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Thinking about Science and Christian Orthodox Beliefs: A Survey Study of Preservice Elementary Teachers

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Abstract
Since its origination with Andrew Dickson White, the Warfare Metaphor has been used to characterize the relationship between science and religion, specifically orthodox Christianity. Though thoroughly discredited by historians of science, the ideological descendants of Thomas Huxley, who spoke of science in quasi-religious terms, have kept the Warfare Metaphor alive. On the other hand, there are substantial numbers of Christians who at least appear to oppose science given their high-profile opposition to the general theory of evolution. The purpose of the research reported in this paper was to examine this specific question: does anti-science sentiment increase with increasing orthodox Christian belief? Two validated, published instruments were used: the *Thinking about Science Survey Instrument* and the *Christian Fundamentalist Belief Scale*. The subjects for the study were 545 preservice elementary teachers. The analysis did *not* show that anti-science sentiment increases with increasing Christian belief. Subjects with strong Christian beliefs were found to be just as supportive of science, if not more so, that subjects with no Christian beliefs. The study concludes with a caution against projecting attitudes toward science based on attitudes toward evolution.

Since its origination with Andrew Dickson White, the Warfare Metaphor has been used to characterize the relationship between science and religion, specifically orthodox Christianity. Though thoroughly discredited by historians of science, there are on the other hand, substantial numbers of Christians who at least appear to oppose science given their high-profile opposition to the general theory of evolution. The purpose of the research reported in this article was to examine the specific question: does anti-science sentiment increase with increasing orthodox Christian belief?

LITERATURE BACKGROUND

When people think of the history of science and religion, the Warfare Metaphor often comes to mind. Certainly, almost everyone working in any science or science-related area has heard of the this metaphor, the idea that the relationship between science and religion is ordinarily one of conflict, with science "winning" an historical "war" for ultimate truth. Judging from the literature, science educators and researchers are certainly aware of the metaphor and some even endorse it (e.g., Good, 2001a). This perspective on the relationship between science and religion has Enlightenment roots, but most scholars today associate it with Andrew Dickson White, the first president of Cornell University who was (ironically) an historian himself. In the latter part of the nineteenth century, White published several versions of the "warfare" idea, culminating in a two-volume work bearing the highly descriptive title, *A History Of The Warfare Of Science With Theology In Christendom* (1896). In this book he catalogued numerous episodes of alleged "conflict" between Christian theology and science, supporting his overall conclusion that the historical record is one of unremitting conflict between two fundamentally opposed ways of understanding the world.

White's book remains in print more than one hundred years later, and it is also available from several internet sites—including one called "atheism.about.com,"[1] which suggests one reason why such a profoundly unreliable book is still popular in certain circles. What is surprising is that some members of the science and science education communities seem to think that White wrote the final chapter on this topic, that he did the job properly, and that no better history of science and religion has been done since. As a result, in contemporary events in which science and religion often seem to have different goals, the events are often immediately interpreted in light of the Warfare Metaphor.

The truth about White and the Warfare Metaphor is quite the opposite. Historians of science since White's book have effectively discredited the Warfare Metaphor as an accurate description of the relationship between science and religion (Brooke, 1991; Brooke & Cantor, 2000, Livingstone, 1993; Numbers, 1992; Rudwick, 1981; Stark, 2003). One can learn something rather interesting from this literature, such as, that the "conflict icons," Galileo and Darwin, do not represent simple, unproblematic cases of religion attempting to oppress science. One would also learn that religious beliefs have often provided powerful motivation for doing science, and that some fundamental attitudes, assumptions, and theories in modern science are closely related to the religious beliefs of the scientists who held them or created them. These points have been documented repeatedly by many leading historians of science, especially in the past twenty-five years, to such an extent that it is no longer possible for informed scholars to take White's book seriously as a work of historical scholarship.

Simply put, Andrew Dickson White was not a very good historian. Of the dozens of examples we could cite, we offer for consideration a remarkably imaginative paragraph in which White quotes "statements" about astronomy by two of the most famous Protestant theologians who have ever lived, John Calvin and John Wesley.

