

Introduction

The social context of religious knowledge includes many different aspects of an individual's life, including the external structures, such as class and political environment, which influence social behavior and the social processes, such as attitudes and values, which influence and provide a level of consistency in individual's viewpoints, including the way that they encounter, react to, and attempt to incorporate new knowledge. This study examines these relationships from the perspective of a prevalent contextual factor, expressed religious views, as these relate to a group of specific scientific issues: global climate change, evolution, confidence in the scientific community, stem cell research, continental drift/age of the earth, the big bang, and nanotechnology. The religious attitudes selected for examination are related to belief in God, feeling of being born again, extent of religious feelings, religious commitment, feelings about the Bible, and whether God punishes people who deserve it. This topic gains importance when considered from the perspective of the rapidly changing world of religious belonging and religious views and the equally rapid advance of scientific theories. An analysis of these relationships should lead to a better understanding of the role of religious attitudes in accepting or rejecting specific kinds of scientific knowledge.

Literature Review

Although the Church has long been regarded by many as the mother of the arts and sciences in the Western world, a different view, which holds that religion is a perpetual source of ignorance and superstition has also been extant at many times. Proponents of this approach often cast religion, particularly conservative monotheism, as a force which threatens to destroy the social and cultural advances that have been made in modern times. Those who conceive the past as a tumultuous, historic struggle to set proper limits between the domains of religion and science, frequently also assert that the encounter between faith and science has been a cruel and costly affair in human terms, with the treatment of Galileo by the Inquisition and the Scopes' Monkey Trial as archetypal examples of the product of this engagement. "In popular culture, religion is assumed to be opposed to scientific knowledge itself" (Dawkins 2006; Harris 2004; Mooney 2005) as well as "opposed to scientific technologies such as reproductive genetics and embryonic stem cell research" (Evans, 2011, p. 707).

The majority of the academic literature on this topic focuses on Christian conservative beliefs, including those referred to as creationist, fundamentalist, or literalist. In most cases, these papers fall into two categories. The first category includes theological and sociological discussions that probe the beliefs and viewpoints that divide some religious adherents from those who more readily embrace scientific reasoning. The early works in this category are referenced in almost all the subsequent literature, and a good introduction to this line of thought can be found in both Baker (2012) and Evans and Evans (2008). Upon inspection, these papers fall in two subgroups. The second category, discussed below, approaches these topics from an empirical perspective.

The discussion papers in the first category fall naturally into two subgroups: those that suggest these positions are inimical and those who suggest that they are not. Wilson (1982) provides an example of the reasoning found in the first subgroup when he suggests that there is no place in the modern social system for the conception of ultimate salvation. Writing twelve years later, Locke (1994) reflects on the points that divide these two positions. Employing a more cautionary tone, Holton (1992) explores “anti-science” sentiment, warning that “it is prudent to regard the committed and politically ambitious parts of the anti-science phenomenon as a reminder of the Beast that slumbers below. When it awakens, as it has again and again over the past centuries, and as it undoubtedly will again someday, it will make its true power known” (p. 125). Although the authors in this subgroup approach their subject from different directions, a common thread links their discussions: the uneasy assumption of disquieting disagreement.

The writers in the second subgroup suggest that these differences are less profound than often portrayed. Evans and Evans (2008), for example, suggest that there is no firm foundation for the warfare narratives found in many papers. Employing, perhaps purposefully, the imagery (*militant atheists* and *comrades-in-arms*), to which Evans and Evans (2008) object, Clague (2010) provides a dense theological discussion that faults the extremists found in both anti-Christian and anti-scientist groups. He agrees with both Wilson (1982) and Locke (1994) “that theories concerning the process of creation have created a rancorous division between militant atheists who believe that science has disproven the Genesis account of creation, thereby undermining the authority of the whole of the Bible and Christianity itself, on the one hand, and biblical literalists” (p.95). However, he also agrees with those who see this conflict abating when he contends that, “Moderate, mainstream Christian churches have now had time to reassess the situation and do not see science as an existential threat and implacable

enemy. Science and Christianity are partners, but in different fields, in the quest for equality and justice for humanity.” (p.96)

