking skills might also be less inclined to examine their religious beliefs and practices. Extrinsically oriented participants engage with their religion for reasons of social interaction and other protective factors. Such external motivations may be less connected with internalized belief than with other factors, such as social norms and peer

expectations. It therefore follows that participants who rated themselves as extrinsically oriented might perform more poorly on critical thinking tasks because it was the poor critical thinking ability that led to the extrinsic orientation in the first place. It is also important to note that this relationship was not observed across all critical thinking areas. Extrinsic religious belief was only related to poor performance on Deduction and Assumptions. On the CCTT-X, these two areas of critical thinking are highly related and utilize similar reasoning skills. Ten of the test items that load on the Deduction score also load on the Assumptions score, so comparable performance between the two areas was not unexpected. Of the areas tested by the CCTT-X, Deduction is the most formal in its basis on logic and reasoning.

In considering future research, this study suggests several new directions through its findings, and also through its limitations. First, these results have less potential for generalization due to the homogenous nature of the sample. Nearly three quarters of participants reported an affiliation with the same religious group (LDS). Neither were the participants heterogeneous in age. Additionally, all were college undergraduates at the same university, indicating comparable levels of education and exposure to critical thinking instruction, although this was not directly assessed. Additionally, this study did not control for the participants' level of university education, but since the sample was recruited from general education psychology courses, it can be assumed that most participants were early in their education.

Results from a longitudinal study condicted at UCLA by the Higher Education Research Institute (HERI) suggested that there is a difference between the way college students rate their spirituality and religious participation as incoming freshmen, and later

as juniors (HERI, 2004a). As freshmen, students reported much higher levels of spirituality, and religious certainty and participation than they reported 3 years later. In the full report (HERI, 2004b), LDS respondents (members of The Church of Jesus Christ of Latter-day Saints), the major religious affiliation for this study's sample, were found to have "one of the most clear cut patterns of all the religious groups" (p. 18) on their sruvey responses. Specifically, LDS participants received the highest scores on the factors of religious commitment, religious engagement, religious/social conservatism, spirituality, and equanimity. They also received the lowest scores on religious skepticism, a finding with implications for critical thinking. Given these findings, a more heterogeneous sample drawn to include different ages and religious affiliations, with consideration to level of education, would have greater generalizability.

As to the relationship between the passage condition and critical thinking performance, the results were unexpected and counter to the hypothesis that the priming of religious schema would predict poorer performance on critical thinking. It is possible that the passage intended to activate religious schema instead elicited critical thinking. The passage contained a message in favor of the principles of evolution and argued against the teaching of Intelligent Design, a controversy with religious overtones. Participants were therefore asked to comment on content they may have found at odds with their personal beliefs. But rather than promoting belief persistence, the passage that was selected for religious schema activation may have inadvertently caused the participants to think critically about content they did not agree with. More specifically, the questions participants answered about the religious passage may have been promoting agent for critical evaluation and thought.

Future research might address this problem by selecting religious material with consideration of the degree to which participants will agree with its content, and the degree to which the prime engages other mental processes. A more neutral task, such as the sentence scramble of religious and neutral words used by Randolf-Seng and Nielsen (2007), might mitigate these effects, because the priming of schema need not be explicit or even conscious to have an effect. The type of stimulus presentation used in IAT is specifically designed to access underlying cognitive associations while avoiding the use of explicit higher order processes. Although IAT is not necessarily intended to prime schema, the stimulus presentation it employs would be a better choice in future research on the effects of religious schema on critical thinking performance to avoid engaging other explicit processes. Such primes could take the form of Randolf-Seng and Nielsen's word scramble. Other options might include visual primes such as religious imagery and symbols, arranging for participants to observe a religious authority (e.g., clergy or missionaries), or administering the critical thinking test following a religion class.

Another direction for future investigation suggested by this study might be the use of the Intrinsic/Extrinsic-Revised (I/E-R) scale developed by Gorsuch and McPherson (1989). This revision of the Age Universal I-E Scale breaks the extrinsic scale into orientation that is personal (Ep) and social (Es). However, the I/E-R has fewer items than the Age Universal I-E Scale (14 compared to 20), and lower reliability estimates for Ep, $r = .57$, and Es, $r = .58$. Given this low reliability, a better measure of extrinsic orientation would be suggested for future research. The Age Universal I-E scale was chosen for this study for its greater reliability, and for the fact that the research suggested a potential relationship between the Intrinsic scale, which would be

theoretically related to religious schema, and critical thinking. Given the present findings on extrinsic orientation, future studies might utilize a scale better designed to examine extrinsic orientation as it relates to critical thinking performance.

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APPENDICES

Appendix A:

Religious Content Passage

I argue strongly against teaching ID in biology classes in state-supported schools. If people want to do this in privately funded religious schools, well, that is one of the costs of democracy.