> While Lutheranism was thus condemning the theory of the earth's movement, other branches of the Protestant Church did not remain behind. Calvin took the lead, in his *Commentary on Genesis*, by condemning all who asserted that the earth is not at the centre of the universe. He clinched the matter by the usual reference to the first verse of the ninety-third Psalm, and asked, 'Who will venture to place the authority of Copernicus above that of the Holy Spirit?'… and even John Wesley declared the new ideas to 'tend toward infidelity.' (White, 1896; http://abob.libs.uga.edu/bobk/whitewtc.html02)

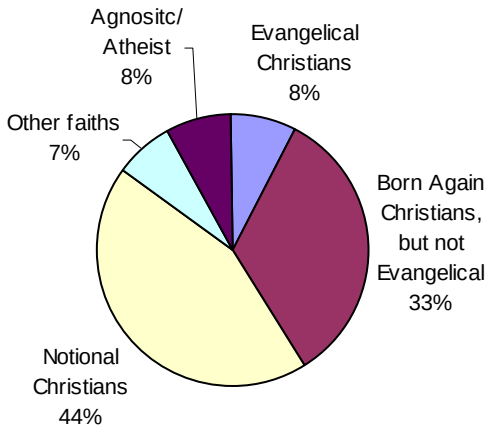
These statements have become famous examples of the "obscurantism" of theologians when confronted with scientific truth, yet neither "statement" was ever uttered.

White begins this paragraph by first condemning Lutheranism apparently ignorant of the fact that *De Revolutionibus Orbium Coelestium* was published by a Lutheran printer. White then attributes to Calvin a quote that is totally false and yet Bertrand Russell, Thomas Kuhn, and many others have subsequently continued the error., the White goes on to attribute an equally fallacious quote to John Wesley.[2]. Indeed Wesley fully accepted heliocentrism. [3, 4] Unfortunately, White was an historian who seems to have checked primary sources about as often as he watched television. Nevertheless, his work is taken as historical support for an antagonism made famous by Thomas Huxley, known as Darwin's Bulldog, who spoke of science in quasi-religious terms. Huxley's ideological descendants have kept the Warfare Metaphor alive – or at least its spirit (Dawkins, 1986; Shermer, 2002). These ideological descendants include contributors to the literature on science education (Good, 2001a & b; Mahner & Bunge, 1996; Martin, 1997), which is somewhat understandable given the persistence of anti-evolution sentiment and the high-profile opposition of creationists.

The ranks of anti-evolutionists in America indeed are drawn largely from the community of conservative Christians and conservative Christians are large in number. Within the American public there are five discernible religious segments three of which are associated with Christianity (Barna, 2002). Of the three Christian groups, evangelicals are the smallest. "Non-evangelical born again Christians" compose the second group. Both of these groups can be considered religiously conservative, in contrast to the third Christian group, "notional Christians," which are religiously liberal. Barna (2002) also identified two non-Christian groups identified as atheistic or agnostic, and those who are affiliated with a non-Christian faith. Evangelicals are 8% of the population; non-evangelical born again Christians are 33% and notional Christians are 44%. The atheist/agnostic group contains 8% of adults, while other faith groups have 7%. Because evangelicals are also born again, the total born again (conservative) Christian population in the USA is about 41% (see Figure 1).

Undoubtedly the sheer size of the American conservative Christian community contributes to the concern some have about anti-evolution sentiment. Moreover, recent years have seen a political polarization dubbed the "Culture Wars" (Bolce & De Maio,

Figure 1. Five Areas of American Belief



2002; Orwin, 2004) further dividing the public along the lines of traditionalists and secularists.

However, having embraced the Warfare Metaphor, those who oppose religion appear to have also adopted the view that to be anti-evolution is to be anti-science. As already noted, our interest has not been anti-evolutionism *per se* but the boarder question of whether support for science decreases with increasing orthodox Christian belief, which is the implicit suggestion of Good (2001a & b), Mahner and Bunge (1996), Martin, (1997), among others.

METHOD

The study used a survey method to gain a general impression of support of science and support for orthodox Christian belief. Well-constructed surveys with a sample that has defensible characteristics and of adequate size, allows one to make sound generalizations about a broader population though many specific questions remain unanswered. Our discussion of findings will include a discussion of how our quantitative findings complement qualitative findings extant in the literature.

Instrumentation

Valuation of science was analyzed using the *Thinking About Science Survey Instrumen-v2* (TSSI-v2), and we are reporting the fourth study in a series of TSSI studies (Cobern & Loving, 2002a &b; Sulikowski, Loving & Cobern, 2003. See Cobern & Loving, 2002a, p. X, for a copy of TSSI-v1). TSSI addresses the broad relationship of science to nine social and cultural categories: 1) Epistemology, 2) Science & the Economy, 3) Science & the

Environment, 4) Public Regulation of Science, 5) Science & Public Health, 6) Science & Religion, 7) Science & Aesthetics, 8) Science, Race & Gender, and 9) Science for All.