The second major category, the studies that explore this topic from an empirical perspective, enrich the religion-science debate. Ellison and Musick (1995) provide an early example; and the results they develop using 1988 General Social Survey (GSS) data support the assumption that members of Conservative Protestant groups are more skeptical concerning the benefits of scientific advances than other persons. Three concepts seem to account for these conclusions: biblical literalism, theological orthodoxy, and beliefs related to the ubiquity of sin. Gauchat’s (2007) analysis of anti-science sentiments using 1993 GSS data supports the Evangelical explanation of these attitudes. Evans’ more recent empirical research (2011) leads to a somewhat different conclusion when he reports that the results of his analysis, developed using 2006 GSS data, provide “no evidence of a general epistemological conflict between religious people and science that leads the religious not to seek out scientific knowledge” (p. 723). However, he does suggest that committed members of Protestant traditions, as well as conservative Catholics, tend to assume “that in a conflict between scientific and religious claims about the world, the religious claim is correct” (p.723). In Evans’ opinion, this apparent contradiction suggests *segmenting* behavior that typically acknowledges the value of scientific pursuits, but selectively dismisses results that contend with individual beliefs.

Baker (2012) also found that a relatively low percentage (17%) of the respondents to Wave II of the Baylor Religion Survey (BRS), fielded in 2007 by the Gallup Organization, agreed that religion and science are incompatible. Further analysis of this relatively small percentage found that their members could be divided into two groups, those who privileged religion and those who privileged science. Three variables accounted for much of the difference between the groups: religious service attendance, view of the bible, and theistic non-belief. Those who considered science and religion incompatible and favored science were demographically similar to those who considered science and religion compatible. Those who considered science and religion incompatible and privileged religion were more likely to be of lower socioeconomic status, attend church services, and view the bible literally. Reflecting on these findings Baker concludes that most of the public “seem to assemble and maintain conceptions of science and religion malleable, compartmentalized, or circumscribed enough to co-exist peaceably” (p. 349), but he also suggests there are specific issues, such as evolution and homosexuality, over which scientists and believers in certain religious communities continue to disagree (p. 339).

A number of other empirical researchers suggest that this is the case, but not all. In an early study of college students located in a conservative community, Hood and Morris (1985) considered opinions related to abortion, school prayer, religious freedom, homosexuality, the Equal Rights Amendment, national defense, and secular humanism, and while they found positive relationships between fundamentalist beliefs and conservative attitudes, they conclude that, “No simple predictions of fundamentalists and other dependent variables are likely to survive empirical scrutiny” (p. 143). Writing more recently, Nisbet and Goidel (2007) focus on stem-cell research. Drawing on telephone interviews collected in 2003 by the Louisiana State University Public Policy Research Lab, these authors conclude that “as primary influences, our results show that Christian conservatism and social ideology are directly associated with more negative views of embryonic stem cell research and therapeutic cloning, but they also connect to an individual’s more global and generalized attitudes about abortion and the impact of science on society” (p. 435).

Based on data collected in July 2006 by the Pew Research Center for the People & the Press/Pew Forum on Religion & Public Life survey, authors Keeter, Smith, and Masci (2007) report that Americans typically respect science and scientists, but are swayed by religious beliefs on issues related to evolution and homosexuality. Sherkat and Ellison (2007) suggest that, “Conservative Protestants and biblical inerrantists are significantly less likely to report political or private environmental behaviors” (p.77). However, Stiff (2009) finds no support for the suggestion that fundamentalist views on the authority of God, the inerrancy of the Bible, and perceptions about punishment for sin are inversely related to global warming concerns when other factors are considered.

There is more agreement on the question of abortion, but the issue is still not straightforward. Hoffmann and Johnson (2005), in their analysis of GSS data, find considerable evidence that suggests that the gap between the attitudes of Evangelical Christians and others on the issue of elective abortion widened during the late 1980’s and 1990’s. Unnever, Bartkowski, and Cullen (2010) point to the influence of perceptions of having a close relationship with God on attitudes about abortion and capital punishment. Brint and Abrutyn (2010) report a highly significant evangelical effect on attitudes related to abortion. However, the evangelical effect disappeared when moral standards traditionalism was the only additional predictor added to the regression analysis.