Why do I say this? Why should my beliefs--my evolutionary beliefs--be given unique status in biology classes? First, because teaching an essentially religious theory like ID is illegal. ID is religion carefully disguised as science to get around the Constitution--that is why ID supporters rarely talk explicitly of God--but it is religion nevertheless. If the Supreme Court rules otherwise, then that will not be the first time that the Supreme Court has been wrong.

More importantly, ID should not be taught because it is not fruitful as science. Saying that the designer did something is what the philosopher Alvin Plantinga has labeled a "science stopper." If you say that someone intervened, then you are stuck about what to do next. The successful scientist, including the scientist who spends all day Sunday on his or her knees in church praying, is a methodological atheist. Science works by assuming blind law and then going out to find it. Putting matters bluntly, today's biologists argue that Darwinian evolutionary theory works; it is well tested; and although there are controversies (for instance, over the paleontological theory of punctuated equilibrium promoted by the late Stephen Jay Gould), the theory is accepted. On the other hand, ID theory adds nothing to our store of knowledge. It is promoted only because people have religious beliefs they hold dear, and that is simply not the basis for good science.

But what about the argument that students should be allowed to decide for themselves? With all due respect to the president, that is nonsense. Good education is

not a matter of indifferently offering to students a range of options--a kind of intellectual smorgasbord--and then letting them choose. Good education is teaching the best that you have, together with the critical skills to take inquiry further--perhaps indeed overturning everything that we hold dear. If I heard that my university's med students had to take time out from surgery or pharmacology in order to learn the principles of faith healing or witch-doctoring, because some people believe in them, I would be appalled--and so would you.

So, I say: ID is religion. It is Creationism Lite. Teach students about it in comparative religion courses, along with Christian ideas and the ideas of other faiths. But keep it out of biology classes. It has no place in them.

Adapted from: Ruse, M. (n.d.).

Appendix B:

Neutral Content Passage

Salmon is the common name for several species of fish of the Salmonidae family. Several other fishes in the family are called trout. Salmon live in the Atlantic and Pacific Oceans, as well as the Great Lakes and other land-locked lakes. The Kamchatka Peninsula, in the Russian Far East, contains the world's greatest salmon sanctuary.

Salmon are anadromous: they are born in fresh water, migrate to the ocean, then return to fresh water to reproduce. Folklore has it that the fish return to the exact spot where they were born to spawn and modern research shows that usually at least 90% of the fish spawning in a stream were born there. In Alaska, the crossing over to other streams allows salmon to populate new streams, such as those that emerge as a glacier retreats. How they navigate is still a mystery, though their keen sense of smell may be involved. Young salmon migrate to the ocean where they will develop in about two to three years, (depending on the species) into mature salmon. After they develop, the adult salmon will return to its native stream, breed, spawn and die. No one knows why they go back to the stream they were born in to die, but in order to complete their cycle they must die. Before they die the females release the eggs and the males fertilize them.

Salmon is the third largest seafood product raised on fish farms, with shrimp being the second and carps being by far the largest product. Raising salmon on farms decreases the demand for wild salmon. Salmon are carnivorous and are currently fed a meal produced from catching other wild fish, so as the number of farmed salmon increase, the demand for other fish to feed the salmon increases. Work continues on substituting vegetable proteins for animal proteins in the salmon diet. Most farms in Alaska have a special process for breeding the salmon. The salmon are born inside a stream in the farm and are bred in special waters until they are old enough to become

independent. They are released into the ocean were they are free to live and develop fully until it is time for them to die. When they sense they are going to spawn they immediately return to their stream of birth, in this case they return to the farm where they were born. The farmers allow them to release some of their eggs and some of the other eggs are stripped off to produce the eggs that are sold around the world.

Adapted from: Fishery Management. (n.d.)

Appendix C:

Passage Questions

Religious Content Passage Questions

1. What is your first reaction to this passage?

2. Do you agree with the overall message contained in the passage?

3. If applicable, do your religious beliefs agree with the message contained in the passage?

4. How are your religious beliefs similar to the message contained in the passage, or how do your religious beliefs differ?

Neutral Content Passage Questions

1. In one or two sentences, describe the life cycle of the salmon.

2. Why might salmon migration be advantageous for salmon young?

3. What, if any, might be the effects of salmon farming on wild salmon populations?

Appendix D:

Questionnaire

QUESTIONNAIRE

Please answer the following questions.

Age:

Gender: _____ M _____ F

Major:

Religious Affiliation:

If you do not have a religious affiliation, please skip the rest of these questions.

Do you currently attend religious education classes? _____
      If so, for how many years have you attended such classes? _____

Did you attend religious education classes in the past? _____
      If so, for how many years did you attend such classes? _____

Are you a convert to your present religion? _____
      How recently? _____

I consider myself to be an active participant in my religion.
(1) not true of me   (2) somewhat true of me   (3) true of me   (4) very true of me

I see myself practicing my present religion for the rest of my life.
(1) not true of me   (2) somewhat true of me   (3) true of me   (4) very true of me

I believe that my religious beliefs are more correct than the beliefs of other religions.
(1) not true of me   (2) somewhat true of me   (3) true of me   (4) very true of me