Each category is composed of items that either defend science or object to science. The categories are not intended to represent an authoritative scientific worldview (Cobern, 1991), but a scientific worldview version commonly found in both the popular media and the popular literatures of science and science education. We refer to this public image as the *Model*. Subjects respond to the survey items on a scale of one to five. The "1" is labeled "strongly disagree." The "3" is labeled "uncertain," and the "5" is labeled "strongly agree." Category means are calculated on the basis of item responses. Means of about "4" and "5" for the categories indicate agreement with the *Model*. Moreover, a category mean of "5" for all nine categories would be indicative of scientistic thinking. On the other hand, scores of "2" and "1" for the categories indicate disagreement with the *Model*; and a category mean of "1" for all nine categories would be indicative of anti-science thinking. Based on the data, profiles are developed with respect to the categories of the *Model*. Category means based on the composite of category items are calculated to form the profiles (see Cobern & Loving, 2002a).

Subsequent to the original TSSI studies, items composing the categories of Science & the Environment, Science & Religion, and Science & Aesthetics were redesigned to improve internal consistency. Revised items were trailed with 30 preservice elementary teachers. The items showing the greatest internal consistency within each of the three categories were retained. The replacement items are shown in Table 1, that is, TSSI-v2 used in the present study is composed of the original TSSI-v1 items with the exception of the replacements shown in Table 1.

Table 1. Revised TSSI Items

Category 3: Science & the Environment (ENVIR)
Science plays a key role in the conservation of our environment.
Science plays a key role in the protection of our environment.
Science can help us preserve our natural environment and natural resources.
Without science we will not be able to preserve our natural environment and natural resources.
Science contributes important knowledge about our natural environment.
Alpha = 0.7037
Category 6: Science & Religion (RELIG)
The discoveries of science consistently rule out the claims of religion.
When scientific and religious descriptions of natural phenomena conflict, the scientific description should have the clear priority.
There is little common ground on which science and religion can meet.
The more humans learn scientifically about the natural world, the less reason they have for religion.
If a natural phenomenon can be described scientifically in natural "cause and effect" categories, then any religious description of that phenomenon must be excluded.
Scientific understanding of natural phenomena has made impossible any belief in the supernatural work of a deity.
Alpha = 0.7523
Category 7: Science & Aesthetics (BEAUT)
Scientific explanations tend to spoil the beauty of nature. (Scored in reverse)
It is more important for a person to learn about science than it is to learn about the arts.
It is more important for a person to learn about the arts than it is to learn about science. (Scored in reverse)
Alpha = 0.5209

Science interest was gauged in the current study using the same format used in the earlier studies (Cobern & Loving, 2002a). As a cursory indicator of science interest, students are asked: Based on all your experiences with school science, is science a subject you like? The poles of the 5-point response range are marked “dislike” for the number one and “like very much” for the number five.

For orthodox Christian belief, we used a published instrument called the *Christian Fundamentalist Belief Scale* (see Table 2) by Gibson & Frances (1996), who reported a Cronbach’s alpha of 0.92 with a sample of 866 Scottish adolescents. We report the same alpha value.

Table 2. Christian Fundamentalist Belief Scale

- I believe that God made the world in six days and rested on the seventh.
- I believe that the Bible is the word of God.
- I believe that Jesus Christ was born of a virgin.
- I believe that Jesus Christ will return to earth some day.
- I believe in hell.
- I believe that God judges what I do and say.
- I believe that Jesus Christ died to save me.
- I believe that Jesus Christ changed real water into real wine.
- I believe that Jesus Christ walked on water.
- I believe that Jesus Christ was the Son of God.
- I believe that God is controlling every bit of our lives.
- I believe that Jesus Christ really rose from the dead.

Subjects

The subjects in the current study (as in previous TSSI studies) were preservice elementary teachers. Elementary teachers make good subjects for our type of research because they are much like the educated public at large. They are well educated in general but not greatly science-educated. In addition to their critical role in the education of children, this makes elementary teachers an interesting group for examining the thoughts people have about science with respect to other important ideas in modern American society.