While common discourse may suggest that science contests against religion, some scholars suggest a different set of circumstances where religion may be perceived as incongruent with science only in particular cases rather than generally antagonistic thereto. For the purposes of this study, these points were explored more fully from a null hypotheses perspective and the following hypotheses were used to guide data collection and analysis.

Study Hypotheses:

(H1) There are not statistically significant differences between individuals with positive attitudes about religion and individuals with little, none or even negative religious attitudes and their attitudes towards topical scientific issues.

- It is expected that differences do exist between individuals with positive attitudes towards religion and individuals with little, none or even negative religious attitudes and their attitudes towards topical scientific issues; however, it is not expected that those differences will be statistically significant.
- It is not expected that hypothesis one will be rejected.

(H2) The strength of religious attitudes (from strong to low or none) in the individuals surveyed will be inversely correlated with positive acceptance of findings about topical scientific issues.

- It is expected that the positive acceptance of the findings of topical scientific issues will decrease as positive religious attitudes increase.
- Conversely, it is expected that the acceptance of the findings of topical scientific issues will increase as positive religious attitudes decrease.

(H3) The strength of the relationships between religious and science attitudes will vary.

- It is expected that the relationships between religious and science will not be uniform.

Methodology

The data used in this study were collected from a representative random sample of 2,044 Americans who participated in the 2010 GSS conducted by the National Opinion Research Center (NORC). The survey questions selected for analysis are described in Appendix Tables A1 and A2. Eight of the questions chosen from the survey appeared to explore the survey respondent's positive, ambivalent, or negative attitudes towards religion. Those variables were chosen based on the literature summarized

above. Eight questions explore attitudes towards the scientific community and scientific findings on specific topical issues such as climate change or stem cell research.

Data Analysis

Hypothesis one, that there are not statistically significant differences in attitudes towards scientific findings between religious and non-religious or ambivalently religious individuals, was tested with a series of chi-square tests comparing each religious variable to each scientific variable. Hypothesis two, the expectation that relationships between religious attitudes and attitudes towards scientific findings on specific issues are inversely related, was tested using the phi-coefficient for binomial variables and Spearman's rank correlation coefficient for all other variables. Hypothesis three, that relationships between religious and science attitudes are not uniform, was also tested using the appropriate correlation coefficients. The Chi-square analyses were performed using the Statistical Package for the Social Science (SPSS). Prior to entry to the SPSS software, the data for each of the 64 chi-square analyses was scrubbed using Microsoft Excel software to remove missing data and invalid responses, including data coded "no answer" or "do not know." As discussed below, each SPSS chi-square procedure produced a cross-tabulation frequency matrix. The chi-square procedure results included the chi-square value, degrees of freedom, and the p -value, which represents the probability that the results were not due to random chance given a Type I error (alpha) level of .05. The appropriate correlation coefficients (phi or Spearman's) were also produced by the chi-square procedure.

Results

H1) There are not statistically significant differences between individuals with positive attitudes about religion and individuals with little, none or even negative religious attitudes and their attitudes towards topical scientific issues.

Of the 64 chi-square tests run during analysis, 20 tests were invalidated by low cell counts (see the *Limitations* section, below). Only the BIGBANG and EVOLVED science variables could be compared to all of the eight religion variables. The results of the chi-square and correlation tests comparing the BIGBANG science variable and each of the religion variables are shown below in Table 1. As shown in Table 1, there is a statistically significant difference in attitudes towards the big bang theory between religious, non-religious, and ambivalently religious individuals ($p < 0.005$ for all religion variables, alpha = .05). Therefore, hypothesis one can be rejected for the BIGBANG variable.