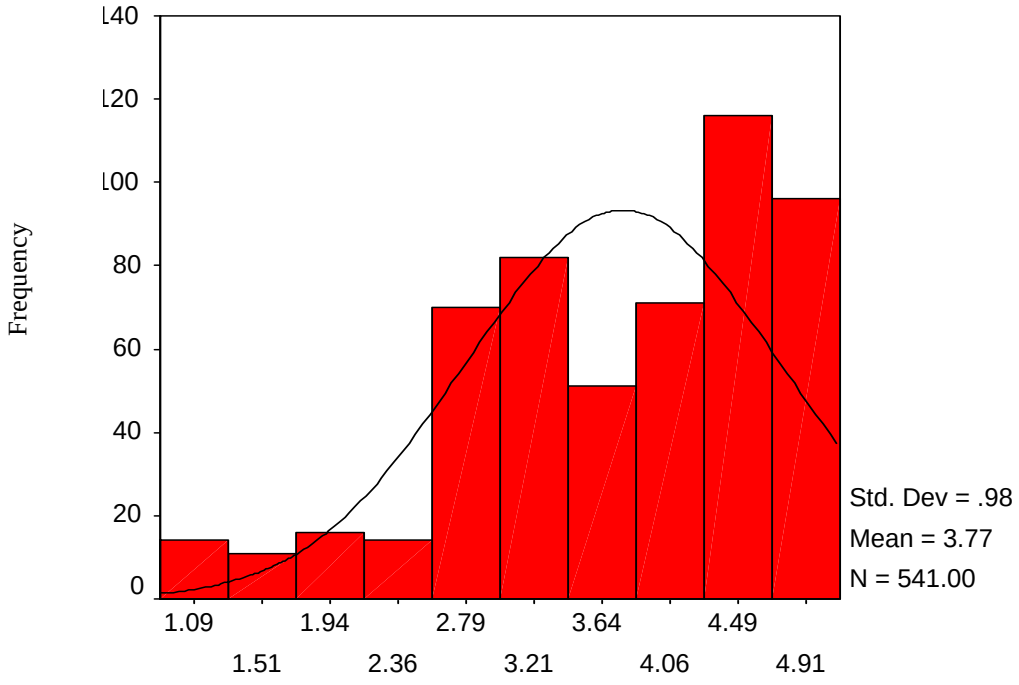
Thus, the 545 subjects for this study were drawn from elementary education majors at a large midwestern university. During a three-year period (2001-2003) students in an upper level elementary science methods course were asked to voluntarily take the TSSI and Christian orthodoxy survey. Virtually all students participated. The subjects were either seniors or second-semester juniors in a degree program that includes an elementary science methods course as a part of a 21-hour mathematics/science minor. At the time of the survey, the students had each taken at least 3 courses in science and 2 in mathematics. The student population was typical for an elementary teacher certification program. The vast majority were between the ages of 20 and 35. Most of the students were women (see Table 3).

Table 3. Gender Frequencies amongst Respondents

		Frequency	Percent
Valid Cases	Women	450	82.6
	Men	77	14.1
	Total	527	96.7
Missing Cases		18	3.3
Total		545	100

This gender percentage rate is consistent with previous years (see Cobern & Loving, 2002b). A few students were non-traditional older students. Fewer than 10% of the students were persons of color. With regard to ACT scores and grades in general education, university required courses, the students compared very well with the rest of the university. The majority of the students at this university come from regions of the country where there are high percentages of conservative Christians. The results from the Christian Orthodoxy survey to be discussed below bore this out with 61% of the participants falling in the "strong Christian" range (see Figure 2)

Figure 2. Histogram of Christian Orthodoxy Scores for Participants in the Study



Null Hypotheses

The study examined 5 Null Hypotheses. The first two hypotheses are about possible gender effects. Any significant gender effect on science interest or Christian Orthodoxy

would need to be considered when interpreting the results for the three main hypotheses, which specifically address the question of Christian Orthodoxy and valuation of science.

H1) There are no significant differences regarding science interest between women and men preservice elementary teachers.

H2) There are no significant differences regarding Christian Orthodoxy scores between women and men preservice elementary teachers.

H3) There is no significant correlation between Christian Orthodoxy scores and science interest.

H4) There are no significant interactions between gender and science interest with Christian Orthodoxy scores

H5) Regarding TSSI categories, there are no significant differences between subjects with high Christian Orthodoxy scores and those with very low Christian Orthodoxy scores.

FINDINGS

Null Hypothesis 1: *There are no significant differences regarding science interest between women and men preservice elementary teachers.*

The null hypothesis was tested by a regression analysis with gender as the independent variable and science interest as the dependent variable. The null hypothesis was sustained (see Table 4). Men ($\overline{X}$ = 2.75) and women ($\overline{X}$ = 2.96) show similar interest in science with gender accounting for no more than 0.4% of difference. Since this effect size is negligible, it will not be considered in the discussion of findings.

Table 2. Gender Analysis Regarding Gender and Science interest

Gender	Mean	N	Std. Deviation
Women	2.96	450	1.183
Men	2.75	77	1.387
Total	2.93	527	1.216

Model Summary

R	R Square	Adjusted R Square	Std. Error of the Estimate
.061	.004	.002	1.215

a Predictors: (Constant), gender

ANOVA

	Sum of Squares	df	Mean Square	F	Sig.
Regression	2.871	1	2.871	1.946	.164
Residual	774.669	525	1.476		
Total	777.541	526			

a Predictors: (Constant), gender

b Dependent Variable: science interest

Null Hypothesis 2: *There are no significant differences regarding Christian Orthodoxy scores between women and men preservice elementary teachers.*

The null hypothesis was tested by an ANOVA analysis with gender as the independent variable and Christian Orthodoxy as the dependent variable. The null hypothesis is rejected at p=0.023 (see Table 3). Women are more orthodox than men; however, the effect is very small ($Eta^2 = 0.01$).

Table 5. ANOVA Comparison of Christian Orthodoxy Means by Gender

Gender	Mean	N	Std. Deviation
Women	3.8056	446	.93609
Men	3.5316	77	1.17758
Total	3.7652	523	.97895

ANOVA Table

			Sum of Squares	df	Mean Square	F	Sig.
Orthodoxy * Gender	Between Groups	(Combined)	4.930	1	4.930	5.185	.023
	Within Groups		495.330	521	.951		
	Total		500.260	522			

Measures of Association

	Eta	Eta^2
XTIAN * Gen	.099	.010

Null Hypothesis 3: *There is no significant correlation between Christian Orthodoxy scores and science interest.*

The null hypothesis was tested by a regression analysis with Christian Orthodoxy as the predictor variable and science interest as the dependent variable. With an R-value of 0.55 and with p< = 0.208, the null hypothesis is sustained (see Table 6).

Table 6. Correlation of Christian Orthodoxy with Science interest

	Mean	N	Std. Deviation
Non-Christian	2.64	55	1.352
Neutral	2.92	151	1.140
Christian	2.98	329	1.218
Total	2.93	535	1.214

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.055[a]	.003	.001	0.846

a Predictors: (Constant), Christian Orthodoxy

ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1.137	1	1.137	1.589	.208
	Residual	381.181	533	1.416		
	Total	382.318	534			

a Predictors: (Constant), Christian Orthodoxy
b Dependent Variable: science interest

Null Hypothesis 4: *There are no significant interactions between gender and science interest with Christian Orthodoxy scores.*

The interaction analysis involved a 2X3 factorial design with Christian Orthodoxy as the dependent variable and gender (men, women) and Science Interest (high, neutral, low) as the predictor variables. The Null hypothesis was sustained

Table 7. UNIANOVA on Gender and Science interest with Christian Orthodoxy
(Tests of Between-Subjects Effects; Dependent Variable: Christian Orthodoxy

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	7.115	5	1.423	1.492	.191	.014
Intercept	3024.925	1	3024.925	3171.253	.000	.860
Gender	2.559	1	2.559	2.683	.102	.005
Science Interest	1.766	2	.883	.926	.397	.004
Gender * Science Interest	.822	2	.411	.431	.650	.002
Error	493.145	517	.954			
Total	7914.769	523				
Corrected Total	500.260	522				

a R Squared = .014 (Adjusted R Squared = .005)

Null Hypothesis 5: *Regarding TSSI categories, there are no significant differences between subjects with high Christian Orthodoxy scores and those with very low Christian Orthodoxy scores.*

Null Hypothesis 5 was the principle focus of this study. It is in this hypothesis that we ask about a relationship between valuation of science and orthodox Christian belief. For this analysis, Christian Orthodoxy scores were collapsed into three groups: Non-Christian (1.00<= X <= 2.50), Neutral (2.50< X < 3.50), and Christian (3.50<= X <= 5.00). An ANOVA with Tukey Multiple Comparisons of category means was calculated to determine statistical significance. The standard ANOVA table (Table 8) yielded statistical differences for Epistemology, Science & the Economy, Science & Public Health, and Science & Religion. However, when the Tukey Comparisons of means was calculated (Table 9), Science & the Economy failed to show significance at p <= 0.05. Hence, Figure 3, which shows the category profiles for Christian and Non-Christian subjects, shows only four categories in bold type indicating statistical significance.