Crosstabs Results for BigBang	Number of Respondents	Chi-Square Value	Degrees of Freedom	<i>p</i> Value (alpha = .05)	Spearman's Correlation	phi-coefficient
Bible	653	107.767	3	0.000	-0.392	
Conclerg	422	10.805	2	0.005	-0.160	
God	652	99.466	5	0.000	0.387	
Reborn	652	64.921	1	0.000		-0.316
Savesoul	661	77.084	1	0.000		-0.341
Punsin	624	37.640	3	0.000	-0.237	
RelPersn	657	66.990	3	0.000	-0.314	
RelExp	659	15.085	1	0.000		-0.151

The results of the chi-square and correlation tests comparing the EVOLVED science variable and each of the religion variables are shown below in Table 2. The comparison of the EVOLVED science variable to the eight religion variables also leads us to reject hypothesis one—there is a statistically significant difference between the strength of religious attitudes and acceptance of the theory of evolution for all of the religion variables ($p < 0.017$ for all religion variables, alpha = .05).

Crosstabs Results for Evolved	Number of Observations	Chi-Square Value	Degrees of Freedom	<i>p</i> Value (alpha = .05)	Spearman's Correlation	phi-coefficient
Bible	796	146.399	3	0.000	-0.404	
Conclerg	497	8.117	2	0.017	-0.127	
God	802	135.208	5	0.000	0.409	
Reborn	800	142.424	1	0.000		-0.422
Savesoul	809	143.115	1	0.000		-0.421
Punsin	763	82.190	3	0.000	-0.319	
RelPersn	806	132.498	3	0.000	-0.399	
RelExp	806	45.081	1	0.000		-0.237

Table 3 below contains the results of the comparisons of all other science and religion variables where response rates were sufficiently high enough to satisfy expected cell requirements in the chi-square analyses. As shown in Table 3, responses were particularly sparse for the science variables ICECAPS and NANOWILL. The religion GOD variable could only be analyzed in relation to the BIGBANG and EVOLVED science variables (see Tables 1 and 2, above). Unlike the analysis of the BIGBANG and EVOLVED science variables, Table 3 contains several instances of *p*-values (indicated by an asterisk in the table) that exceed the alpha value of .05; therefore, hypothesis one should not be rejected for those variables. For example, there is not a statistically significant difference between the attitudes of religious and non-religious individuals towards the benefits of nanotechnology research in terms of three of the religious variables (SAVESOUL, REPERSN, and RELEXP). In interpreting this result, it should be noted that the response rates for these comparisons were lower than the other comparisons shown in Table 3. The other chi-square tests resulting in rejection of hypothesis one include the following

comparisons: CONSCI/RELEXP, CONDRIFT/CONCLERG, CONDRFIT/RELEXP, ICECAPS/SAVESOUL, TEMPGEN/REBORN, and TEMPGEN/SAVESOUL.

Table 3: Comparison of Science Variables to Religion Variables

Variable Description	Number of Observations	Chi-Square Value	Degrees of Freedom	p Value (alpha = .05)	Spearman's Correlation	phi-coefficient
Consci to Conclerg	1268	38.109	4	0.000	0.068	
Consci to Reborn	1286	18.231	2	0.000	-0.119	
Consci to Savesoul	1302	20.470	2	0.000	-0.123	
Consci to Punsin	1234	27.595	6	0.000	-0.134	
Consci to RelPersn	1296	18.418	6	0.005	-0.104	
Consci to RelExp	1293	3.616	2	.164*	-0.053	
Condrift to Conclerg	526	2.229	2	.328*	-0.064	
Condrift to Reborn	820	12.039	1	0.001		-0.121
Condrift to Savesoul	803	11.357	1	0.001		-0.117
Condrift to Punsin	777	18.101	3	0.000	-0.138	
Condrift to RelPersn	825	12.912	3	0.005	-0.123	
Condrift to RelExp	825	0.283	1	.595*		-0.019
Scresrch to Conclerg	273	13.381	6	0.037	-0.131	
Scresrch to Reborn	436	33.464	3	0.000	-0.241	
Scresrch to Savesoul	443	39.912	3	0.000	-0.283	
Scresrch to RelPersn	438	39.860	9	0.000	-0.222	
Scresrch to RelExp	441	25.064	3	0.000	-0.138	
IceCaps to Savesoul	609	3.924	2	.141*	0.079	
TempGen to Conclerg	694	24.174	8	0.002	-0.152	
TempGen to Reborn	1311	6.936	4	.139*	-0.031	
TempGen to Savesoul	1322	7.114	4	.130*	-0.060	
TempGen to Punsin	1261	36.991	12	0.000	-0.113	
TempGen to RelPersn	1319	37.803	12	0.000	-0.086	
TempGen to RelExp	1312	8.601	4	.072*	0.029	
Nanowill to Reborn	246	4.850	2	.088*	-0.090	
Nanowill to Savesoul	247	3.818	2	.148*	-0.054	
Nanowill to RelPersn	246	11.356	6	.078*	-0.157	
Nanowill to RelExp	247	0.603	2	.740*	-0.017	
* Cannot reject H ₀						