Table 8. ANOVA on TSSI Category Means by Christian Orthodoxy

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
EPIST	Between Groups	4.191	2	2.095	4.945	.007
	Within Groups	227.972	538	.424		
	Total	232.163	540			
ECON	Between Groups	1.981	2	.991	3.227	.040
	Within Groups	165.151	538	.307		
	Total	167.133	540			
ENVIR	Between Groups	1.869	2	.935	1.715	.181
	Within Groups	293.229	538	.545		
	Total	295.099	540			
POLY	Between Groups	4.283	2	2.141	4.156	.016
	Within Groups	277.227	538	.515		
	Total	281.510	540			
HEAL	Between Groups	3.256	2	1.628	3.302	.038
	Within Groups	265.234	538	.493		
	Total	268.490	540			
RELIG	Between Groups	123.110	2	61.555	108.049	.000
	Within Groups	306.496	538	.570		
	Total	429.606	540			
BEAUT	Between Groups	1.426	2	.713	1.205	.300
	Within Groups	318.149	538	.591		
	Total	319.575	540			
RACE	Between Groups	3.040	2	1.520	2.182	.114
	Within Groups	374.851	538	.697		
	Total	377.891	540			
For_All	Between Groups	1.355	2	.678	1.843	.159
	Within Groups	197.743	538	.368		
	Total	199.098	540			