(H2) *The strength of religious attitudes (from strong to low or none) in the individuals surveyed will be inversely correlated with positive acceptance of findings about topical scientific issues.*

As shown in Table 1, above, the correlation coefficients between the BIGBANG science variable and seven of the eight religion variables are consistent with the expectation of hypothesis two — individuals agreeing that the big bang theory is true tend to have less positive attitudes towards religion and the slope of the correlation is negative. The correlation coefficient of the comparison between the BIGBANG and GOD variables is positive due to GSS coding of the responses to the GOD variable question inversely to the other religion variables (see Appendix Table A1, where “do not believe” is coded as “1”

for the GOD variable whereas a value of “1” equates with strong religious attitudes for all other religion variables). Because of the inverse coding, the positive correlation of the BIGBANG and GOD variables is consistent with hypothesis two. The correlations between the science variable EVOLVED and the religion variables in Table 2, above, are consistent with hypothesis two when the inverse coding of the GOD variable is taken into account.

All but three of the correlations shown in Table 3 retain a negative slope, indicating an inverse relationship between strong religious attitudes and acceptance of the scientific findings associated with the science variables, as expected by hypothesis two. The first exception, CONSCI compared to CONCLERG, indicates a nearly negligible (less than .01) positive relationship between confidence in organized religion and confidence in the scientific community. The small (.08), yet positive correlation of the second exception, ICECAPS compared to SAVESOUL, is due to GSS inverse coding of the ICECAPS variable, where a value of “1” indicates that the ice caps are increasing. The third exception consists of a small (.03) positive correlation between the perception of danger from climate change temperature rise (TEMPGEN) and experience of a life-changing religious experience (RELEXP). Also shown in Table 3, the chi-square tests of the ICECAPS/SAVESOUL and TEMPGEN/RELEXP variables resulted in rejection of hypothesis one, leading to an expectation of a positive correlation for the TEMPGEN and RELEXP variables, whereas the otherwise expected positive correlation between ICECAPS and SAVESOUL was due to GSS inverse coding.

(H3) The strength of the relationships between religious and science attitudes will vary.

Tables 1 and 2, above, contain support for hypothesis three. With the exception of the CONCLERG variable, the correlations between the EVOLVED and religion variables are somewhat stronger than the correlations between the BIGBANG science variable and the religion variables, with acceptance of the theory of evolution decreasing as the strength of religious attitudes increase. Correlation coefficients in the range of +/- .5 are generally considered indicative of moderate relationships between variables. The strongest correlations between the variables shown in Tables 1 and 2 are between BIBLE and EVOLVED (-.404) and GOD and EVOLVED (-.409).

Table 3, above, also contains support for hypothesis three. The strength of the correlations in Table 3 range from a low of -.017 for the relationship between variables NANOWILL and RELEXP, to a high of -.283 for the relationship between variables SCRESRCH and SAVESOUL. Correlation coefficients in the range of +/- .2 are generally considered indicative of weak relationships between variables. Only three of the relationships shown in Table 3 are stronger than -.2 (SCRESRCH/SAVESOUL,

SCRESRCH/REBORN, SCRESRCH/RELPERSN). We can conclude that, while hypothesis three is supported, the relationships between the variables shown in Table 3 are generally weak.

Limitations

The efficacy of chi-square analysis is limited where expected cell counts in the frequency matrices are low. Therefore, the analysis of some variables, particularly comparisons involving the nanotechnology research variable (235 mean respondents) and the change in ice cap variable (573 mean respondents), were limited by missing or incomplete responses. Although the confidence in the scientific community variable represented the highest mean number of respondents (1,283 mean respondents), comparisons to the Bible and God religious variables were limited by low expected cell counts in some cells. Cell counts met expectations for all chi-square tests comparing the big bang and evolution dichotomous science variables to the eight religion variables.

Conclusions

The above analysis supports the suggestion that the relationship between religious beliefs and attitudes toward science is a complex issue. It supplies moderate support for Baker's suggestions that, while some issues are likely to be uncontested, others are more likely to provoke disagreement. The data also provide a fresh viewpoint concerning the influence of increasing religiosity on the likelihood of conflict.

Although there are eleven exceptions, the majority of the chi-square tests resulted in rejection of *Hypothesis One*, indicating that there are significant differences between individuals with positive attitudes about religion and individuals with little, none, or negative attitudes and their views on topical science issues. Future research involving expanded data sets, for example those that will support the sort of panel studies conducted by Hoffmann and Johnson (2005) and the construction of a composite religion index would add weight to any further investigations.

It is also worth noting that the results of this analysis do not bode well for increasing the acceptance of science, scientists, and scientific life. Although the obvious negative relationship between many religious attitudes/feelings and many scientific issues is not always uniform or strong, the tendency toward non-acceptance of the religious person by the scientist and vice versa cannot be

ignored. Gauchet (2008) and others point out that severe tensions are attracting Protestant evangelicals to strong anti-science views; and Granger and Price (2007) suggest that a fundamentalist religious background is likely to have a strongly negative on individuals who want to pursue a career in science. Both points have important policy implication. If primary and secondary schools become more frequently supported through mechanism such as vouchers systems, this development could have a negative impact on our production of scientists. Increasing antagonisms between those who reject scientific reasoning and those that don't is also likely to result in dissimilar levels of scientific literacy and increasing social and political polarization on important issues that require rudimentary science knowledge. In situations such as these, compromise is often more difficult and public policy issues are likely to go unattended because of loss of social and political capital associated with their attention. In a society characterized by rapid scientific and technological development, the likelihood of these problems is not abating.

Appendix: Tables of 2010 General Social Survey Religion and Science Variables

TABLE A1: RELIGION VARIABLES		Coded Response Options				
VARIABLE	DESCRIPTION	1	2	3	4	5
BIBLE	Feelings about the Bible	Actual word of God	Inspired word of God	Ancient book	Other	
CONCLERG	Confidence in organized religion	Great deal	Only some	Hardly any		
GOD	Confidence in existence of God	Do not believe	Do not know, no way to find out	Higher power	Believe sometimes	Believe with doubts
REBORN	Ever had a "born again" experience	YES	NO			
SAVESOUL	Tried to convince others to accept Jesus	YES	NO			
PUNSIN	Sinners must be punished	Agree strongly	Agree somewhat	Disagree somewhat	Disagree Strongly	
RELPERSN	Consider self a religious person	Very religious	Moderately religious	Slightly religious	Not religious at all	
RELEXP	Have religious experience that changed life	YES	NO			

TABLE A2: SCIENCE VARIABLES		Coded Response Options				
VARIABLE	DESCRIPTION	1	2	3	4	5
CONSCI	Confidence in scientific community	Great deal	Only some	Hardly any		
BIGBANG	Universe began with a big explosion	TRUE	FALSE			
CONDRIFT	The continents have been moving	TRUE	FALSE			
EVOLVED	Human beings developed from animals	TRUE	FALSE			
SCRESRCH	Government should fund stem cell research	Definitely should	Probably should	Probably should not	Definitely should not	
ICECAPS	Change in polar ice caps over last 25 years	Larger	Smaller	Stayed same		
TEMPGEN	Temperature rise from climate change	Extremely dangerous	Very dangerous	Somewhat dangerous	Not very dangerous	Not dangerous at all
NANOWILL	Benefit of nanotechnology outweigh harmful results	Benefits greater	About equal	Harmful results greater		

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