Table 9. Multiple Comparisons of TSSI Category Means by Christian Orthodoxy

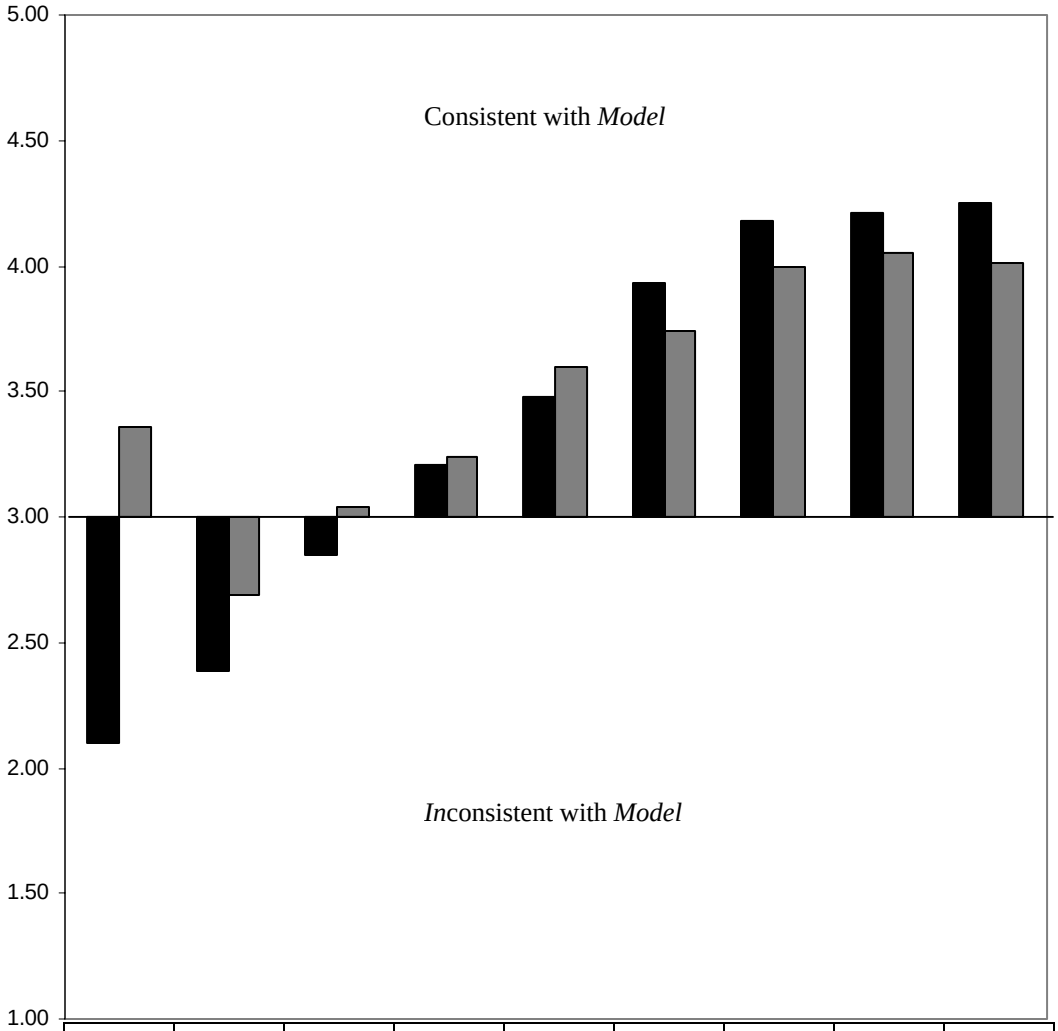
Multiple Comparisons

Tukey HSD

Dependent Variable	(I) 1=non; 2=neutra 3=XTIAN	(J) 1=non; 2=neutra 3=XTIAN	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
EPIST	1	2	.0127	.10243	.992	-.2281	.2534
		3	.1903	.09473	.111	-.0324	.4129
	2	1	-.0127	.10243	.992	-.2534	.2281
		3	.1776*	.06369	.015	.0279	.3273
	3	1	-.1903	.09473	.111	-.4129	.0324
		2	-.1776*	.06369	.015	-.3273	-.0279
ECON	1	2	-.1022	.08718	.470	-.3071	.1027
		3	-.1855	.08063	.056	-.3750	.0040
	2	1	.1022	.08718	.470	-.1027	.3071
		3	-.0833	.05421	.275	-.2107	.0441
	3	1	.1855	.08063	.056	-.0040	.3750
		2	.0833	.05421	.275	-.0441	.2107
ENVIR	1	2	-.1349	.11617	.477	-.4079	.1381
		3	-.1933	.10743	.171	-.4458	.0592
	2	1	.1349	.11617	.477	-.1381	.4079
		3	-.0584	.07223	.698	-.2281	.1114
	3	1	.1933	.10743	.171	-.0592	.4458
		2	.0584	.07223	.698	-.1114	.2281
POLY	1	2	.2050	.11296	.166	-.0605	.4704
		3	.2928*	.10446	.015	.0473	.5383
	2	1	-.2050	.11296	.166	-.4704	.0605
		3	.0878	.07023	.424	-.0773	.2529
	3	1	-.2928*	.10446	.015	-.5383	-.0473
		2	-.0878	.07023	.424	-.2529	.0773
HEAL	1	2	-.1455	.11049	.386	-.4052	.1142
		3	-.2439*	.10217	.046	-.4840	-.0038
	2	1	.1455	.11049	.386	-.1142	.4052
		3	-.0984	.06870	.325	-.2598	.0631
	3	1	.2439*	.10217	.046	.0038	.4840
		2	.0984	.06870	.325	-.0631	.2598
RELIG	1	2	.4224*	.11877	.001	.1432	.7015
		3	1.2625*	.10984	.000	1.0044	1.5206
	2	1	-.4224*	.11877	.001	-.7015	-.1432
		3	.8401*	.07385	.000	.6666	1.0137
	3	1	-1.2625*	.10984	.000	-1.5206	-1.0044
		2	-.8401*	.07385	.000	-1.0137	-.6666
BEAUT	1	2	.0240	.12101	.978	-.2604	.3084
		3	.1224	.11190	.518	-.1406	.3854
	2	1	-.0240	.12101	.978	-.3084	.2604
		3	.0984	.07524	.392	-.0785	.2752
	3	1	-.1224	.11190	.518	-.3854	.1406
		2	-.0984	.07524	.392	-.2752	.0785
RACE	1	2	-.1379	.13135	.546	-.4466	.1708
		3	.0321	.12147	.962	-.2534	.3176
	2	1	.1379	.13135	.546	-.1708	.4466
		3	.1700	.08167	.095	-.0220	.3619
	3	1	-.0321	.12147	.962	-.3176	.2534
		2	-.1700	.08167	.095	-.3619	.0220
For_All	1	2	-.1109	.09540	.476	-.3351	.1133
		3	-.1634	.08822	.154	-.3707	.0440
	2	1	.1109	.09540	.476	-.1133	.3351
		3	-.0525	.05932	.650	-.1919	.0869
	3	1	.1634	.08822	.154	-.0440	.3707
		2	.0525	.05932	.650	-.0869	.1919

*. The mean difference is significant at the .05 level.

Figure 3. TSSI Category Means for Orthodox Christians and Non-Christians



	RELIG	**POLY**	**EPIST**	RACE	BEAUT	ENVIR	ECON	For_All	**HEAL**
Christian	**2.10**	**2.39**	**2.85**	3.21	3.48	3.93	4.18	4.21	**4.25**
SD	0.758	0.712	0.666	0.853	0.765	0.694	0.494	0.552	0.661
Non-Christian	**3.36**	**2.69**	**3.04**	3.24	3.60	3.74	4.00	4.05	**4.01**
SD	0.995	0.792	0.856	0.759	0.944	1.051	0.861	0.876	1.000
Difference	**1.26**	**0.30**	**0.19**	0.03	0.12	0.19	0.18	0.16	**0.24**
F	**108.049**	**4.156**	**4.945**	2.182	1.205	1.715	3.227	1.843	**3.302**
sig	**0.000**	**0.016**	**0.007**	0.114	0.300	0.181	0.040	0.159	**0.038**

RELIG = Science & Religion
POLY = Public Regulation of Science
EPIST = Epistemology
RACE = Science, Race & Gender
BEAUT = Science & Aesthetics
ENVIR = Science & the Environment
ECON = Science & the Economy
For_All = Science for All
HEAL = Science & Public Health

From left to right, the categories in Figure 3 are ranked by the Christian means from lowest to highest. The bold type indicates statistical differences between means.

Discussion of Findings

The purpose of the research reported in this paper was to examine whether anti-science sentiment (measured as valuation of science) increases with increasing orthodox Christian belief. Figure 3 tells an interesting story. Examining the figure quantitatively, there are significant differences between Christians and non-Christians on four of nine categories. For three of these (Science & Religion, Public Regulation of Science, and Epistemology), the means for the non-Christians are more consistent with the *Model* than are the means for the Christians, and the two groups not unexpectedly differ most over the Science & Religion category. However, the means for the non-Christians fall in the neutral zone ($2.50<X<3.50$); the non-Christians clearly do not embrace these aspects of the *Model*. The fourth significant difference is for the Science & Public Health category. Both groups embrace the *Model* response on this category but in fact the Christian group is more strongly supportive– not less.

While the quantitative results are informative, it is the qualitative effect of the group profiles shown in Figure 3 that arrests one's attention. All subjects show support for science although it is a qualified support. The salient difference between the Christian and other students is simply that the Christian students do not think that science is more important than religion. Hence, the suggestion that support for science decreases with increasing orthodox Christian belief finds no empirical support.

Conclusion

The principal finding of this study is that there is no empirical corroboration for the suggestion that support for science decreases with increasing orthodox Christian belief. The study did not address the specific question of anti-evolutionism but it would not be surprising if it were found that many of the Christian subjects of this study did have reservations about evolution. We know from studies such as Jackson, Doster, Meadows, and Wood (1995) that Christians with good science credentials sometimes oppose evolution. From our study and others, therefore, we conclude that anti-evolution sentiment is *not* indicative of anti-science sentiment; and, if anti-evolution sentiment is *not* indicative of anti-science sentiment, then it is surely a mistake to approach the improvement of the public's understanding of evolution with the assumption that anti-evolution sentiment and anti-science sentiment are linked phenomena, let alone synonymous. Rather, we suggest that future research more closely examine how orthodox Christian students and teachers integrate knowledge of science and evolution, when integration occurs. Where evolution is rejected, rather than dismissing rejection as evidence of an anti-science attitude, research should examine the reasoning processes and knowledge bases that objectors draw upon in support of their rejection of evolution while still remaining supportive of science in general.

[1] See <http://atheism.about.com/library/texts/white/bl_white_chapter01.htm>

[2] *A History of the Warfare of Science with Theology in Christendom*, i. 128. Edward E. Rosen first uncovered the spurious attribution to Calvin; see "Calvin's Attitude Toward Copernicus," *Journal of the History of Ideas* 21 (1960): 431-41.

[3] White apparently based the Wesley quote on a comment in Charles Woodruff Shields, *The Final Philosophy* (1877, p. 61). In a discussion of various theological opinions about life on other worlds, Shields notes that Wesley, "in a sermon on the VIIIth Psalm, after [William] Derham and [Christiaan] Huyghens had associated a plurality of worlds with revealed truths, termed that opinion the palmary argument [i.e., an unanswerable argument] of infidels, and declared he would doubt it, even though it were allowed by all the philosophers in Europe." In the sermon in question, entitled "What is Man?" (a reference to Psalm 8:4), Wesley rejected not Copernicanism, but "the plurality of worlds, a very favourite notion with all those who deny the Christian revelation," partly on the basis of Huyghens' telescopic observation "that the moon has no atmosphere" and therefore "no clouds, no rain, no springs, no rivers; and therefore no plants or animals." It is quite a stretch to conclude from this, as White did, that Wesley opposed heliocentrism.

[4] *The Works of John Wesley*, ed. Albert C. Coulter, 23 vols. (Nashville: Abingdon, 1984-), iii. 454-63, quoting 462. For a lengthy discussion of Wesley's position on extraterrestrial life, see Michael J. Crowe, *The Extraterrestrial Life Debate, 1750-1900* (Cambridge: Cambridge University Press, 1986), 92-6; for his overall attitude toward science, see J.W. Haas, Jr., "John Wesley's Views on Science and Christianity: An Examination of the Charge of Antiscience," *Church History* 63 (1994): 378-92.

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